Description of a Virtual Learning Environment for preliminary schools

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ABSTRACT

This project is associated with the field of Information Systems and more specifically with Virtual Learning Environments (VLEs). These environments are becoming very popular in the last years, especially in higher education. However, we decided to focus in lower level education since there is lack of these learning platforms and their spreading is limited.

More specifically, our project will focus on the description of a Virtual Learning Environment for preliminary schools. The target age will be 5-8 years old. The design of our system is based on the guidelines of a preliminary schoolteacher in Spain, who is actually our stakeholder. Designing a system for so young students means that various aspects have to be taken into consideration such as their level of computer knowledge, their maturity, their not still developed studying abilities and the fact that it is their first approach to school as a learning environment. However, we believe that if they can be integrated in the information society in such an early age, it will be beneficial for their future and the future of information technologies as well. We hope that through this project we will be able to contribute to computer based education and equip the young students with new ways and potentials of learning.

On a theoretical basis, we could say that our project contains two different parts: a theoretical part and a more practical one. In the theoretical part, all the related work of similar VLEs is presented in an effort to see what products already exist in the market and try to create a new, innovative system taking into consideration various educational aspects. In addition, a review of our literature research concerning computer based education and VLEs is included in order to provide the necessary theoretical background before starting to design our system. Finally, a summary of our research made including questionnaires and interviews as well as the analysis and the conclusions of this research are presented since before designing our system we tried to include the opinion of the different people involved in this system like the students and their parents, the teachers and the pedagogues. On the other hand, the second more practical part focuses on the description of the learning platform. The architecture of the system as well as the use cases is included here. A prototype of the system is also provided but we were not able to complete the whole implementation due to time limitations.
This Master Thesis has been written at the School of Mathematics and System Engineering (MSI) at Vaxjo University. During the last months we have put a lot of effort for completing this project. There are different people who have contributed in the accomplishment of our Master Thesis who we would like to thank.

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CHAPTER 1 - INTRODUCTION

This chapter is intended to provide a background and the basis of our master thesis. We will introduce our topic and the reasons why it has been chosen. An overview of what the thesis aims to study will be given and the research questions, the methodology, the limitations and the outline of the thesis will be presented.

The rapid development of technology is the main characteristic of the 20th century. Nowadays, the use of computers is spread in every field of life. When a new technology comes out in the scientific spotlight, people from different scientific fields try to apply this innovation in their field for different reasons. One of the reasons is the expectation to create a totally new situation through the use of this new technology. Another reason is the willing to find a solution in a problem which cannot be solved with the traditional way. Thus, in the educational field as well, the experts experiment and try to adapt in their scientific field every new technology. They approach the computer and the related technologies aiming to increase the effectiveness of teaching and learning.

Computers, which are the “kids” of technology and are being used in all the activities of our life, have strongly invaded the educational field. This is normal since education is one of the major human activities and it could not stay out of this innovative change.

A lot of educational researches focus on the ways learning takes place and on how the students’ abilities can be totally exploited in order to achieve maximization of learning. This modern educational medium is proper to the children’s nature since it might start being used as a game and end up being used as a learning medium. The use of computers gives to the students the possibility to devote more time for learning, to try more and to feel comfortable for their studying object. That means that learning, one of the main goals of education, can be improved through the use of computers.

The development of computers and their use as a teaching medium can also help the modern educationalist in his task. If the right software is used, computers can offer a variety of teaching approaches adapted in the personal knowledge model of each student. In that way, the teacher can deal with each student or group of students separately, find their weaknesses and help them to improve them.

It has been proved that students who used computers as a teaching medium have developed a more positive attitude towards the course in comparison to the students who were taught in the traditional way. A lot of experts claim that the most developed school systems are the ones that use the computer as a teaching medium. The appropriate software can improve the efficiency of students and create the right conditions for the development of positive attitudes towards learning.

The software that facilitates computer-based education is called Virtual Learning Environment (VLE) and this will be the focus of our thesis. Virtual Learning Environments compose useful tools for distance education but they are also used in face-to-face classroom.
1.1 BACKGROUND

This project has its foundation in virtual learning environments. We are going to provide the related theoretical background and design a virtual school system. Nowadays, there are different software educational systems that can make education more efficient and effective. Schools today also have a bigger interest in these systems. This is because schools want to provide education in the most effective way and this means that they might have to be innovative and change the traditional way of teaching and learning.

This project is made by a group of two members, with different backgrounds (information systems and computer science) and nationalities (Greek and Spanish). This makes the starting point of the project more interesting because of the mixed different values. We believe that we can get a different result from the differences in the group; this is something positive from which the project can benefit. During the project there has been good cooperation and discussion for writing the different parts included. More specifically, during the design process we have had effective collaboration with discussion and feedback from each other but we could say that Francisco has contributed more to this part. The prototype is made by Francisco. I have focused mainly on the introduction, the literature study, the empirical findings and the structure of the thesis. However, it is hard to say who contributed more to each part because there have always been discussions between us and we have been advising and helping each other throughout the project for the different parts included. We were both working on each part without concrete division of who will do what.

We came in contact with a real teacher, our stakeholder, and this contact combined with the theoretical foundation in virtual learning environments will hopefully lead to a better result in the end.

Virtual learning environments compose software aimed to be used for teaching and learning in higher and lower level education. There are similar terms to describe this concept like Learning Management System (LMS), Course Management System (CMS), Learning Content Management System (LCMS), Managed Learning Environment (MLE), Learning Support System (LSS) or Learning Platform (LP). All of these terms refer to education based on computers or online education. These systems most of the times run on servers in order to present the course to students as internet pages. The popularity of these systems has highly increased in universities and schools the last years for various reasons such as limiting the time of teaching staff, providing the opportunity to students to use the internet for learning resources, promoting distance learning education and many others.

1.2 PROBLEM FORMULATION

Nowadays, most of the virtual learning environments are focused on high-level education. Why are the lower levels neglected? We believe that if the students get used to virtual learning environments in an early age, they can use them in a more
efficient way in the future and, as everybody knows, the base for an effective education is the preliminary school.

It is true that the demand of such pedagogic methods by schools is continuously increasing. These new learning methods compose a first approach for the children of the new society in which they are going to be involved, the information society.

There were different reasons that drove us into choosing this topic for our thesis. However two of them are the most important ones: firstly, the lack of virtual learning environments in lower level education and secondly the rapid development and invasion of technology in education nowadays. In other words, the use of computers as a teaching medium internationally and the researches conducted in the educational field with positive results as far as learning is concerned.

We believe that education can improve and profit from the development of modern technologies. Our thesis intends to contribute in the new information society by supporting the new educational methods where technology is highly integrated. Our focus will be in virtual learning environments in lower level education.

We came in contact with a teacher of a school that is interested in developing a learning system for children between five to eight years old, which is going to cover many educational aspects. The handicapped students will be taken into consideration as well. The aim of our project is to describe the architecture of this virtual school system. Our approach for the solution of the problem will be to make a prototype of our virtual school system following the directions given by interviews and using Unified Modeling Language (UML) + Rational Unified Process (RUP). Our system is based on different pedagogical ideas like the motivation and variation offered to the students and we hope that it will add knowledge to the children. Since handicapped students will be taken into consideration, many pedagogical advantages can be offered to their education like for example the reading ability can be stimulated through the computers if you have problems with seeing.

1.3 PROBLEM STATEMENT

The research of this master thesis has been focused on virtual learning environments and more specifically in the following issues:

- Provision of the theoretical background concerning virtual learning environments and computer-based education.

- Research and feedback from the involved parts in this system through questionnaires and interviews.

- Description of a virtual learning environment for students aged 5-8 years old according to our stakeholder’s guidelines and taking into consideration handicapped students and other educational aspects.
1.4 DELIMITATIONS

We are aware of the load of work that is needed for the whole development of an effective virtual school system and the time frame this thesis provides is not sufficient to fully develop our system due to the high complexity and the long period of time needed to do it. Therefore, we focused in the description of the architecture in order to make a prototype.

In our thesis we tried to get feedback from students, parents, teachers and pedagogues about their opinion on our virtual school system. This feedback includes measurements but we believe that it is hard to measure the efficiency of our system with figures and statistics and especially if we do not have the whole system implemented. However we handed out some questionnaires and made some interviews to get some kind of feedback as a result. In addition, our initial aim was to conduct 5 interviews with pedagogues-professors but we finally managed to come up with only 2 due to difficulties of reaching the rest of them.

1.5 OUTLINE OF THE THESIS

Chapter 1- Introduction
In this introductory chapter the background of the thesis as well as the problem formulation, problem statement, delimitations and methodology are presented.

Chapter 2 – Literature study
In this chapter the theoretical background for virtual learning environments and computer-based education with which we came up after literature research is provided. Various topics like the advantages of VLEs, the software used in VLEs, the student’s level of computer knowledge and others are examined. In addition, the related to our virtual learning environment work is presented. Other virtual learning environments and their applications are described.

Chapter 3 – Empirical Findings
In this chapter our empirical part is presented. This part includes the description and analysis of the questionnaires which were handed in to the students and their parents as well as the interviews with the teachers and our stakeholder.

Chapter 4 – “Kronos”
In this chapter we are trying to describe the architecture of our system. In addition, the vision, the characteristics of our product, the architecture and all the use cases recognized are presented. Finally, there is a presentation of the prototype we designed.

Chapter 5 – Conclusions
In this chapter we come up with our conclusions and recommendations after our research work. We are giving an answer to the questions presented in the problem statement and future work is proposed.

Finally, in the last pages the appendix is available in order to facilitate the reader.
1.6 METHODOLOGY

There are a lot of different methods that can be used for different research problems. In this chapter, we will describe some methodologies that exist and are connected to our research problem. We will also present the methods and the techniques we used in our master thesis in order to reach our final purpose. Finally we will explain why we used these methods and a short presentation of our research journey will be made. Our methodology part is based on the book “On research methods” by Pertti Jarvinen (2001) but other literature sources have been used as well.

1.6.1 Defining our master thesis topic

According to Jenkins’ (1985) model of the research process, there are 8 sequential steps during the research process: ideas – library research- research topic – research strategy- experimental design – data capture – data analysis – publish results. The three first steps of his model exist in every research process and after that the researcher has to choose a certain research strategy, which should be the most effective approach to the problem he is studying.

The first step of Jenkins’ model is the research idea and more specifically where it came from. Our research idea emerged from the fact that nowadays technology affects our daily lives in a lot of different sectors and one of these sectors is the education sector. More specifically, the connection between technology and education gets stronger every day since a lot of technological systems are developed in order to be used in education and a lot of people claim that in the future education will be technology-based. The virtual learning environments are a vital part of this future technology-based education. So we chose to focus on learning platforms from the beginning because we both thought of it as an interesting and attracting subject from which a lot of issues and problems rise.

The second step of Jenkins’ model is the library research. Our first research was very general and included some articles and books, which are focused on education and the technology used for it. Our purpose was to come up with our final research topic, which is actually the third step of Jenkins’ model. So we reviewed existing literature in order to develop more insightful questions about computer-based education. During this first general research, we noticed that there is a lot of literature concerning VLEs but almost all of it is based on higher-level education. There were a lot of learning platforms presented and a lot of information about their importance and their social aspects. But most of these systems and information were about universities or high schools.

Based on that observation, we came up with the idea to describe the architecture of a virtual school system and to make a prototype of this system. This system aims at lower level education and more specifically at the first classes of preliminary school. We thought that this idea would be something original since very few work has been done on this sector. So in this point we defined the main problem we would examine and the main questions we would try to give an answer to.

In the next pages, the strategies and the methods we used for our research are presented.
1.6.2 Purpose of research work

According to Huczynski and Buchanan (1991) there are four possible purposes of science: 1) to describe, 2) to explain, 3) to predict and 4) to control. However, these four purposes of science do not cover all the studies. Wynekoop and Conger (1991) proposed another two purposes: 5) study if we can build a new construction and 6) understand a system, its design, construction and evaluation.

Our research work purpose belongs to the fifth category since we are going to study if we can build a virtual school system and how we can do that.

1.6.3 Model used

The model on which our work process was based is the mayeutic cycle which was designed by Alfred Holl.

“The mayeutic cycle comprises a deductive-rationalistic half (corresponding to the synthetic phase of a software life cycle) and an inductive-empiristic half (corresponding to the analytic phase of a software life cycle). Figure 1 shows the mayeutic cycle in IS in comparison to the one in natural sciences (cf. Holl, 1999, p. 175), the latter marked with italicized text in parentheses. The four quadrants represent four phases; the four cardinal points represent the results of the four phases.”(Alfred Holl)

Figure 1.1: Mayeutic cycle in IS and natural sciences (according to Holl, 1999)
We will try to explain our process of work based on this model. Our work actually started in the end of the second quadrant (Use, gathering of experiences) where we gathered a lot of information through the interview with our stakeholder and pedagogues as well as through the questionnaires we gave to the students and parents. This actually composes the empirical part of our study. We gathered specific information and opinions from different parts that have some kind of involvement in our thesis topic.

After we had gathered all the observation data (qualitative and quantitative), we moved to the third quadrant (Elicitation and analysis of the current state/experiences) where we did the analysis of our empiricist information. The conclusions of our analysis would later be used for the design of our virtual school system.

Here we have to say that the end of the third quadrant is where all the information gathered from literature review, books and theories is entering the mayeutic cycle from the external environment. This information composes our rationalistic part, which includes all the knowledge we acquired from different theoretical sources.

Our next step was the fourth quadrant (Design of the planned state) where the design of our system took place but not its development. All the UML diagrams we constructed and the Rational Unified Process that we followed are included here. It is like when you design a table, you need some drawings at the beginning, which will show its final form, and this part is where these drawings would be included. It is actually our idea of how the system will be based on the analysis of our empiricist and rationalistic part.

Our work finished at the beginning of the first quadrant (Software development) since we only completed a small part of it. This quadrant includes the development of the whole system and because of the time limitation, we just came up with a prototype. The rest of this quadrant is proposed for future work.

The process of our work based on the mayeutic cycle can be seen in figure 2:
1.6.4 Investigation approach

After the definition of our problem focus area, we had to decide which research strategies we would use taking into consideration several aspects.

1.6.4.1 Derivation process (RESEARCH APPROACH)

There are two derivation processes that can be used in a research depending on the way we are looking at the problem: induction and deduction. There is also a third process, which is a combination of these two, and it is called abduction.

According to W. Laurence Newman (1997), the deductive approach begins with an abstract, logical relationship among concepts and then more towards concrete empirical evidence.

On the other hand, the inductive approach begins with detailed observation of the world and moves towards more abstract generalizations and ideas.

“Thus deductive research starts with the general and proceeds to the specific, inductive research starts with the specific and proceeds to the general.”
(http://tulsagrad.ou.edu/statistics/content/InductiveOrDeductive.asp 2006-10-9)

Our thesis was based on the induction technique. We started by gathering specific information from different parts involved in our topic of the subject and this was our observation or empirical data. This included the interviews with our stakeholder and pedagogues as well as the questionnaires to the students and parents. So we started from the specific part. After that, we analyzed all this information, we gathered all the
rationalistic data (literature review) and based on all this information we constructed our model, which is the general part. It is the general part because it composes a general theory which satisfies all the specific information and opinions of different, specific and interested parts. So we actually moved from the specific towards the general and this is the induction technique. All this can also be explained through the mayeutic cycle in figure 1 since we started from the end of the second quadrant (Use, gathering of experiences) and we finished at the beginning of the first quadrant (Software development). And as the mayeutic cycle indicates, our route was the analytic phase, which is the induction technique.

1.6.4.2 Qualitative vs. Quantitative research (RESEARCH METHOD)

There are many ways to categorize the research methods. The most common division is between qualitative and quantitative research methods.

According to W. Laurence Newman (1997), qualitative and quantitative approaches differ in many ways, but they complement each other as well. One of the differences between the two styles comes from the nature of the data. Soft data, in the form of impressions, words, sentences, photos, symbols dictate different research strategies than hard data, in the form of numbers.

The aim of the qualitative research is to gain a deeper understanding of the problem while the quantitative research aims to give a detailed view of the social reality. The data collected in a qualitative research is more thorough than the data in quantitative research. Quantitative studies contain statistics, formulas, mathematics and other statistical measurable data. Quantitative methods can be described as the method of conducting research by gathering quantitative data and analyzing them by means of mathematical methods.

In our study, we will mainly use the qualitative approach since we want to get a deeper understanding of the system architecture, which our virtual school should have. We will gather most of the data for describing the virtual school system through interviews, questionnaires and literature research. However, we will also use the quantitative method to a smaller extent since the results from the tests that we will perform while describing our system will be somehow in the form of numbers. Besides, we believe that it is more effective to use several methods during one study because in that way we can avoid the constraints created by the use of a unique method.

1.6.5 Research approach

According to Jarvinen (2001) there are 6 possible research approaches:

Mathematical approach
In the mathematical approach a certain theorem, lemma or assertion is proved to be true.

Conceptual analytic approach
In the conceptual analytical approach basic assumptions behind constructs are analyzed, theories, models and frameworks used in previous empirical studies are identified and logical reasoning is applied.

**Theory testing approach**
In the theory-testing approach methods as laboratory experiment, survey, field study and field test are used. The theory, model or framework is taken from the literature or developed or refined.

**Theory creating approach**
The theory creating approach includes case study, ethnographic method, grounded theory, phenomenography, contextualism, discourse analysis, some longitudinal study methods, phenomenological study, hermeneutics etc.

**Building a new innovation**
In building a new innovation utility aspects are striven and a particular development model is applied.

**Evaluating the innovation**
In evaluating the innovation some criteria are used and some measurements are performed.

In our project we used two different research approaches: the “theory creating” and the “building a new innovation” approach. These two approaches do not exclude each other but they can be combined and used together. We actually started with the “theory creating” approach by gathering information, doing research and creating a theory about how our system should be. After that we continued with the “building a new innovation” approach by applying the theory and designing our system. This can also be seen in the mayeutic cycle in figure 1, since our work started in the end of the second quadrant (Use, gathering of experiences) and finished in the beginning of the first quadrant (Software development). The end of the second quadrant and the third quadrant compose the “creating a new theory” approach and the fourth quadrant with the beginning of the first quadrant compose the “building a new innovation” approach.

Our motivation behind building the architecture of a virtual school system was the lack of this kind of systems in lower level education. We started from an initial state, which was the information about the functions our system should perform. After that, following the building process, which in our case was Rational Unified Process, we tried to reach the target state. Our target state was the description of a VLE for children between five to eight years old, which would also take into consideration the handicapped students and cover many educational aspects. The building process is shown in Figure 3:

![Figure 1.3: The Building Process](image)
Rational Unified Process

The following information is based on the book “UML 2 and the Unified Process” by Jim Arlow and Ila Neustad (2005):

“The Rational Unified Process (RUP) is a commercial version of UP from IBM, who took over Rational Corporation in 2003. It supplies all of the standards, tools, and other necessities that are not included in UP and that you would otherwise have to provide for yourself.”

One of the basic axioms of RUP is the use cases (requirements). Use cases are a way of capturing requirements, so we could accurately say that UP is requirement driven. Moreover, UP predicates software construction on the analysis of risk.

UP is iterative and incremental. The key point is that each iteration contains all the elements of a normal software development project, thus every iteration has five core workflows:

- Requirements – Capturing what the system should do;
- Analysis – Refining and structuring the requirements;
- Design – Realizing the requirements in system architecture (how the system does it);
- Implementation – Building the software;
- Test – Verifying that the implementation works as desired.

Some possible workflows for iteration are illustrated in figure 4:

![Figure 1.4: Possible workflows for an iteration](image)

The UP structure has four phases, each of which ends with a major milestone:

- Inception – Getting the project off the ground: Life Cycle Objectives;
- Elaboration – Evolving the system architecture: Life Cycle Architecture;
- Construction – Building the software: Initial Operational Capability;
- Transition – Deploying the software into the user environment: Product Release.
Figure 5 is really the key to understanding how UP works. Along the top, we have the phases. Down the left-hand side, we have the five core workflows. Along the bottom, we have some iterations. The curves show the relative amount of work done in each of the five core workflows as the project progresses through the phases.

In our project we did not complete all the workflows of all the phases due to time limitations. More specifically, our work done in each phase is presented below:

**Inception:** We did the interview on which the whole project was based and using that interview we started forming our vision document. After that, we designed the first use cases that were totally clear. We also did research about related work of other existing VLEs.

**Elaboration:** We made our second interview with our stakeholder in order to get some additional information about some parts of our system that was missing. The Vision document was revised and complete too. We did the elaboration in two parts, firstly by completing the material from the inception phase from the phase before and secondly by doing the use cases beginning with the interfaces design. The use cases were the core of this phase so we focused mainly on them.

**Construction:** In this phase we started by reviewing the use cases. Moreover, we designed the architecture based on the documents that we had already formed from the previous phases. Our next step was the system implementation.

**Transition:** Since we will not come up with a final system, in this phase the completion of the prototype and maybe a test on it will be included.

**1.6.6 Data Collection**

The data we have collected for completing our project includes many different sources but it can generally be divided in theoretical and empirical. Below we will present our sources and how we came up with all the data provided in this thesis.
1.6.6.1 Theoretical data collection

Our theoretical data comes from literature review, journals and Internet sites. We used different theoretical sources because in that way we could get different perspectives of the same problem. During the literature review, a lot of different books were used which were available in the library as well as books in electronic format. In addition, different articles of journals were studied so that we could get more updated and specialized information when it was needed. These articles were collected from the library or from electronic databases. Finally, various Internet sites were used when the required information could not be obtained from books or journals. The objectivity of the material from these sites was firstly criticized and after that some of its parts were used according to our judgment and opinion. A lot of these sites were company sites and we are aware that the information provided aims to promote themselves and that is why we have filtered it.

Before starting our project, we collected some first theoretical data concerning computer based education and the use of computers in schools. After some time, our research was getting more specialized to virtual learning environments and various related aspects. The theoretical data was being collected throughout the whole project in order to give us the necessary theoretical background for designing our system and to complement our empirical findings.

1.6.6.2 Empirical data collection

Our aim as far as the empirical data is concerned was to include all the involved parts of our system in the research. Five different parts are recognized in our virtual learning environment and these are: the students, the parents, the professors, the pedagogue and the administrator. We managed to include 4 out of the five parts, excluding the administrator because we did not come up with a fully implemented system to present to him. We want to emphasize that the involvement and the research on the involved parts refers to their preliminary opinion of our system and not on their opinion on the final developed system.

According to Yin R. (2003), empirical data can be collected mainly through interviews, questionnaires and observations. The important thing should be that the chosen way of collecting the empirical data should be compatible with the research method (qualitative or quantitative). For example, questionnaires are more appropriate for quantitative data. In our case, we chose to interview our stakeholder and the professors-pedagogues while for the students and the parents we chose to use questionnaires.

Interviews

The data collected from the interviews is mainly qualitative, especially when the interviewees chosen satisfy certain criteria. Interviews can be structured when there are specified questions trying to lead to a certain result and information or
unstructured when the questions and the answers are more free and not specified. There is also a third category, semi-structured interviews, which is a combination of the previous two categories. In our project we chose to use semi-structured interviews since we had specified the questions we wanted to ask but we were flexible to discuss any other significant point that could come up during the interview and give the opportunity to the interviewees to speak freely about related situations and opinions.

Our project includes 4 interviews, two of them were with our stakeholder who is a teacher in a preliminary school in Castilla-La Mancha, a region in Spain, and he has studied Computer Science (he asked to remain anonymous for personal reasons). The third interview is with Martin Stigmar, who is working at Vaxjo’s University center for educational development and has previously worked on a project concerning the development of a virtual environment. Finally, the fourth interview was with Kjell Johansson who is a professor of IT for teacher students in Vaxjo University.

The interviews with our stakeholder were conducted in Spanish since this was his native language and one of the project members is Spanish, but they were translated in English in order to be presented in the project. These interviews were conducted through email. The other two interviews were conducted in English since the native language of the interviewees was Swedish and the Swedish language level of the project members was inadequate for conducting an interview. These interviews were conducted face-to-face.

The interviews with our stakeholder included questions concerning the design of our virtual learning environment. On the other hand, the interviews with the professors were focusing on their preliminary opinion of our system and its effectiveness. Both the interviewees were asked the same questions so that their answers could be compared. All the interviews are included in the appendices while the result of the interviews and the analysis is presented in our empirical findings.

**Questionnaires**

As it has been mentioned, questionnaires were used for two of the involved parts in our system, the students and the parents. The reason why we used questionnaires for collecting the data from the parents and the students was because we wanted to obtain quantitative results and be able to draw statistical conclusions from them. The questions asked in these surveys were related to the user’s opinion and acceptance of our VLE, their willingness to use it in a hypothetical case as well as their proposals. There were some similar questions between the 2 questionnaires in order to be able to make comparisons and draw conclusions from the results.

The questionnaires of the students were distributed in a high school of Castilla-La Mancha, a region of Spain, by our stakeholder. The language of the questionnaire was Spanish but they were translated in order to present the results in our thesis. Our sample was the second grade of high school (13 years old) that consists of five classes of 105 students in total. The questionnaires of the parents were transferred to them after request to the students on which the first survey was conducted. These questionnaires are available in the appendices while their results and analysis is presented in our empirical part.
We know that the results of this research cannot be generalised for the whole Europe or world but they are only based on a high school of Spain. This creates problems of quality about our research and we are aware that our resources are limited but we could not expand the investigation due to time limitations. So although these results do not represent the general students’ and parents’ opinion, we hope that they can be used at least as an indication.

1.6.7 Critique of methods

According to Miles & Huberman (1994), it is important to refer to your projects’ credibility, focusing on its validity and reliability. We will try to criticize the quality of our thesis by analyzing these two concepts.

1.6.7.1 Validity

According to Miles & Huberman (1994), the validity of the project shows if you have studied what you should have studied and if reality is captured. As far as interviews are concerned, the interviewer should understand what the interviewee means and present it in that way without changing the results based on personal believes and preoccupations. In addition, the questions should be formed and asked in a right way, without affecting the interviewees’ answers.

The same rules apply for the questionnaires since the construction of the questions should be clear, understandable and not affecting the respondents’ answers. On this matter, we have committed a mistake concerning the form of the questions asked to the students and the parents which we only realized after our supervisor’s indications but it was too late to change the questionnaire. More specifically, both in the students’ and parents’ questionnaire, there are two questions concerning the effectiveness and the attractiveness of our system and the possible answers were: “very effective/attractive”, “not very effective/attractive” and “not effective/attractive at all”. However, after our supervisor’s indication, we realized that the second answer (“not very effective/attractive”) is very abstract and could mean a lot of things, ranging from “pretty effective/attractive” to “almost not effective/attractive at all”. A better answer instead of this could possibly be “Effective/Attractive”. The problem was that we realized our mistake after the questionnaire had been distributed and we could not change our answer.

Another aspect of validity is that the results of a survey should not be generalized unless they are tested in different environments. Concerning this aspect, we have to say that our results from the questionnaires of the students and the parents only represent a high school of Spain and cannot be generalized for the rest of the world but we hope that they can at least be used as an indication.

1.6.7.2 Reliability
According to Yin (2003), a research is reliable if when the same method and procedure of the research is followed by another person, the same results will be reached. So the research should not be dependent on the person who is conducting it, although in some cases the pre-understanding of the researcher could change the results. In these cases there should be analytical documentation of what has been done including all the references used. In addition, reliability shows how reliable the different used sources are.

In order to achieve reliability in our project, we conducted interviews with different people who already had some background and involvement in the studied subject and we obtained different perspectives. There were some similarities between the different interviews and questionnaires and in that way we could check and compare the different results. The results were analyzed based on our personal knowledge and experiences but we tried to be as close to reality as possible. However, we are aware that this could change the result. The fact that the project consists of two members and that means that two different perspectives are used, increases the rate of reliability. Finally, the interviews and the questionnaires as well as their summary are attached in the project so that the reader can form his own opinion and interpretation.
CHAPTER 2 LITERATURE STUDY

In this part, a general theoretical framework will be given. This is done to give the readers a basic outline of our research problem. We attempt to clarify some terms that may occur in our thesis, and then we give a background to our research problems. All the existing related work to our project is also presented.

2.1 INVASION OF COMPUTERS IN EDUCATION

Some years ago, the personal use of a computer was beyond the expectations of most people. Thanks to microelectronics, the technology of 70’s, the computers have invaded our daily lives and they are not anymore limited to the laboratories.

The spreading of computers in our daily life composes an opportunity and at the same time a challenge for education. It is an opportunity to strengthen and add value to the existing educational circumstances and also a challenge to make up our minds about how we will use these machines and which work environment we will create.

Historical, economical and cultural factors lead to the spreading of computers and as a result changes were brought up, which could in no way have been predicted 40 years ago. The computer is a history product and nothing can change that anymore.

The innovation of computers was that they managed to expand in various fields and highly integrate each one of them. There is still room for development in each field and the fact that the computer is a “national” tool, creates the need of cooperation of a lot of people in order to exploit their potentials and increase their effectiveness.

2.1.1 Models of computer teaching

Dividing the way of using the computers or choosing different ways for using them is not the point in which people should focus and this has been proved by different factors that affect the educational environment (technological equipment, social and economical reasons and others). The focus point in computer teaching should be the complete and analytical planning of what the application of the computer will offer in teaching taking into consideration the following points:

- Knowledge of how the computer will teach
- Knowledge of what the computer will teach
- Knowledge of who will be taught

A way of dividing the computer-based practice (Crook C. 1994) is categorizing their use as a tutor, pupil or tool.

The computer as tutor: According to Crook C. (1994) this model has accepted a lot of criticism among which supporting that if the computer will be used as a tutor, then the students will be controlled by technology. However this model can be used in combination with traditional teaching and it is very popular. The computer as a tutor has the role of a machine for the “electronic” provision of teaching programs. Actually, the computer after having been programmed by experts through educational
software, it presents the content of a certain course and the student answers. The computer evaluates the answer and decides about the choice of the next activity. This way of using a computer has advantages and disadvantages. The advantages are the interactive learning, the individualization and the control of the learning rhythm by the student. On the other hand, the disadvantages are the kind of the individualization and the danger of reducing the time of the interaction between the child and the environment because of the use of the computer.

In the tutor model appear the author languages, which approach in an alternative way the development of software through typical programming languages. The author languages were created in order to be used from certain subjects, rather than from professional programmers. However, these languages have disadvantages as well like their complexity and their application. The last years, authors seem to try to move the model of tutor towards the expert systems, which is an application of virtual intelligence (Adams T., 1988).

The computer as pupil: According to Crook C. (1994) this model shifts the practice from teacher-centered to pupil-centered. In the tutee model the computer is not used in order to teach the student and it does not control the sequence of steps or the type of the functions of the user. In that case, it is the user who controls the computer. Most of the functions of this type are based on programming languages or compilers, which allow the user to give commands to the computer until the desired task is over. In that way, the student uses the computer in order to solve a problem or generally in order to create a more favorable environment. A lot of people claim that in that way the students improve in the solution of problems and generally in thinking.

The work done in LOGO environment was very important for the development of the tutee model. Seymourt Papert (1982) says that in all the other applications of the computers in teaching, it is the computer that programs the child, while in LOGO environment the relationship is reversed. The child, even during the pre-school age can control and program the computer and while teaching the computer how to think, the child starts investigating its own way of thinking.

The computer as tool: According to Crook C. (1994), the spreading and the acceptance of computers as a “toolbox” is increasing by teachers. This is because “toolbox” is the general way most people think about computers and that is how they want to see them in education as well. The computer as a tool includes a large range of functional uses in which the computer is a tool or an extension of humans, which helps the user to complete a task easier, faster and more effectively. When the computer is used as a tool, it does not teach or at least it does not teach in the meaning of the computer as a “tutor”. The user inserts an activity through the computer and remains under its control during the interaction with the computer.

Luerhrmann A. (1984) provides different examples of the application of the computer as a tool in the educational environment which include:
- Acquisition of information in social sciences from a large database
- Problem solution through the use of algorithms
- Representation of information in the form of text for creation and analysis
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- Simulation of an ecological system
- Creation and processing of graphical information

The route and the development of the use of computers as tools in education extend the applications in database management systems and spreadsheets, which are used like learning strategies. Its application in expert systems is also under development. Actually, this kind of application mainly aims in the disengagement of the student from the traditional views of learning.

2.1.2 Student’s level of computer knowledge

Nowadays, the rapid development of software creates the need of computer knowledge for effective interaction between the people and the computers. Although it is believed that younger people have an advantage in computer knowledge in comparison to older generations, studies have shown that their level of computer knowledge, attitude and experience varies (Facer & Furlong 2001). Computer-learning, which can be acquired either by learning on your own or by external requirements like school courses, is a task requiring a lot of effort and time and at the same time bringing a lot of responsibilities to the users. Its rapid spreading and development requires a constant need for learning and refreshing the knowledge. This need could change the self-confidence of people as far as learning is concerned.

The need and importance for computer knowledge in the economical and social environment has driven politicians in taking action for invading and spreading computers in schools so that a strong relationship between the students and the computers will be established. In addition, universities and schools tried to develop an educational system where computers would be included in a way that their consideration of computers in education would be satisfied. However, it looks like this effort has not been very successful since researches have shown that the main place where students use computers is their home and not the school (Nachmias et al. 2001). Other research shows that even the students with high computer knowledge ought this to their family, friends and personal effort and not to the school. According to Wellington (2001) although the school is based on controlled learning results and on dominating forces between teachers and students, it has not yet managed to realize the new circumstances that are demanded for computer learning.

Wellington (2001) says that there will always be other sources of computer-learning than the educational environment because the applications of computers are needed in a lot of daily tasks through which computer knowledge can be achieved. Actually, computers are presently used in different sections in our daily lives like entertainment, work and learning and in that way computer learning is achieved at different times and with different content. However, in this kind of events the main goal is not the learning of computers and that is why the knowledge is unstructured. Although there are different hierarchical levels for computer learning, it is common that users jump over the different levels trying to reach the highest one and obtain the desired abilities. While the users obtain the desired abilities, they are applying them and transferring them to their colleagues. Generally, computer learning is most of the times symptomatic and not planned because it is acquired by various activities related to computers like a chatting community or installing some software. According to
Marsick (2001) in order to constantly improve and refresh the knowledge of computers the users must have willing, motivation and potential for developing new skills through demanding challenges. In the new information society, the meaning of the word “skillful” will correspond to the people who will have a good learning strategy, inventive mind and the ability to apply their skills in any kind of situations.

**Characteristics of computer learning**

Barron (2004) used the words “ecology of learning” for describing the complexity of the sources which lead to computer learning. The learning strategy developed by each user of this “ecology” depends on the characteristics of the available knowledge sources, his particular field of knowledge, and his personal preferences and interests.

**Characteristics of knowledge sources**

According to Marsick (2001) in order to exploit the knowledge sources, they firstly have to be available. For example, children who had older brothers were learning about the use of computers from their advice, the exemplary use and the help provided whenever it was needed. However, this does not mean that a knowledge source will be used if it is available, it. Actually, people choose and exploit the different available sources based on their attributes like their proximity, sufficiency and reliability (Foster 2000). In addition, their choice depends on how close the source is to their learning preferences and to which rate it can adapt to their needs. This is why it is common that people choose computer experts of their social environment for their computer related problems since these people already know their knowledge level and their preferences.

**Characteristics of the field**

The choice of sources also depends on the characteristics of knowledge that the users wish to acquire. Knowledge about the basic functions of a computer most of the times are usually not very useful and they have a limited application since they are related to a certain software and hardware and they have a short-life. This kind of knowledge cannot easily be organized to theoretical shapes. The most appropriate sources for their learning is the ones that can provide the relevant information in summary, are easily accessible and are constantly updated. On the other hand, more complex knowledge with longer life duration like programming or the effects of computers in the society can possibly be offered more effectively from more organized forms of sources like a course in the school.

Moreover, the learning strategies are defined from the estimated difficulty of executing the tasks for learning. People usually explore directly simple or intuitive applications, like a text processor, in order to find out their functionality. On the other hand, in case of complex applications, like video processors, self-directed acquaintance is relatively hard and external help is usually preferred (Taylor 2003).
Characteristics of the person

The personal experience and the preferences of people affect the choice of knowledge sources. Research has proved that trainees with important experience on computers develop certain learning strategies, which decrease the time demanded for learning the new functions (Taylor 2003).

According to Phelps (2005) people with low self-confidence are not willing to try and to develop new learning strategies, while self-directed students who have developed and strong skills can design and exploit new strategies for different learning occasions.

The gender of people has also been related with the way of learning the functions of computers. For example, Downes (1999) concluded that female students, when they were seeking for help or trying to learn a function, used mostly the help system and the books, while the male students were going through their alternatives and combined various strategies in order to acquire the desired skills. In addition, most men belong in the category of “hard techniques” (because they are seeking the total control of the computer with analytical severity), while most women belong in the category of “soft techniques” (because they treat computers as ontology with which you have to negotiate in order to produce a product).

Barron (2004) says that the development of learning strategies improves with the age as well. Older students enjoy larger independency of choices in most environments, like in the school or at home, and they can use the available sources based on their personal preferences.

2.1.3 Advantages and disadvantages of computer based education

Computer based education exploits the advantages of the computer as a teaching medium and the potential of the computer for interaction. One of the advantages is the individualized education that the computer provides for the student (http://coe.sdsu.edu/eet/Articles/adultliteracy/index.htm , 14-11-2006). Depending on the mistake the student makes, there is the possibility of choosing the appropriate constructive teaching. Moreover, the student has the opportunity to devote as much time as he needs in order to acquire the knowledge needed. If he answers wrongly, the student is not scared that his classmates or teachers will make fun of him. He knows that the computer will just show him an error message and he will have the chance to try again. In addition, the pictures presented on the screen as well as the various colors attract his interest and attention. So the computer is something special among the other educative mediums and that shows how unique its advantages are.

According to Aggarwal A. (2003), through using the computer and the web, students learn how to navigate in different internet sites and to develop criticism for the different sources. In addition the different e-libraries around the world are connected through the web and in that way the student is provided with a huge database on his computer. Computers have the ability to adapt to the needs of the student while he is receiving lessons. In that way, although the books and the movies only consist of information, we can say that educational software consists of education – a
combination of information – and a method, which provides this information at the student, adapted to his special needs.

According to Najjar (1996), through the use of computers the students are motivated because they have control over their pace of studying, they can go on studying new material and not get bored with the presentation of material they already know. The computer-based education helps the educator to use activities based on the type of each student. The educational software is a perfect educational medium combining its ability to stimulate the interest of the student to knowledge and the advantages of the machine. The color, the pictures, the way of presenting the information on the screen, the direct empowerment, the encouragement, the feedback, and the personal rhythm of learning can help the educator in his task. The use of the corresponding to the student’s model of learning software, gives the opportunity to the student to maximize the learning by creating the right conditions of learning. In that way, the student is being taught in a way close to his model of learning and that makes education an interesting activity. In addition, the educators can empower the potential of their students by collaborating with them in activities through the use of computers.

Although the computer is just a machine, it might be the most effective teaching media among the other ones. It has the potential to turn into the perfect helping tool of the educators if it is supplied with the appropriate educational software. A book, a movie or any other mechanic media can only distribute the saved data in one way, from the beginning towards the end. On the other hand, although the computer actually stores information and presents it to the students exactly like a book or a movie, it can also:

- Save its data in an electronic chart so that it can be stored as a stock and be presented at the student in any sequence and not just from the beginning to the end.
- Interact with the student, so that the student is not only taking data but also giving.
- Combine the data and the ability of interaction in order to provide information on the inside of its program, which will depend on the data that the student will give.

Among the different benefits of using computers as an educational media, we believe that their motivation and their positive attitude come mainly from the following ones (http://coe.sdsu.edu/eet/Articles/adultliteracy/index.htm, 14-11-2006):

1) Control over pacing and sequencing of learning: The student can use the time needed in order to comprehend the subject without disturbing his classmates.
2) Low confidence and high anxiety of academics: The only one who realizes the student’s mistake is the computer so the student does not have to feel embarrassed in front of the whole class. This is actually one of the reasons why a lot of students avoid answering the teacher’s questions in front of their classmates.
3) Individualized learning, privacy and instant feedback: The students have the feeling of exclusiveness when they use the computer in comparison to the feeling that the teacher belongs to the whole class. Once the student answers, the computer informs him right away if the answer was correct or not.
4) Higher interactivity: The students are active participants during the course and not just passive observers.
5) Lack of subjective grading: The computer evaluates the student with objective criteria and not based on his feelings or his social relationships with the student like it often happens with the teacher.

According to Aggarwal A. (2003), one of the disadvantages of using computers in education is the fact that the researches and their use so far in education have not officially proved that it works and that it adds value to the educational system. In addition, if computers are going to replace books and journals through their databases and the web, we have to take into consideration that the process of converting the existing materials in multimedia format is time consuming. The necessary computing skills for converting the materials and distributing them in a user friendly way are also needed. Another precondition for effective computer based education is that the technology has to be driven by the appropriate pedagogical considerations which does not always happen.

Another disadvantage of the integration of computers in education is that through the web, students can be tempted to cheat and to plagiarize (Aggarwal A. 2003). This can happen through “cutting” and “pasting” parts from different sources or through buying written “help” projects and as a result students do not learn how to develop the necessary skills for writing a project. Besides that, when students use the computers for writing all their school tasks, the writing skill is affected. The fact that not all the students have the same internet connection, level of computer performance and computer literacy creates matters of inequality among them, which is another problem of computer based education. According to Wertheimer & Zinga (1998), although the projects of students nowadays look professional in the way they are written, there are problems as far as the quality of their content is concerned. This problem arises because of the internet sources used whose trustworthiness lacks validity instead of the traditional library research.

It is true that the use of computers in education will change the traditional way of teaching. We cannot deny that problems will be provoked but the question that arises is if the advantages will be equally satisfying. The most important thing is that the use of computers in education should be based on pedagogical principles and maybe the best solution would be a combination of the traditional classroom with computers integrated in it. Concluding, more research has to be done on the effectiveness of Information Technologies in education and a lot of relative questions remain to be answered.

2.1.4 Software in computer based education

A computer can be programmed since it consists of:
- Hardware which consists of its mechanical and electronic parts and
- Software that is the programs that are being executed on the computer.

The educators are mainly interested in the educational software, which helps them teaching the different courses. Shade (1996) says that the most important decision the
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teacher has to make as far as the use of computers in the classroom is concerned is to choose the appropriate educational software. Various aspects should be considered by the teacher before starting to use educational software like how many computers he is going to use, what exactly he wants to teach, which software is associated with this kind of teaching, in which computers can this software be used and others. Some of these aspects require specific knowledge which we will try to present.

“Friendly Programs”

According to Said Khalifa et al. (2000), before choosing the appropriate educational software the educator should consider if it has some basic features that will make it easy and friendly to be used. That means if:

- It interacts with the user’s language and not with any other hard to read, code language.
- It is protected so that if the user makes a mistake, the program or any other data that have been saved in the program will not be damaged.
- It avoids the user from being lost and automatically takes care of the user’s questions and sends him to help “windows” inside the program in case the user tries something unsuccessfully twice or more times.
- The interfaces used are clear, understandable and attractive.
- It gives certain guidelines for the correct use on the screen and not in any guideline brochure.
- The commands typed from the keyboard buttons are kept in line with the definition of the program control.
- It provides evaluation and feedback to the students for their answers.
- Navigating through from one activity to the other is easy and user-friendly.

In order to create an effective educational program there has to be collaboration between good programmers, experienced scientists and experts on analytical programs. The problem is that it is hard for these 3 categories to speak the “same language”. In addition, the hardest thing is to adapt the educational programs in a way that they will satisfy the educational needs and at the same time function properly on the computer.

The adaptability of educational software varies because not all the categories of software fully exploit the advantages of computers. So there is the software, which just replaces the book by providing information when the student types a button of the keyboard without any interaction between student-computer. In the next stage, it is the software that has the ability to check the answer of the student and in that way let him pass to the next question or repeat the same one.

The best educational software is the one, which continually adapts to the student’s needs. This software has the ability to face all the possible mistakes of the student, to categorize them based on their type and to provide constructive learning for each one of them. In that way, when the student makes a mistake, the answer is not just “try again” but the wrong answer is checked and depending on each type, the relevant constructive teaching is provided. Moreover, this kind of software has the ability to
provide the opportunity for evaluation not only in the end (summative evaluation) but also in the middle of the course (formative evaluation).

For even better strengthening of the course, scaled exercises should exist at certain moments starting from the simple ones and moving to the more complex ones, so that the knowledge is more deeply acquired. This software takes advantage of the potentials of the computer as a media of teaching, including its potentials of saving information in an adaptive environment and calling them back in any order according to the student’s needs.

More developed educational software keeps records of the student’s performance and the point at which the course had stopped, so that the teacher can be informed at any time about the progress of the student and the student can continue from his last point without having to do meaningless repetitions.

2.2 VIRTUAL LEARNING ENVIRONMENTS

So far, we have presented various aspects of computer-based education and the software used in it. When a software system is used in computer-based education, learning platforms are created which are called Virtual Learning Environments (VLEs).

According to Ryan (2000), VLEs are “integrated course delivery systems that provide an environment for the management, delivery and assessment of students studying via the Web”. Another definition for VLEs is “education web platforms providing interaction of various kinds between learners and tutors.” (JICS, 2002). Other similar terms used to describe a VLE are Learning Management System (LMS), Course Management System (CMS), Learning Support System (LSS), Learning Content Management System (LCMS), Managed Learning Environment (MLE) or Learning Platform (LP). We want to emphasize that the meaning of “VLEs” is not equal to “e-learning” since the first one is actually included in the second one. E-learning has a broader meaning which represents all kinds of training where a computer is used like online learning, CDs, sharing files and other while VLEs represent the learning platform that is used.

2.2.1 Various aspects of Virtual Learning Environments

The spreading of real time services either through Internet or through specialized systems of material and software (e.g. teleconference, telework) promote the development of VLEs. This created the opinion that these environments can be effective if they are used for the support of the educational process, mainly for these reasons (McArthur 1998):

- The cost (number of professors, training cost etc.) can be reduced and the productivity (richer courseware etc.) can increase.

- In that way the inequality of opportunities in education, which comes from the fact that some areas are isolated, would be faced.
- The data networks can offer opportunities for collaboration, change of opinions and supply of specialized counseling in subjects concerning the educational process among all the involved parts (state, pedagogues, students etc.)

- The information and communication technologies allow any kind of information (text, picture, video) to be transmitted rapidly from one part of the world to another. In that way, teachers and students have the chance to gain access in educational material which otherwise would only be accessed either by face-to-face meetings or by post but in that way it would be hard to constantly update the information.

- The information and communication technologies can create new teaching and learning paradigms or strengthen the existing ones. This can make teaching, learning and student evaluation methods more effective and attractive.

The virtual learning environments fastly expanded after the spreading of Web and the following dominance of Internet. They are mainly based on the instructional paradigm of collaborative learning rather than on the self-instruction paradigm. According to Zhang and Nunamaker (2003), the VLEs could be considered as a learning process, which is characterized from the use of a combination of communication, information technologies and multimedia in which:

- All the interactions among for example teachers, students and educational material, which are necessary for the learning process, can be materialized.

- All the information and knowledge (in different forms of representation), which is demanded for the learning process, are accessible and readable.

- A high rate of flexibility can be chosen as far as the location, the time and the learning rate are concerned.

VLEs can be used for distance education but also in face-to-face classroom as a tool for the educator. In the second case, the educational process is called blended learning. According to Harrison (2001), blended learning is “the integrated combination of traditional learning with web based online approaches”. In a VLE, different ways of education can be combined like collaborative learning and education with or without the live presence of the teacher and the main aim is the creation of the participative feeling among the involved parts and the development of educational principles. Through information and communication technologies certain educational aims can be accomplished, like the ones described below:

- Renewal of the pedagogic methods and environments in the educational institutes.

- Creation of stimulations for the spreading of information and training material among educational institutes all around the world.
- Promotion of collaboration, which is a very effective educational technique as well as promotion of collaborative learning.

- Motivation of trainees through the use of new and effective technological equipment during the courses in order to develop their learning abilities.

- Effective transmission and distribution of the training material at the trainees.

In order to create a technologically “rich” educational environment, a lot of initiatives have to be taken. The VLE is one of the technological tools, which can contribute in the solution of some educational problems and in the improvement of the productivity and the competition of organizations. It refers to various applications and network technologies which can be used from the interested parts and organizations in order to change the learning models and create new ones which will give to the students more positive knowledge in comparison to the existing ones.

2.2.2 Related work to our Virtual Learning Environment

Our system belongs in the category of virtual learning environments. There are a lot of existing virtual learning environments but the innovation of our system is that it is supposed to be easy and simple to use, without too many and complicated functions because it refers to lower level education and more specifically to the first classes of preliminary school. Moreover, our system does not specialize on a certain field like for example mathematics and it is not a distant learning system neither since the students are supposed to be in a special computer classroom with the teacher.

On the other hand, most of the existing virtual learning environments refer to higher-level education and they are distant learning. However there are some systems used in lower level education in some schools but they are used for the teaching of a specific field like history or mathematics. There are also some environments, which although they were designed for higher-level education, in their client list they also included possibilities for lower level education. The problem is that if these systems are supposed to be used by very young children, their whole interface has to be very simplified and adjusted to the young children’s knowledge, which is only done by few of them. Finally, the last years some interesting projects have taken place concerning virtual learning environments which connect different primary or secondary school classrooms around the world like for example Euroland. These projects use distant learning platforms and video-conferencing but they are beyond the limits of our proposed system. We have to say that there are some CD-ROMS which can perform the same functions as our system but they are not online environments. So it was very hard for us to find a virtual learning system based on the same ideas and features as ours.

During our literature research, we found very few similar virtual school systems and almost none of them was officially used in education. We chose to present two learning platforms, which we considered to be close to the ideas of our system, Moodle and Assimilate. Moodle is a widely used virtual learning environment and it focuses on different educational levels. A primary study was conducted concerning its use in primary school, which we will also present in the following pages. Assimilate,
Chapter 2 – Literature Study

is a learning platform providing computer-based education in primary and secondary schools in the UK.

2.2.2.1 Moodle

Moodle is a free, open source software package (also known as Course Management System or Virtual Learning Environment). It has a remarkable user community which exceeds 150,000 registered users in 160 countries. Moodle can help educators create online courses including various ways of interaction. Its open source license allows different users to participate in its development and additional functionalities. It can be run on Unix, Linux, FreeBSD, Windows and any other system that supports PHP. According to “Alexa Web traffic for Virtual Learning Environments”, it has the second highest market share after Blackboard.

How Moodle works

Once the administrator has set up Moodle and he has assigned a new, blank course for the teacher, the teacher can log in the course homepage and use the features provided. The teacher can form the homepage of the course by adding resources and activities. Different ways can be used in order to enroll the students and assign them to different groups.

A sample of the course homepage is shown in figure 1. As we can see, there are blocks on the left and the right side, which can be modified by the teacher if he wants to add new blocks, resources or activities. These blocks describe the course content. If editing is turned on, the teacher can add, remove or hide the blocks. Some of the available blocks are "Latest News", "Blogs", "Upcoming Events", and "Recent Activity".

![Figure 1: Getting started](image-url)
There is a variety of interactive learning activities that Moodle allows to be added in the course. For the communication the “Chat” and “Forum” functions are provided as well as “Choices” for getting group feedback. “Wikis” are also provided and in that way collaborative authoring is allowed. Through the functions “Assignments” and “Workshops”, the students can submit their papers and teachers can mark them.

The “Assignment Module” allow students to upload a piece of work in order to be marked by the teacher. Once the student has finished his work, he uploads the file. The student clicks on the file to see the work, he chooses one of the available grades and he can write comments in a box. The student will receive an email saying that his work has been marked and he can view the grade and the comments at anytime through the site. The parents will also be able to see all the grades and comments of their children’s work if the teacher or student decides to provide them with a password. Some other activity functions provided are “Lessons”, “SCORM”, “Glossary”, “Survey”, “Database” and “Quiz”.

Finally, Moodle supports different types of resources like “Text page” or “Web page”. In that way, teachers can include different types of contents in their course page.


Pilot study concerning the use of Moodle in a primary school

Miles Berry is the head of Alton Convent School's prep department. He was the first one to use Moodle and Elgg in primary education as the deputy head at St Ives, a prep school in Haslemere for girls aged 3-11 years old and he won the 2006 Becta ICT in Practice Award for primary teaching. St Ives School has relatively small class sizes and the IT provision is good although other resources like books and teachers are limited.

Miles was responsible for the students aged 5 and 6 mathematics curriculums for the purposes of a pilot study, and it is in these classes that Moodle was used. In this virtual learning environment, Miles had chosen to use mathematics enhancement materials from Plymouth University. Moodle was used in the classroom but its main usage was to extend the classroom into the home.

Miles says that their usual way of working was to enter the computer area and they could work as a group through the traditional way of teaching, but at the same time since the girls were sitting at computers, they could work as individuals. The part of the class during which they worked as a group without using the computers, was recorded by a screen capture tool, which records everything that happens on the board like a movie. This file would be saved and put into Moodle so that any student who was absent would be able to open the file and see the main parts of the lesson. It could also be used from students for revising.

According to Miles, the advantage of using Moodle in his classrooms was that while the students were working on their own on the exercises, they could discuss with each
other or ask him questions and in that way there was instant feedback which is the social aspect of learning and that is why the teacher should not be left on the side. Through Moodle, Miles could see what activities the girls have done and how long they needed for doing them as well as the results of the tests. Another advantage of Moodle was that the students could see their mistakes right away while performing an activity thanks to the mechanisms that are used by the platform, and they did not have to wait for the next day or the next few days like it usually happens. In addition, Miles says that his workload was reduced through Moodle and that once his material is prepared, he can reuse it the next years by just adjusting it to fit the idiosyncrasies of particular groups. Finally, Moodle gave him the opportunity to continue the discussions that he encourages into class at home through the online forum and chat.

This pilot study showed that virtual learning environments can offer a lot to primary schools especially if they combine interactive, whole class teaching, with independent online work, which nevertheless maintains a social dimension to learning. Some of the conclusions from the use of Moodle in this primary school were that students who were shy in the class participated more in the forum and chat discussions, the students’ computing and typing skills were improved, the students gained more awareness of the processes involved in software development since Moodle is an open source platform, their performance in mathematics raised and they thought that the process of learning was more interesting in that way. After the successful pilot study of Moodle, St Ives School is now trying to expand its use on other classes as well.


2.2.2.2 Assimilate

Ramesis is one of the providers in learning technologies and services to schools and local education authorities. It was established in 1984 and its headquarters are in UK. One of its products, Assimilate, is a learning platform, which provides technology-based education in primary and secondary schools of UK. It is working with over 16,000 schools and among its clients are Kent County Council (the largest local authority in the UK supporting over 600 schools and colleges) and Philip Morant School and College. Assimilate gives the opportunity to the learner for individualized and personalized learning. It is a fully integrated online system which changes the dimension of teaching and learning. Its flexible approach allows the new technology teaching methods to be blended with the traditional learning methods.

Assimilate gives each student a personalized learning environment in which they can create personal content, store personal files and folders and access a range of communicative and collaborative tools as well as lesson management applications. The users are provided with a dynamic interface that adapts itself based on the age, role and school the user belongs to. Assimilate allows access from any location including the home and supports a broad range of user types including teachers, students of all ages, parents and local education authority staff. It provides a secure platform for schools to collaborate and share practice material both internally and with other schools. Moreover, it provides sophisticated management tools that allow
groups of schools and local education authorities to effectively share information between their staff and students. This includes curriculum resources, lesson plans, staff development information and secure collaborative communities. This collaboration between schools gives them the opportunity to share special skills and work together to raise standards and easily transfer students’ process.

Assimilate can also assist schools in implementing a personalized learning strategy by giving teachers the flexibility to create the classes and assignments to individual student needs. One of the advantages for the students is that they can work on their own pace and adjust their work to their needs. This gives them flexibility, which actually means control and that can make learning more interesting for them. When Assimilate is accessed by a web browser, the students can adapt at any time and anywhere learning concepts and learning outside the classroom is encouraged. For example, the teacher can upload certain activities like crosswords and the students can do them even at home. The teachers can also add additional links that they would never say in the classroom and let the students who are interested to access them. Assimilate is based on the idea that students do their work at school and reinforce their learning when they go home.

In addition, Assimilate allows parents to get involved in this learning by allowing access to communities and resources from home. Among the advantages of Assimilate are that it can reduce the teacher’s workload, provide a basis for them to continue their teaching and it engages students of all ages by introducing a variety of different classroom techniques.


2.2.2.3 Other Virtual Learning Environments

Since few work is done on virtual learning environments concentrating in lower-level education, we decided to provide some information on the functions of the available systems in high-level education, among which some can also be used in lower level. Below a list of some virtual learning environments is provided, including a short presentation of each system and some of their available features. We decided not to make any comparison of these systems because there are many such comparisons on the web. Moreover, there are different comparisons based on different criteria and that does not leave us any space for further research on this section.

- **.LRN**

.LRN (pronounced "dot learn") is a very widely adopted enterprise-class open source software for supporting e-learning and digital communities. It was firstly developed at MIT. Over than half a million people use .LRN in higher education, government, non-profit, and K-12. It is based on OpenACS toolkit.

Out of the box, .LRN comes with the following applications: Assessment, forums, e-mail, calendar, curriculum, .LRN e commerce, homework drop box, edit this page, grade book/evaluation, expenses tracking, FAQs, file storage, LORS central
(Learning Object Repository), LORs management, news, photo albums, project manager, staff list, survey, syllabus, user tracking, web logger, slide presentations.

(http://dotlrn.org/, 21-11-2006)

- **ANGEL LEARNING**

ANGEL Learning develops and markets the web-based learning management system - ANGEL LMS and ANGEL ePortfolio. ANGEL provides a virtual learning environment for higher education, K-12 and business and professionals. The philosophy of the company is based on openness and community-based product development.

Headquartered in Indianapolis, Indiana, ANGEL Learning was founded in July 2000. ANGEL Learning and ANGEL LMS evolved from research and teaching experience at Indiana University-Purdue University Indianapolis. The initial research system deployed in 1996 became Indiana University's OnCourse. Today, ANGEL Learning has grown from a campus-based organization of university researchers and instructors to an established global software provider.

ANGEL LMS tries to offer easy-to-use and powerful enterprise software for teaching and learning. An open database schema, a Learning Object Repository and other features are included in this software. ANGEL ePortfolio provides students with a digital destination for growing their knowledge. Institutional assessment and reporting are provided for accreditation management. Some of its features are custom rubrics, blogging, and published data base schema, system-wide reporting and certified artifacts.


- **BLACKBOARD - WEBCT**

WebCT (Web Course Tools) was acquired in February 2006 by Blackboard Inc., which is an e-education software producing company, headquartered in Washington, which was founded in 1997 and went public in June 2004. The mission of Blackboard Company is to enable educational innovations everywhere by connecting people and technology. Its main products are five software applications bundled in two suites, the Blackboard Academic Suite (TM) and the Blackboard Commerce Suite (TM). Blackboard’s main clients are colleges, universities, schools and other education providers.

The *Blackboard Learning System* is a software application for institutions dedicated to teaching and learning. It includes various features and tools such as tools for semester-to-semester migration and archiving, a WYSIWYG (What You See
Is What You Get) editing tool that provides a rich text editing interface similar to a word processor, adaptive release, syllabus reader, learning units, course cartridges, personal information management, discussion board, virtual classroom, grade book and many others.


- **CLASSCENTRAL**

ClassCentral is a course management system by Reazon Systems, Inc. and a part of Reazon Academic Solutions which includes facultyCentral.com, a suite of tools and services for faculty, rCampus.com, an eCommunity suite for college students, and TBXN.com, the book exchange network. ClassCentral was created from Ramesh Sabettiahsraf because he needed it for more effective teaching in his classrooms.

Some of its special features are that you can view all messages in a single inbox, or view them by class or team, it allows the teacher to assign the same coursework to multiple classes, under different titles, due dates, and number of points, it allows the creation of Online classrooms and faculty web sites through its Course Management System and Instant Web Presence tools, it provides grade statistics with interactive charts and pies for easy analysis and you can create web pages easily for classes, tutor rooms, study groups and faculty's personal web page.

(http://www.classcentral.com/, 22-11-2006)

- **DESIRE2LEARN**

Desire2Learn was founded in 1999 and it specializes in providing eLearning solutions to academic and other organizations around the world. Its corporate headquarters are located in Kitchener, Oradio, Canada. Its clients according to the company are numbered to four million users worldwide. Desire2Learn products include a web-based learning environment that combines a Learning Management system and a Content management system, Learning Repository, Live Room and other educational innovative technology.

Some of the features of Desire2Learn Learning Environment are customizable design, branding and pedagogy, convenient course management, community interaction and collaboration, discussions, grades, statistics and feedback, feature-rich quizzing, scoring rubrics, reporting and data warehouse, survey system, conditional releases and learning paths, drop box, blog, ease-of-migration and glossary.

(http://www.desire2learn.com/, 22-11-2006)

- **DOKEOS**
Dokeos is an integrated learning management suite integrating a Learning Management System, a reporting dashboard, live conferencing ability and rapid content authoring. It is free software for learning and collaboration. According to the company 1200 organizations use Dokeos in 65 countries since it is translated in 31 different languages. Responsible for the development of Dokeos are several universities, schools and other organizations since it is actually an international, collaborative effort while its development is based on programming, usability theory and collaborative open source development methodology.

Some of its special features are announcements, links, forums, tracking, Ms-PowerPoint to learning path conversion, integrated live conferencing, templates and styles for rapid online authoring, search engine, new question types like hotspots and open answers, reporting dashboard with export to Ms-Excel, surveys and educational blogs.


- FIRSTCLASS

FirstClass is a high-performance, multiplatform communications system. It is a Division of Open Text Corporation (provider of Enterprise Content Management solutions). The headquarter of FirstClass Division of Open Text is in UK. FirstClass supports both Windows and Macintosh clients. Its customers are schools and school districts, learning organizations and businesses.

One of the special features of FirstClass is the Unified Communications option which converges user's email, voice and fax messages into their FirstClass mailbox but it also has a lot of capabilities including e-mail, instant messaging, calendars, contact management, collaboration, document sharing, file storage, web publishing and voice and fax messaging.


- SCHOLAR 360

Scholar360 supplies e-learning software to smaller institutions of higher education and provides comprehensive IT services including application, backend solutions, consulting and training. Its corporate headquarters are located in the Ghent district of Norfolk, Virginia.

The Scholar360 Learner Management System provides a lot of features among which the ability to create online courses, communities and student accounts, course discussion with commenting and file attachment, syllabus up loader, tracking student progress through the online grade book, test manager and testing center, personal journal, peer network relationships, internal messaging system and digital drop box allowing students to submit assignments directly to instructor.
- **FLE3**

Fle3 (Future Learning Environment) is a web-based learning environment or more specifically it is server software for computer supported collaborative learning (CSCL). Fle3 is open source and free software released under the GNU General Public Licence (GPL). The user interface of Fle3 is available in more than 20 languages and it is used in 50 different countries.

Fle3 uses 3 special tools, the WebTop for the user in order to store and share different items, the *Knowledge Building* which is a discussion environment for structured knowledge building in groups and the *Jamming* which is a tool for collaborative construction of digital artifacts (pictures, text, audio, video).
CHAPTER 3 EMPIRICAL FINDINGS

Before designing our system, we thought that if our literature study would be complemented with a related empirical study, we could reach a more effective result for the design of our system. For our empirical findings, two different research methods were followed: interviews and questionnaires. Our first step was to interview our stakeholder, a teacher who was interested in designing a virtual learning environment. Our work was based on his ideas and instructions, which we obtained after two interviews. So after having the general guidelines of the virtual school system we would design, we decided to do some surveys before designing our system because we thought that if more people are involved in the development of the system, it could be more effective.

This lead us to think which are the main “actors” involved in this system and whose opinion would be important for this system. Soon, we came to the conclusion that our research should focus on the students, the parents and the teachers or pedagogues. Moreover, we decided that the most effective way for investigating the students’ and the parents’ opinions would be the questionnaire while for the teachers/pedagogues would be the interview. All the research we did is analytically described in the following pages. The final conclusions from our empirical findings are presented in the “CONCLUSIONS” chapter (Chapter 5).

3.1 INTERVIEW WITH THE STAKEHOLDER

Our contact person was a teacher in Castilla-La Mancha, a region of Spain, who has studied computer science and was interested in developing a virtual learning environment, which would take into consideration various educational aspects. After he had given us a general description of the system we were going to design, we decided to make an interview with him in order to go through the system functionality in detail. We managed to gather a lot of information during the first interview but when we started working on the design of the system, we realized that some essential information was missing for covering all the functionalities. That led us to conducting a second interview with the stakeholder.

From the first general description that he had given to us, we identified two different information parts where we wanted to focus the interviews with the stakeholder. These parts are: system users and communication users. We will describe these parts and we will present the interview in order to identify the information used.

As far as the way of conducting the interviews is concerned, our first aim was to do it face-to-face. However, due to the different locations – our stakeholder’s work place is in Spain – and the impossibility of visiting his work place, the interviews were finally conducted through mail. The choice of telephone interview was also considered, but the stakeholder told us that he preferred to do it by mail. As a result, we structured our first interview including questions that would cover all the requirements for the design of our virtual learning system and send it to him through email. The interviews are
available in the appendices while the information acquired from the two interviews is presented below.

### 3.1.1 Interview 1

**System users functionality**

In our VLE, five users were identified:

**Student User:** The student will be involved in activities, which will be evaluated by the teacher in charge. Everyday one or more activities will be specified for each student and these activities are going to be loaded when the student starts the system. This loading must be automatic after the teacher selects using his interface. The age of the students involved will be between 5 and 8 years old. The system must also be prepared for work with children of a specific handicap, such as handicapped mind or marginal children, etc. For this reason the system has to allow the teacher to load different activities to a person or a group of students who are different from the rest.

**Teacher User:** Every teacher is going to be in charge of just one group, which includes being in charge of a calendar, of the schedule of the activities, of the review of the results and of the private activities modification. There will be two different kinds of activities. One of those, public activities are going to be generated by the default developer system group and the system administrator will be able to control them, by the design of new ones or by modifying or deleting some of the available ones. The second kind, privates, is designed by the teacher for his group and he can decide if he will put them in the public stack of activities or not. The teacher will be able to access the results, which are automatically generated by the system when the student finishes the activity. These results could be modified from him, before the system automatically generates the statistics. When a new activity is generated, it is also defined a grading scale for it, which the system has to take for getting the automatic result when this activity is done. (The teacher also defines the end of the activity).

**Administrator User:** The administrator will be the one in charge to control the users of the system, assigning to them a username and a password besides to define the access rules to it (the system). He will also be the one in charge to administrate the stack of public activities that will be brought with the system so that he can create new ones or modify those that already exist. He is also in charge of establishing the different communication tools that are in the system.

**Pedagogue User:** The pedagogue will be the one in charge to evaluate the development of the learning in the school, through the activities evaluation and checking the students’ statistics and results. Within the system, the pedagogue will be able to make meeting requests with the professor as well as with the students’ parents.

**Parents User:** The parents will be able to access the system and to consult just the statistics of their children and of the classrooms to which they belong. The parents will be able to use the communication tools developed for the classroom to which their children belong. Within these tools there will be the classroom forum, the
professor mail list and the meeting requests with the professor as well as with the pedagogue through the meetings module (also this will be used in the inverse way by professors and pedagogue).

*System Communication Functionality*

In the system, different tools must be developed that allow the communication between the school educators and the students’ parents:

*Forum:* A forum by classroom will be created so that the users can read and write visible commentaries for the rest of the users.

*Mail List:* A list of mail by classroom will be created, in the same way as the forums, so that the lists will be administrated by the administrator and used by the person in charge of this classroom. The parents of the children must have an email address (given by the school or private); in the mail list will be included the addresses of the parents that would like to use this communication tool. The mail list is the way in which the professor will be able to send customized information and be sure that this information will arrive to the parents listed in this tool.

*Statistics:* They will be generated from the results that the classroom professor considers that they can be public for each one of the classroom students. They are cumulative statistics, within which we will be able to differentiate according to the time: weekly, monthly, four-monthly and total accumulated of the course. The pedagogue will be able to access all the available statistics in the system. After the pedagogue and in an accessibility scale, the professor could access the statistics of the students and classroom of which he is responsible. And finally the parents will just be able to access the published statistics of their children and the accumulated ones from the classroom to which they belong.

3.1.2 Interview 2

After starting to design the system, we realised that there were some problems due to inadequate information. So we decided to conduct a second interview with the stakeholder. The additional information in each of the systems’ part obtained from the second interview is presented below:

*System Users Functionality*

*Student User:* As far as the access to the system is concerned, the student interface is going to be loaded when they log in. Moreover, due to the poor computer knowledge of the students, the log in is going to be done by the teacher in charge if they have problems doing it on their own. In addition, the students are going to be distributed in many groups with no more than 20 in each one. A teacher will evaluate each group. Finally, the student interface is going to be loaded in a tablet-pc located in a classroom that is going to be used only for these activities.
Teacher User: The teacher will define the schedule, registering the activities that could be done by one student or by a group. The teacher will also be able to insert specific activities for students with specific handicaps. In addition, there will be public results stored in statistics that teachers, pedagouges and parents can access. There will be four types: weekly, monthly, four-monthly and the total accumulated from the course.

Pedagouge User: Pedagogue will be able to access all the public information about the students, either by student or by classroom.

Parents User: The parents will have the right to obtain an email within the system or to use a private one.

System Communication Functionality

Forum: There will be a forum by classroom, accessible by every parent and professor; the user pedagogue will not have access to this communication tool.

3.2 STUDENTS QUESTIONNAIRE

Before designing the system, we thought that the most important “actors” of the system and the main reason why this system is developed are the students and their education. So we decided to do a survey concerning their opinions and proposals about a system like that. The aim of this survey was to know the students’ first reactions and impressions about the idea of a virtual learning environment.

Selected Data Collection Technique: We chose to do the survey in the form of questionnaire. In that way we could get a lot of different opinions and draw statistical conclusions out of them. In addition, the geographical distance could be faced through the use of a questionnaire. Another advantage of the questionnaire would be that the anonymity used would encourage more students to answer the questions and express their opinions freely. One more reason for choosing to use a questionnaire is that its use is more flexible since its distribution to the students did not have to be programmed but it could happen whenever they had available time. The respondents would not be influenced on their answers because there would not be any visual or verbal communication. Finally, the questionnaire is a technique with which most people are familiar and that makes its use easier.

Selected Sample: One of the problems we had was the choice of the age in which the survey would be conducted. At the beginning we thought to do the survey on students of 5-8 years old which is actually the age to which the system refers. However, the problem would be that so young students do not have neither the maturity nor the knowledge to answer this kind of questions and to judge the effectiveness of such a system. Our next thought was to focus on university students who would have both
the maturity and the knowledge to answer these questions and to judge a virtual school e-learning system. The problem in that case was that university studies are divided in different fields and the answers would vary depending on the field in which the survey was conducted. For example the answers of a computer science department would be very different from the ones of a history department. In addition, university students are more than 10 years ahead of the age to which our system refers and that makes it harder for them to imagine themselves in preliminary school using an e-learning system.

We finally chose to conduct the survey on students of the second grade of high school aged 13 years old because of all the reasons mentioned above. We thought that students of that age can answer the questions with a satisfactory level of maturity and knowledge and that they are more close to the preliminary school age. Moreover they all have the same background of studies so the results did not have to be categorized based on their field.

The questionnaires were distributed in a high school of Castilla-La Mancha, a region of Spain, by our stakeholder. The language of the questionnaire was Spanish but they were translated in order to present the results in our thesis. The second grade of high school of this school consists of five classes of 105 students in total.

**Questionnaire structure:** The questionnaire designed for this survey, which is available in the appendix, starts with a general, simplified, theoretical description of the system we were going to design in order to let the students understand what the system is about in an easy and comprehensible way. The students were also asked to go carefully through the system description and take some time to answer the questions based on their true opinions. The questionnaire consists of 7 questions. Both close and open questions are used. All the questions are opinion questions except the first one, which is a factual question.

At the beginning, we had thought that it might be better to do a more practical survey, like for example have the students try the system on computers, but this choice was turned down since we did not have the implementation part and since the necessary equipment was not available. We want to emphasize on the fact that the results of this questionnaire will not judge our system and its functions but they will form a general first impression of the students’ opinions and willing to use the system. The questionnaire is available in the appendix.

**Response Rate:** Twelve questionnaires were not taken into consideration because the answers seemed to be unrealistic – they were making fun of the questions – and they were considered as invalid. That limited our sample to 93 questionnaires, which means that the response rate was 88.5%.
3.2.1 Results of the survey

1) Have you ever used a system similar to this one before in your school or in another educational field?

![Figure 3.1: Students’ results from question 1](image)

2) Do you think that students aged 5-8 years old have adequate computer knowledge for using a system like that?

![Figure 3.2: Students’ results from question 2](image)

3) How much do you support the invasion of technology in education nowadays in comparison to the traditional school education?

![Figure 3.3: Students’ results from question 3](image)
4) How much effective do you think that a virtual school system like the one described above would be from an educational aspect?

![Figure 3.4: Students’ result from question 4](image)

5) How much attractive does the idea of a virtual school system sound to you?

![Figure 3.5: Students’ result from question 5](image)

6) What problems or disadvantages do you think this system will have?

The response rate in this question was low since only 22 students answered (24% response rate) while the rest left the answering space blank. The main points of the students about the disadvantages of the system are summarized below:

- The teachers might not have the requested knowledge to use it properly
- The essential equipment might not be available
- The students might not be able to use it
- The daily face-to-face communication between students and teachers will be restricted
- The parents will not be able to use it if they do not have the necessary knowledge or a computer at their place

7) Can you think of any other functions which you think this system could include? (Please feel free to make any kind of proposals).
The response rate in this question was even lower than the previous one since only 16 students answered (17% response rate). The main proposals of the system are summarized below:

- It might have been better if it was a distance learning system
- I think the parents should not be involved in the system
- The students should be able to communicate with each other through a chatting program
- You should find a way of connecting this system with the traditional way of teaching so that the communication between the students and the teachers will not be lost

3.2.2 Analysis

The survey was conducted in a high school in Spain and that means that we cannot generalize the results for the rest of the Europe or the world. So the following analysis is based on the characteristics of the Spanish students and the Spanish educational system.

The fact that 100% said that they have never used a system like that before was expected since as we have already mentioned, very few work is done on virtual learning environments in lower level education. In addition, most of the existing learning platforms are based on distance learning and do not involve the teacher and the students being in the classroom. That is one of the innovations of our system and in low-level education it can be applied better than a distance-learning platform since the students are very young and they might need the help of the teacher in order to use this system.

As far as the computer knowledge of students aged 5-8 years old for using a system like that is concerned, the majority of the respondents answered that with a little practice there should not be any problem. This shows that the level of computer knowledge of young students nowadays is relatively high because although our system does not require any special computer skills, a basic level of computer knowledge is at least required. Although it is just the opinion of a sample of 93 students, it is positive that they believe that students aged 5-8 years old have almost adequate computer knowledge for using a virtual learning system. If this is really true, the ground for computer based lower level education is prepared and this could be an important innovation in the educative system.

39% of the students answered that they strongly support the invasion of technology in education nowadays in comparison to the traditional school education. This is a high rate if we take into consideration the fact that the sample consists of students who are going to follow different careers in different fields and it does not consist for example only from computer science students. That means that this percentage also includes students who have a tendency and a preference towards historical or medical or law or economical studies and this makes the results pretty encouraging. 37% of the students said that the invasion of technology in education can be effective but we should stay close to the traditional way. That means that they believe in the effectiveness of computer-based education but at the same time they turn it down. This might be
happening for various reasons like for example satisfaction of the existing traditional way of learning and fear to experiment on a new educational medium or lack of information about the way the computer based education can be applied and its advantages.

Only 15% of the students rejected the effectiveness of our virtual school system while the rest 33% thought that it is very effective. The majority of the students seemed to keep a neutral opinion by saying that it is not very effective. These results are similar to the ones about the attractiveness of the idea of a virtual school system. It is interesting that 44% of the students think that the idea of a virtual school system is very attractive but only 33% of them think that our virtual school system is very effective. This could mean two things: either that students are attracted by the idea of something new and different but for some of them it is just the idea and the imagination of using such a system that is attractive and not the effectiveness that it could have, or that students think that a virtual school system is attractive but some of them think that the one that we are going to design does not correspond to the virtual school system they are expecting. In the second case, they probably think that our system has some disadvantages that are actually reflected in the answers of question number 6.

As far as the disadvantages of our system are concerned, there were some interesting opinions from different students. The most interesting argument was that the communication between children would be restricted. This is actually one of the main disadvantages of computer based education and VLEs since computers actually limit the daily face-to-face communication between students and teachers. However, our system is not a distance learning system, which means that the students and the teacher will be in the same classroom and if the student needs something, he can ask the teacher at any time. In addition, there will be a forum where the students and the teachers will be able to communicate and exchange opinions. And most of all, the traditional daily structure of preliminary school, which includes students going to school and being in classrooms of about 20 students, breaks between courses, school celebrations etc. will be maintained. It is the structure of the way of teaching inside the classroom that will change. Of course, even in that case the communication between the students and the teacher inside the classroom will change but that is the price in exchange with all the educational benefits that will be provided.

The other disadvantages mentioned by the students concern mainly the possible lack of knowledge of students, parents and teachers to use our system. It is true that this kind of problems might exist but we believe that with some practice - organized and provided by the school - they can easily be solved. Finally, some students said that the school might not have the necessary equipment for applying this way of teaching which is actually the problem of economical support. It is true that this problem always exists but we hope that if an introduction and a presentation of our system will firstly be made and the involved parts will be interested, then the school might be able to find available financing means for buying the necessary equipment.

The last part of the questionnaire included the proposals of the students about our system. One of the arguments was that maybe this system could be used from distance but as we have already mentioned a distant learning system in such a low education level and young age, it would be almost impossible to be applied. Some other students
said that the parents should not be involved in this system but this is actually impossible because parents are one of the main “actors” of the way the whole educational system works, especially in low level education. This argument is one of the main thoughts students have because it can give them more freedom and independency in their studies but it is proved that in most cases their studies are more effective when parents are involved. Finally, there was one proposal which sounded very interesting to us and it was about trying to find a way to connect the virtual school system with the traditional way of teaching so that the advantages of both ways will be combined. It is a clever proposal and to some extend it might be possible. However this would demand a lot of research and work and it will not be examined in our master thesis.

3.3 PARENTS QUESTIONNAIRE

One of the main parts of our system, which plays an important role in its functions, is the parent. As we have said before, we wanted to include the opinion of all the involved parts before designing our system and that is why we decided to do a survey on the parents’ opinion. The aim of this survey was to get a first impression about the views of the parents as far as a virtual learning environment for their children’s education is concerned, and to understand how willing they are to use this system because the proper function of the system reassumes their involvement.

Selected Data Collection Technique: We chose to do this survey in the form of questionnaire as well. In that way we could get a lot of different opinions and draw statistical conclusions out of them. In addition, the geographical distance could be faced through the use of a questionnaire. We also chose to use a questionnaire because in that way the parents could fill it whenever they had some available time and this provided flexibility of time. The respondents would not be influenced on their answers because there would not be any visual or verbal communication. Finally, the questionnaire is a technique with which most people are familiar and that makes its use easier.

Selected Sample: We thought that the sample we would use should have some connection with the students’ questionnaire so that these two results could be somehow compared. As a result, we chose to conduct this survey on the parents of the students who filled the first questionnaire. So when the students received their questionnaire, they also received another questionnaire for their parents. Our contact person for this distribution was once again our stakeholder. The language of the questionnaire was Spanish but they were translated in order to present the results in our thesis. The students were kindly requested to give this questionnaire to their parents and to ask them to fill it on behalf of us. They were also asked to bring it back when their parents would have filled it and a student was set responsible for collecting all these questionnaires when they would be completed and sending them to our stakeholder. The students were informed that it was up to them to choose if their father or their mother would fill this questionnaire. But they were also advised to give it to the parent who has most knowledge on information technologies. So the selected
sample for this survey was the 105 parents of the students of the second grade of a high school in Spain. The gender of the sample was mixed.

**Questionnaire structure:** The questionnaire designed for this survey, which is available in the appendix, starts with a general, simplified, theoretical description of the system we were going to design in order to let the parents understand what the system is about in an easy and comprehensible way. The structure of the questionnaire is similar to the one distributed on the students and some questions are similar as well. The parents were asked to go carefully through the system description and take some time to answer the questions based on their true opinions. They were also asked to try to think the application of this system on their own children and to answer based on this idea. The questionnaire consists of 8 questions. Both close and open questions are used. Most of the questions are opinion questions but there are some factual questions as well.

**Response Rate:** There were some problems as far as the response rate of the parents’ questionnaires is concerned because after one week there were only 33 questionnaires gathered (31% response rate). We contacted the student responsible for gathering the questionnaires and asked him to remind to the rest of the students to bring the questionnaires. So after one week, another 13 questionnaires were gathered. We decided to make a last effort to raise the existing sample and so we contacted the school and asked them to print another 105 questionnaires and distribute them once again to all the students of the second grade of high school and ask them to pass it to their parents but only the ones who had not done that yet. This last effort finally gave us another 24 questionnaires which means that we had in total 70 questionnaires which corresponds to 67% response rate.

### 3.3.1 Results of the survey

1) Have you or your children ever been involved with a system similar to this one before?

![Parents’ results from question 1](image)

*Figure 3.6: Parents’ results from question 1*
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2) Do you think that your children have adequate computer knowledge for using a system like that?

![Figure 3.7: Parents’ results from question 2](image)

3) How much do you support the invasion of technology in education nowadays in comparison to the traditional school education?

![Figure 3.8: Parents’ results from question 3](image)

4) How much effective do you think that a virtual school system like the one described above would be from an educational aspect?

![Figure 3.9: Parents’ results from question 4](image)
5) How much attractive does the idea of a virtual school system for your children’s education sound to you?

![Figure 3.10: Parents’ results from question 5]

6) Are you familiar with the functions and the use of an email account and a forum?

![Figure 3.11: Parents’ results from question 6]

7) For the proper function of our system, the parents of the students should be willing to use an email account and the forum for an effective communication with the teacher and pedagogue. Are you willing to use the email account and the forum (for parents who do not have the necessary knowledge, a tutorial can be organized)?

![Figure 3.12: Parents’ results from question 7]
8) Do you think that the forum and the email address will be an effective way for your communication and feedback with the teacher and the pedagogue?

![Bar chart showing the results of question 8]

Figure 3.13: Parents’ results from question 8

The question number 8 had a second part if the answer was no: “If the answer is no, please explain why.” Out of the 33 people who answered no, 25 people completed the second part of the question. The main points of the parents who said no are summarized below:

- I do not have a computer at home
- I am not familiar with the use of a forum and an email address
- I think that the feedback is more effective when you speak with the teacher face-to-face
- I support the traditional way
- I do not have time available for getting involved into that
- I do not trust the security of the system. If the security system is broken, then the students could be giving their own feedback to their parents!
- The system might not work properly and connection or other kind of problems might occur.

3.3.2 Analysis

The survey was conducted on the parents of the students of a high school in Spain and that means that we cannot generalize the results for the rest of the Europe or the world. So the following analysis is based on the characteristics of the Spanish parents and the Spanish educational system.

The fact that 100% of the parents said that they and their children have never been involved with a system similar to this one before was expected since the same answers had been given by the students of the school. In addition, as we have already said, there is very little work done on virtual learning environments in lower level education.
The majority of the parents (52%) answered that with a little practice their children should have adequate computer knowledge for using our system. This is an encouraging result since it shows that most of the parents believe that children of that age already have the basic computer knowledge. This question is similar to the question asked to the students and the result of this answer is almost the same since 49% of the students had answered “with a little practice there should not be any problem”. However it is strange that 33% of the parents had answered “no” to this question while only 18% of the students had answered “no”. If the results are valid, that means that either the students overestimate their computer knowledge or that their parents underestimate their knowledge. It is hard to decide whose answers should be taken more into consideration but it is true that sometimes parents do not have sufficient information on their children’s skills and knowledge. Even when they know their children’s knowledge and performance at school, they do not really know their knowledge and performance in other educational fields. It is also true that nowadays young children tend to get a lot of computer knowledge by experimenting on their own on their parents’ and brother’s computer and not from school.

72% of the parents in total answered that they support that we should stay close to the traditional school education among which, 42% considered the invasion of technology in education effective. Although it is a disappointing result, we have to take into consideration the fact that all of the parents who answered were educated through the traditional way of education and a lot of them have insufficient knowledge of the use of technologies in education. Moreover, as we have already mentioned very few work has been done on learning platforms on such an early age and maybe the parents do not want the efficiency of these systems to be tested on their children. But still these results show a generally negative attitude and reaction of the parents against a virtual school system. It would be interesting to ask them the same questions after they get detailed and proper information on VLEs in education.

As far as the effectiveness of our virtual school system is concerned, only 11% of the parents answered that they think that it is not effective at all. It is interesting to compare the results of this question (question 4) with the results of the previous question (question 3). We see that most of the parents believe that a virtual school learning system is effective but at the same time most of them believe that we should stay close to the traditional way of education. Moreover, most of them are also attracted to the idea of such a system (44%). It is complicated to analyse this paradox but in our opinion there are different reasons that drive to it like for example satisfaction of the existing traditional way of learning and fear to experiment on a new educational medium or lack of information about the way the computer based education can be applied and its advantages. We also noticed that the answers to these questions are similar to the ones the students gave to the corresponding questions which shows that parents and students think in a similar way as far as the effectiveness and the attractiveness of a virtual school system is concerned.

In the question concerning the familiarity of the parents with the functions and the use of an email account, the results are surprising: 68% of the parents answered that they are not familiar with this kind of use. It is very disappointing to see such a result since technology has nowadays so deeply invaded in our daily lives. In addition, these results form an obstacle for our system since the proper function of our system presupposes that the parents will participate in it, which is actually impossible if they
do not have the essential knowledge. A solution to this problem could be some tutorials organized by the school for the parents in order to show them how to work with the email and the forum. Fortunately, this does not require any special computer skills and can be taught in a fast and easy way. However, the parents have to be willing to attend these tutorials.

The fact that the majority of the parents were willing to use the email account and the forum for the proper function of our system including tutorial provision for the ones who do not have the requested knowledge is encouraging. This means that if the system would be applied, they would have a positive attitude and be willing to participate in it for the sake of their children. On the other hand, we should not ignore the 41% of the parents who said that they are not willing to participate because the proper function of our system demands 100% participation. As a solution to this problem, we see that the teachers and the pedagogues could have a few hours available per week at the beginning, in order to provide feedback to the parents who are not willing to participate until 100% participation is reached.

The results are almost divided in half concerning the opinion of the parents about the effectiveness of our system in the communication with the teacher and the pedagogue. The parents that said that they think that the communication is not effective provided different arguments.

One of the problems mentioned, was that some of them did not have a computer, which shows lack of equipment. This could be faced in various ways like finding financing means for the provision of computers to the ones that do not have one or by creating a computer room for the parents. The argument that they do not have the requested computer knowledge can be solved as we have already said with some tutorials for the parents. Some of them claimed that in order to get feedback, it is important to speak face-to-face and that is true to some extend since in that way the communication is direct and the body language is also used. This is actually one of the disadvantages of a virtual learning environment and it is connected to another one of their arguments saying that they support the traditional way. As far as the answer “I do not have time for that” is concerned, we have to say that the amount of time the parents are requested to spend on the feedback depends on them and it can vary depending on their involvement on their children’s education. But for example a parent who devotes a lot of time in getting feedback for his child’s performance by often visiting the teachers and speaking with them, can get the same feedback by spending the same or even less time through the forum and the email communication of our system. Some parents said that they do not trust the security system but we believe that with the username and the password that are required, there is hardly any possibility that a student aged 5 years old could break our security system. However, we are taking this argument into consideration for building a stronger security system. Finally, in response to the argument “the system might not work properly”, we have to say that this is what we are working on and we hope to achieve a high level of system functionality.
3.4 INTERVIEWS WITH TEACHERS-PEDAGOGUES

We thought that the opinion of the teachers-pedagogues about our virtual learning environment should be taken into consideration since they are one of its vital elements. Our initial aim was to conduct five interviews with teachers-pedagogues but three of them could not be reached so we came up with two interviews. Our first interview was with Martin Stigmar, who is working at Vaxjo’s University center for educational development and has previously worked on a project concerning the development of a virtual environment. The second one was with Kjell Johansson who is a professor of IT for teacher students in Vaxjo University.

Both interviews were conducted face-to-face and in English. In addition, the same questions were asked to both of the teachers so that we could compare the results. The aim of the interviews was to gain a first opinion of teachers-pedagogues of our system which would help its description and development. We decided to conduct qualitative semi-structured interviews with open-ended questions so that the conversation would not be constrained to the questions of the interview but the interviewees would also have the opportunity to talk about what they want and focus on the points which are the most important according to their opinion. During the interview, a recording machine was used after the interviewees’ agreement on that. In that way, we could ask questions, hear the opinion of the interviewee and focus totally on the interview and not on keeping notes. Moreover, the chance we had to listen to the interview again through the recording machine gave us the opportunity to gather the most important points of the conversation and to pay attention to details.

These interviews were conducted after the literature study and that provided a good theoretical background and knowledge of the subject we would make research on. We formed the interview questions focusing on the points where we wanted to obtain more information and where we thought that the interviewees’ knowledge field can be helpful for our thesis. After meeting the interviewees, we gave them a theoretical description of our virtual learning environment since a prototype was not available and after they asked us some questions in order to gain a better understanding of our system, the interview started. The questions of the interviews are available in the appendix while their results and analysis are presented in the following pages.

3.4.1. Interview with Martin Stigmar

Martin Stigmar has been a teacher in English and in physical education in the past working with students aged 13-16 years old. After that he started teaching in high school. At the same time, he had been studying pedagogy for 4 years. Then he studied for his PhD for another four years. He finished his thesis in January 2002. At the moment, he is working at Vaxjo’s University center for educational development. He had worked in a similar project as the one we are working on but the target group was glassworkers producing glass. He designed a virtual environment for them. Presently his field of interest is pedagogy or educational science.

At the beginning, Martin told us that he thinks that there are several similar systems to our VLE but when we explained to him more clearly the characteristics of our system (preliminary school, blended learning etc.) and that most of the other systems focus
Chapter 3 - Empirical Findings

on only one subject or they are systems developed for higher level education but they just include in their client list preliminary schools, he agreed that there are not any such similar systems. However, he told us that there are CD-ROMS which can perform the same functions but they are not online environments and we are only interested in online environments.

From his point of view, in distant learning it is very easy to identify the benefits because you can be wherever you want, you are free in space and in time and that is why it is fastly spreading. On the other hand, using a computer in a learning environment (that’s what he did in his thesis) is much more difficult to identify the benefits. There are different opinions concerning their effectiveness and it is hard to say if they will add knowledge to the student or not. He said that the relationship between the PC system and the outcome of the learning from the kids is very difficult to be measured. His suggestion was not to go into if it’s better or worse using a VLE in education but to make the description of our system and then look at the outcome (what happened?).

As far as the possibility of integrating our system in a preliminary school is concerned, Martin said that there is different computer availability in different countries and this must be kept in mind. He also said that the problem is not to implement and integrate technology in the classroom, the problem is the support. Earlier studies show that if you put one tenth of the money into computers and VLE (your thinking/planning/computering time etc.) then you should put 10 times as much time into support and that is often forgotten. That’s the problem in his opinion. The kids and the teachers should be very enthusiastic and motivated but the problem would be support.

Martin believes that it is very difficult to measure the effectiveness of our system from an educational point of view because we will not be able to say if the learning outcome will be better with or without computers. However, he thinks that if we would implement it and come up with a questionnaire asking students if they enjoyed it after having used it, they would say it was “serious fan” and they would like it.

Martin believes that the students’ level of computer knowledge in Sweden should be adequate for using our system. However, this will also depend on us, on the way we will design it (interface etc.). He also suggested that we should check out what is their level of knowledge and how computerized they are. As far as the parents willingness and ability to use our system is concerned, he said that it s a question of attitude, if the parents are positive and happy about this idea they will be willing to communicate over the computer. On the other hand, a precondition is that they must have a computer at home because if they do not have access, they will not be able to communicate. There is research in Sweden from 1996 that the students and the teachers were not the problem. The problem was the parents. They were the most conservatives, not willing to move on and to try new pedagogical ideas so parents are an aspect that should not be underestimated. As for the teachers, Martin thinks that they will be able to use the system in a proper way and motivate the students. But an important thing is to introduce the system in a school, speak to the professors about our fundamental pedagogical views and ideas (motivation, variation, the kids work in pairs etc.) and explain the system to them. The same applies for the parents and the students because just by integrating the system without any introduction is useless.
His opinion about the effectiveness of the communication of our system is that it is effective and that the forum and the email are enough because too many channels of communication will make it very hard for the users to know how they are going to communicate (through email, platform, letters etc.). Finally, his opinion about the disadvantages which our system could have is that it is very time consuming to make a prototype of a VLE and time is money. So one aspect is the cost and that it takes a lot of time. The other aspect is the support problem. Another problem is that young people nowadays are used to extremely nice graphics on TV and computers etc. which means that our target group is already used to very nice graphics and for us to come up with a VLE which is very good will be difficult because of the interfaces which will have to stimulate the students.

3.4.2 Interview with Kjell Johansson

Kjell Johansson has been a teacher of IT for the teacher students the last 3 years. In the past, he was responsible of a course for older teacher students about how the system of communication is built up in the university in order to allow them to exchange information and how to use computers and IT equipments in their teaching at schools.

Kjell Johansson told us that he has never heard of a VLE that has similar characteristics with our system and he thought that our idea was very good. According to his opinion, VLEs used in face-to-face classroom should not be used all the time because they will not be that interesting for the kids but they should come as a complementary teaching method. He thinks that if they are used part-time in the education, they can be very effective.

As far as the integration of our VLE in a preliminary school is concerned, he believes that there are a lot of practical problems – especially with support - but also that when it comes to computers and technology, people should not look firstly at the problems because computers are the future. In addition, he told us that our VLE could help education since the kids would be motivated. They like working on computers and in the future they will like it even more so he was very positive towards our system.

Kjell told us that there should not be any problem with the students’ level of computer knowledge for using our system but he suggested that we should design simple interfaces with a lot of pictures. Generally, he thinks that kids of that age are very positive and they can learn quickly but an introduction with computers will probably be needed. As for the parents, Kjell thinks that they are very positive with the computer use, they can see it as the future and many of them work with computers in their main work so they could daily use the email. He believes that the problem would be teachers because they might get a little afraid. There is resistance because some teachers do not know computers very well and they don’t like it that the kids are better than they are because in every class there is at least one person that knows computers very well, maybe even better than the teacher. But teachers are not used to that, they want to be number one and to know everything, to have control and not all teachers want to change. So there could be resistance from their aspect.
Finally, Kjell said that our system sounded right and effective. One of his remarks was that there should be enough computers in the classrooms and that each student has his own computer because if two or more students are sharing a computer, the one that has computer knowledge will do everything and the other one will just be watching.

3.4.3. Analysis of the interviews

These two interviews gave us the chance to get the opinion of two professionals of education concerning VLEs and the design of our system. The fact that the same questions were asked to both interviewees allows us to get two different perspectives for each question and to compare the answers.

Both Martin and Kjell said that they have never heard of a similar VLE to the one we are designing. This confirms the results of our literature study as far as the related work chapter is concerned. We were not able to find any other VLE used in preliminary schools which is designed with simple interfaces, aims to blended learning and does not focus on a single subject except Assimilate and Moodle which have some common characteristics with our system.

Both the interviewees showed a positive attitude towards blended learning, without of course ignoring the benefits of distant learning. Among their suggestions was to limit the use of our learning platform in some courses and not in all of them, and to focus on the outcome of our VLE and not on its advantages or disadvantages. The interviewees also agreed that the main problem for integrating our VLE in a preliminary school is the economical support we will need which should not be underestimated. Their attitude about the educational benefits of our system was positive and they thought that it can be an effective motivation for children.

As far as the acceptance and the effective use of our VLE from the different involved parts are concerned, the interviewees had different opinions. Martin said that the part which would probably not accept the system is the parents because they are conservative and not willing to move on and try new pedagogical ideas. On the other hand, Kjell said for the parents that they are very positive with the computer use and there will not be any problem with them. According to his opinion, the problem will be the teachers because they are afraid that the kids are better in computers than they are. We can see two very different opinions about which part will hardly accept the system and both opinions were supported with good arguments. We could say that both of them were right and maybe the problem will be the parents and the teachers as well. But we believe that if their suggestion is followed – introduce and make a presentation of our system to the parts involved before integrating it – we can overpass this obstacle. Where they seemed to agree, was that the students will not be the problem in the integration of our system since they will be very enthusiastic and motivated provided that our system is properly developed.

The possible problems our VLE could have according to the two interviewees were the cost and the time that are going to be spent on the prototype, the problem of economical support concerning the integration of our system in a preliminary school, the provision of one computer for each student and the demanding interfaces which
have to attract the students and motivate them. All these suggestions were taken into consideration for the design of our VLE.
CHAPTER 4 “KRONOS” VIRTUAL LEARNING ENVIRONMENT

4.1 VISION

A vision of the system that will be developed with its main requirements will be presented in this part. We will try to establish the frame of necessities and functions that our system will cover, as well as to observe the practical approach that it can have in the market.

4.1.1 Positioning

Target market: the market in which our virtual learning environment refers to is the market of education, which is an open market to new ideas although it demands that these ideas have a didactic base corroborated and a professional aspect so that the product will be competitive and effective as an education tool.

Problem description: we will describe a system which in the first place allows the teachers to manage in a simple and automatic way the accomplishment of activities by the students of whom they are in charge, and in which the evaluation of the activities will be self-attended in differentiation to the present system of evaluation of activities which are on paper.

In addition it will have to approach the necessities of the intercommunication between the different people in charge of the students’ education (professors, professionals of the education and parents) and it will facilitate simple tools in its use but not ineffective. All this is included in a flexible system which allows to adapt the punctual necessities of the users in a simple and fast way.

The impact of our system is to cover existing necessities in the education so that the solution through the "virtual classroom" will let us make the pursuit of the students’ education simple and effective.

Positioning of our system: our system will be developed for learning centres that notice the necessity to take the advantages that the application of the new technologies entails with its implantation in the educative system.

A defined global system like "virtual classroom" with different components that covers the exigencies in the educative system will be developed.

This system will be a tool that could be integrated within the implanted educational system in the schools so that it will be an attractive system for the students and an effective and simple tool for the rest of users, trying to obtain a different product from the ones presented in the market through its interfaces and components.

Brief description of the system: due to the increasing interest and the popularity of Internet, its facility of access, the high content of information and the elimination of distances between people of different parts of the world, the possibility of learning through virtual learning environments is a fact.
In order to reach this purpose it is necessary to make a web-based system able to provide the necessary facilities to generate and to support a dynamical academy integrated in the present technology, arising a curiosity in the students which will take them to the learning of the teaching subjects. We hope to manage to create a tool for the support and administration of a virtual classroom for students of ages between the 5 and 8 years old.

This system contains basic security modules as the one for access in the system through the procedure “user and password” and the control of access, in general, through the use of access rules. In addition, it is an administration module where the basic components of security and the process of registry to the system are controlled, with the administration tools. On the other hand, the creation of components that help the users to organize themselves and to communicate in the system is considered such as the meetings module, mail lists, forums, etc.

The system will concentrate its main functionality in the virtual classroom module which mainly affects the students: the activities. For the system, different interfaces and activities will be developed that allow the students to adapt their learning to their capacity, of subjects like mathematics, language, science, music, etc. These activities could be created either by the students so that all the professors have access to the same ones or by the teachers with the option to make them public.

4.1.2 Description of users

**Student users:** they will be the users who make the programmed activities in the calendar of the classroom, through tablet-pcs, and whose results will be published in the school’s statistics.

**Professor users:** users in charge of the classroom composed by students, programming the calendar through the allocation of activities and evaluations. They will adapt the students’ progress results according to their professional criterion and they will be in charge to activate the communication with the rest of the users responsible for the education of the students.

**Administrator user:** he will be the person in charge of the access to the system through the management of the users and passwords in addition to access rules. Also he will manage the part of the public activities and communication tools.

**Pedagogue user:** person in charge, through the study of the statistics, to evaluate the development of the education of the students, and to manage meetings with the rest of people in charge of the education with the purpose of dynamizing the system and making the adaptability of effective measures in education easier.

**Parents user:** system users like people in tutelary charge of the students. They will have access to the statistics of the student they are in charge of, and in addition, to the different tools of communication in order to intercommunicate with the rest of the people in charge of their children’s education for developing an effective educative system.
4.1.3 Surroundings of the users

The part of the system in which each one of the users is located, is described below:

**Surroundings of the Student user:** he will be within a classroom (virtual) as a student with a professor in charge. Within a part of the virtual classroom the activities, which he will have to make each one of the different lecture days, are inserted (calendar). Their results are gathered, and after being reviewed by the professor, they will be put into the statistics of the classroom and the student ones.

**Surroundings of the Professor user:** he is the user for whom most of the system parts are included in his registry. He will develop the calendar with the dynamic creation of private activities (that can be made public). In addition he will use the communication tools to interact with the rest of the users (through the mail list, forum and meetings module) so that the educative system will be more effective and dynamic.

**Surroundings of the Administrator user:** he and the professor are the users who administrate most parts of the system. He is in charge of the public activities module; also he is partly responsible for the access in the system and the users’ registries creation. He also appears in the administration of the communication tools, as well as in the maintenance of the virtual classrooms.

**Surroundings of the Pedagogue user:** he only appears in the part of the system related to the statistics and requests of meeting with the rest of the people in charge.

**Surroundings of the Parents user:** they are an important part of the system since they use the implemented communication tools and consult the published statistics of the school. In addition they can arrange meetings with other users of the system.
4.2 CHARACTERISTICS OF THE PRODUCT

4.2.1 User module

*The user needs to access the system in a safe way:*

- He logs in the system using his corresponding user name and password.
- The system checks the access through the user name and password’s matching and the existing access rules.

This system requirement is shown by the use case “Login”.

*The system loads a user’s customized home web page:*

- The system loads the customized profile corresponding to the logged user including the specific information of each one.

This system requirement is shown by the use case “Access to customized user page”.

*The user logs out of the system:*

- The user exits the system. The system closes the user’s profile and reloads the virtual classroom’s web page.

This system requirement is shown by the use case “Exit from the system”.

4.2.2 Student module

*The student waits until the activity is loaded in his interface:*

- The student user goes into the system and waits until the professor will load in their tablet-PCs the corresponding activities.

This system requirement is shown by the use case “Student activity Tablet-PC”.

*The student does the activity that appears in the interface:*

This system requirement is shown by the use case “Do the activity”.

*The student finishes the activity:*

- The system waits until the professor will give the finishing activity command in order to generate the results in an automatic way.
• The student will not still be able to exit from the system. That option will not be available in his interface unless the professor finalizes the activity from his interface.

This system requirement is shown by the use case “Student activity Tablet-PC”.

4.2.3 Parent module

The parent user signs in the mail list corresponding to his child’s professor or signs out if he is already in:

• The administrator receives a notification with the corresponding mail address of the user who wants to sign in (or sign out) the mail list of his child’s professor.

This system requirement is shown by the use case “Registering in the mail list”.

The parent checks his child’s statistics in the virtual classroom:

• The system tries to find the statistics of the parent’s child or the ones of the classroom to which he belongs.
• The system shows the statistics in the parent’s interface in different formats.

This system requirement is shown by the use case “Check the statistics”.

The parent wants to have a meeting with his child’s pedagogue or professor:

• The system gathers the request and sends it to the corresponding user.
• The system inserts into the corresponding user’s registry the meeting request.

This system requirement is shown by the use case “Using the meeting module”.

The parent accesses the different virtual classroom’s forums in order to read or write comments:

• The parent accesses some of the available forums in the system.
• The parent reads or writes comments.

This system requirement is shown by the use case “Using the forum”.

4.2.4 Pedagogue module

The pedagogue checks the virtual classroom’s available statistics:
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• The system searches the corresponding statistics of the selected student or classroom.
• The system displays the statistics in the pedagogue’s interface in different formats.

This system requirement is shown by the use case “Statistics check”.

The pedagogue wants to ask for a meeting with one or some of the student’s parents or with a professor:

• The system gathers the request and sends it to the corresponding user.
• The system inserts into the corresponding user’s registry the meeting request.

This system requirement is shown by the use case “Using the meeting module”.

4.2.5 Professor module

The professor checks his students’ or his virtual classroom’s statistics:

• The system searches the corresponding statistics of the professor’s students or classroom.
• The system displays the statistics in the professor’s interface in different formats.

This system requirement is shown by the use case “Statistics check”.

The professor wants to ask for a meeting with one or more pedagogues or with the student’s parents:

• The system gathers the request and sends it to the corresponding user.
• The system inserts into the corresponding user’s registry the meeting request.

This system requirement is shown by the use case “Using the meeting module”.

The professor accesses the different virtual classroom’s forums in order to read or write comments:

• The professor accesses some of the available forums in the system.
• The professor reads or writes comments.

This system requirement is shown by the use case “Using the forum”.

The professor wants to review his students’ results obtained from the activities that they did:
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- The system checks if that information exists and if so it is displayed on the screen.
- The professor has the possibility to modify the results.

This system requirement is shown by the use case “Results’ review”.

_The professor arranges the course schedule and the activities that will be done:_

- The professor accesses the classroom’s calendar.
- The professor inserts in the lecture days’ schedule, the activities that are more appropriate for the students and their capacities based on his opinion.
- The professor can review the calendar and modify the activities’ schedule as many times as he wants.

This system requirement is shown by the use case “Calendar Administration”.

_The professor decides when an activity will be loaded in the student’s interface:_

- The professor programs the system for loading the selected activity in the selected day in the student’s interface.

This system requirement is shown by the use case “Student activity Tablet-PC”.

_The professor can modify the automatic activity allocation that is going to be loaded in the student’s interface:_

- The professor can modify the activity that will be loaded in the student’s interface before loading it.
- The professor can load a different activity to a student or to a group of students.

This system requirement is shown by the use case “Student activity Tablet-PC”.

_The professor decides when the activity will be finalized in the student’s interface and gives permission for logging out:_

- The professor programs the system when to finalize the activity that the students are doing in their interfaces.

This system requirement is shown by the use case “Student activity Tablet-PC”.

_The professor can send massive e-mails through an e-mail list:_

- The professor accesses his mail list.
• The professor selects the destinies and sends the e-mail.

This system requirement is shown by the use case “Using the mail list”.

**The professor can create public activities or private activities that cannot be used from any other user:**

• The professor can create new activities or modify or delete the ones that he has already created.
• The professor can publish the private activities that he has created.

This system requirement is shown by the use case “Private activities administration”.

4.2.6 Administrator module

**The administrator is in charge of the maintenance of the public activities of the system:**

• The system opens the tool that allows the administrator to create, to publish, to modify or to eliminate public activities.
• The system makes the appropriate changes in the public activities.

This system requirement is shown by the use case “Public activities administration”.

**The administrator is in charge to make the publication of a private activity:**

• The system opens the tool that allows the administrator to publish the private activity.
• The system makes the appropriate changes in the public activities.

This system requirement is shown by the use case “Public activities administration”.

**The administrator administrates the mail lists of the different professors:**

• The administrator is in charge to insert or delete those users who want to register or unregister from a mail list as long as their profile allows that.

This system requirement is shown by the use case “Mail list administration”.

**The administrator administrates the mail accounts of the registered users:**
• The administrator is in charge to assign a mail account to the users registered in the system.

This system requirement is shown by the use case “Mail list administration”.

_The administrator acts as a moderator of the different forums available in the system:_

• The administrator is in charge to moderate the forums and has the option to delete a comment if it does not fulfil the rules established by the school.

This system requirement is shown by the use case “Forums administration”.

_The administrator inserts or deletes the users pertaining to a determined virtual classroom:_

• The administrator is the one who registers (or unregisters) those students pertaining to a classroom or to its associated professor.

This system requirement is shown by the use case “Classroom administration”.

_The administrator describes the access rules to the system and sets their priorities:_

This system requirement is shown by the use case “System access administration”.

_The administrator assigns a username and a password when a user registers in the system:_

This system requirement is shown by the use case “System access administration”.
4.3 SOFTWARE ARCHITECTURE

In this part we are going to present a general view of the architecture which our system is going to have.

Our purpose is to manage to obtain a comprehensive description of the system architecture. In order to do that, different architectonic views will be used with the objective to represent different aspects of the system that is going to be developed.

In the following pages we will describe the use cases related to the system so that we can obtain a vision of the class diagram referring to the system. We will also provide a general view of the use cases that have been considered appropriate for the development of the system, establishing a particular view for each one but without approaching a total specification of them. Also a logical view of the system will be included where the involved classes in the system will be identified.

**Architecture representation:** The captured requirements were identified in the initial phase after the interviews with the stakeholder, being a global vision, not specific and not the last of the system. Before that, we took into consideration:

- The system general views of the use cases, where the actors and scenes that we found in the system will be described
- The logical view where we describe the classes that belong to the interaction of the elements that compose the system

**Architectonic aims and requirements:** The objective of the system architecture is to allow controlling the activities that the students are going to do in the virtual classroom. These activities will be done in the tablet-PCs that the school will provide for the development of the system. The system will gather the results of the finished activities by the students and will generate a series of statistics to which the professors and the pedagogue who are granted in the system will have access via Intranet. The students’ parents that are registered in the system will also have access through Internet. The system will have different communication tools so that direct communication between the people in charge of the students’ education can be established. This communication will facilitate the evaluation of the students within the virtual classroom and in the school. In order to access to the system every user will need to login and his access request will be filtered through rules.

4.3.1 Use cases general view

The significant system use cases, through which we will specify the actors and scenes that describe our system, are included here. Each use case is described in a way that it covers one or several system requirements. Through the use case diagram we can establish the architecture from which the virtual classroom will be constructed. The use cases can be initiated by the system users. These users can be the students, professors, pedagogue, parents or administrator.
The use cases general view is shown in figure 1:

Figure 4.1: Use cases general view

The identified use cases are the following ones:

- **Do the activity**: This use case is initiated by the student. This use case shows the student’s possibility to interact with the interface of the loaded activity in his tablet-PC.

- **Private activities administration**: Since each professor will have exclusive access to his private activities, the actor who initiates this case of use is the professor. In this use case the professor’s possibility to administrate his private activities for creating new ones, modifying those that already exist, erasing them or publishing them is reflected.

- **Results review**: The actor who initiates this use case is the professor. In this use case the professor accedes to the students’ results and can modify them according to his criteria.

- **Activity student Tablet-pc**: The professor actor also exclusively initiates this use case. In this use case, the professor is allowed to load the activity that was programmed in his calendar or to modify it or to include another activity for one or
more students. This use case also includes the necessary option to finalize the activity in the students’ tablet-PCs.

- **Calendar administration:** This use case is initiated by the professor. In this use case the handling functionality of the lecture days is included so that the professor can program the activities that will be done throughout the lecture course.

- **Use mail list:** The actor who initiates this use case is the professor. It shows the possibility that the professor has, to send massive mails through a mail list in which the students’ parents can register through the virtual classroom that he uses.

- **Use forum:** Use case that can be initiated by two different actors: the parents or the professor. This forum shows the possibility to exchange messages between the different parents and professors. In that way, it works like a useful multimedia tool in the communication of the educators and parents of the students.

- **Use meeting module:** This use case can be initiated by three types of actors: professors, parents or pedagogue. In this use case, the actor has the possibility to send meeting request to the users, or to answer to these requests.

- **Statistics consult:** Use case that can also be initiated by the professor, the parents or the pedagogue. This case of use allows consulting the students’ statistics of a virtual classroom, or the virtual classroom results in a global way.

- **Register mail list:** Use case initiated by the actor parents. It allows to register them in the mail list from the classroom to which their child belongs, or to delete them if they were already registered.

- **Classroom administration:** The administrator as an actor is the one who initiates this use case, and allows him to administrate the students and the professor who belong to a specific classroom.

- **Public activities administration:** In this case we allowed the public activities administration, with the option to create, modify or erase them. This can be done exclusively by the administrator actor who is the one who initiates this use case.

- **Communication tools administration:** The administrator initiates this use case which allows him to access to the administration of the different communication tools available in the virtual classroom (forum, mail list, mail accounts).

- **System access administration:** Use case that shows the necessity of a restricted and safe access to the system through registered usernames and passwords that can be complemented with access rules, if the administrator wants, since he is the actor who initiates this use case.

- **Access to user page:** This use case contains the action of accessing from outside of the system. The user actor initiates it.

- **Logout of the system:** Use case initiated by the user. It allows him to logout of the system.
- **Create an activity**: Use case that allows the actor who initiates it (professor or administrator) to define a new activity and settle its interface and its automatic evaluation.

- **Forums management**: The administrator initiates this use case. It allows him to administrate the different forums that exist in the system, corresponding to the different classrooms.

- **Mail list management**: Like in the forums, this use case allows the administrator actor (who is also its initiator) to administrate the mail lists associated to each classroom.

- **Mail accounts management**: This use case is initiated by the administrator. It allows him to manage the mail accounts assigned to the different system users.

- **Login**: Use case initiated by the actor user indicating the action of logging in the system in order to access to it.

- **Access to customized user page**: This use case is initiated by the actor user and reflects the customisation that receives each user page based on his profile.

The private activities administration use case diagram is shown in figure 2:

![Private activities administration use case diagram](image)

**Figure 4.2: Private activities administration use case diagram**

**Make a private activity**: Use case that allows the professor to create a private activity.

The public activities administration use case diagram is shown in figure 3:

![Public activities administration use case diagram](image)

**Figure 4.3: Public activities administration use case diagram**
**Make a public activity:** Use case that allows the administrator to define a new public type activity that will be accessible by the professors.

The communication tools administration use case diagram is shown in figure 4:

![Communication tools administration use case diagram](image)

**Figure 4.4: Communication tools administration use case diagram**

**Forums management:** Use case through which the administrator has the possibility of administrating the different system forums and of taking care that commentaries that do not fulfil the school’s demanded requirements for this kind of communication will not be included.

**Mail list management:** Use case that allows the administrator to include or delete the parents’ mail addresses from the mail list of their child’s professor. In that way he can have a control over the professors different mail lists.

**Mail accounts management:** Use case that includes the system possibility to assign a mail account to those users registered in the system with a certain profile (parents, professor and pedagogue). This use case will be initiated by the administrator.

The access to user’s page use case diagram is shown in figure 5:
**Login:** Use case that the user starts when he wants to access to the system and that verifies that the provided password is correct and corresponds to the user who wants to access to the system. Moreover, it fulfils the described access rules in order to have a restricted and safe access way.

**Access customized user page:** When the user has logged in the system correctly, his profile home page with his personal information will be loaded.
4.3.2 Data View

In this view of the architecture the data model that is going to be used in the project with its distribution is shown.

4.3.2.1 Data model

In figure 6 the data model that is going to be used is represented:

![Data Model Diagram]

Figure 4.6: Data model
4.3.2.2 Classes’ description

Users: It is the system user’s generic class. It includes the registry that is created initially of each authorized user in the system and the assignment of the password. It contains the most general data of each user. The index attribute of the table in the database is "User" that must be unique in the system.

<table>
<thead>
<tr>
<th>User</th>
</tr>
</thead>
<tbody>
<tr>
<td>USER : String</td>
</tr>
<tr>
<td>PASSWORD : String</td>
</tr>
<tr>
<td>Profile : String</td>
</tr>
<tr>
<td>Name : String</td>
</tr>
<tr>
<td>Surname 1 : String</td>
</tr>
<tr>
<td>Surname 2 : String</td>
</tr>
<tr>
<td>Address : String</td>
</tr>
<tr>
<td>City : String</td>
</tr>
<tr>
<td>State : String</td>
</tr>
<tr>
<td>Telephone number : Integer</td>
</tr>
<tr>
<td>Gender : String</td>
</tr>
<tr>
<td>Birthdate : Date</td>
</tr>
<tr>
<td>Mail adress : String</td>
</tr>
</tbody>
</table>

Professor: This class shows the most specific data of the virtual classrooms’ professors, as well as the mail list that corresponds to him, which he will be able to use within the virtual classroom. The table index corresponds to the attribute "Professor user”.

<table>
<thead>
<tr>
<th>Professor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professor user : User</td>
</tr>
<tr>
<td>Mail list : Mail list</td>
</tr>
<tr>
<td>Meeting : Meeting</td>
</tr>
<tr>
<td>Picture : Variant</td>
</tr>
<tr>
<td>Classroom : Classroom</td>
</tr>
</tbody>
</table>

Student: In this class the specific data of the student user is shown including the data of his parent and the classroom to which he belongs. In this case the corresponding table index in the database would be "Student user".

<table>
<thead>
<tr>
<th>Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student user : User</td>
</tr>
<tr>
<td>Parent name : String</td>
</tr>
<tr>
<td>Parent surname 1 : String</td>
</tr>
<tr>
<td>Parent surname 2 : String</td>
</tr>
<tr>
<td>Classroom : Classroom</td>
</tr>
<tr>
<td>Picture : Variant</td>
</tr>
</tbody>
</table>
Parents: It is the class that gathers the data of the students’ parents, as well as the meetings module that corresponds to them. In the case of the parents’ table, the index would be "Parent user".

```
Parents

Parent user : User
Son user : User
Meeting : Meeting
```

Pedagogue: This class shows the pedagogue’s school profile including him like a registered system user. In the table pedagogue, the attribute used as index would be "Pedagogue user".

```
Pedagogue

Pedagogue user : User
Picture : Variant
Meeting : Meeting
```

Administrator: Class that corresponds to the administrator user of the system. Like in the rest of user type’s tables, index is "Administrator user".

```
Administrator

Administrator user : User
Picture : Variant
```

Mail list: It is the class associated to the professor that shows the registered users in it and the corresponding electronic mails. In this case the attribute used as index in the corresponding table would be an auto-numerical code set in the database.

```
Mail list

ID : Single
Registered parent name : String
Registered user : User
Registered mail : String
```

Classroom: Class that agglutinates the main characteristics of the system, because it will include a calendar with the activities that will be loaded for the students, as well as the corresponding statistics. It also includes the registry of the associated forum to each classroom of the system. In this case as well, an auto-numerical code is set in the table index.
Meeting: System class associated to some users (professor, pedagogue, parents) allowing the meetings organization between the different users through the meetings module. In the corresponding table the index would be set from the "User" attribute.

Access rule: Class that contains the different system access rules, as well as the priorities that are set in the rules order application. An auto-numerical code is used again like table index.

Forum: It is a class associated to the classroom and showing the messages that will be included as well as the date and their authors. We also set the index of the corresponding table with an auto-numerical code.

Statistics: It is another one of the associated classes to the classroom that shows the daily-obtained students’ results and the calculation on them in order to be presented on screen. The index corresponds in this case with the "Classroom" attribute.
Calendar: The last main class associated to a classroom, which contains the lecture days of the school with the activities schedule that the professor proposes for the classroom. In this case the table index is set by the "Student user" attribute.

Activity: System class where the private and public system activities are stored, as well as their authors. It also includes additional information for the activities, a preview and a comment done by the author for each activity, with the interface and evaluation criteria. In this case in the table “Activity”, the index refers to the "Name" attribute which must be unique in the system.

4.3.3 Distribution
In the raised system in order to develop the project, a data model is established without distribution at the data level, so that all the tables are in the same database. Thus, figure 7 shows a representative scheme of the situation:
The design of the application would also allow us to make a distributed data modeling, using the modules of the different users who can be identified within the system and associating the dependent modules of each type of user. Five types of users can be recognized:

1. **Student:** He is the user who will do the activities and he will belong to a virtual classroom of the system with a calendar of activities.

2. **Parents:** Rhetorical person that reference to the parents or people in tutelary charge of the student, who will access periodically the students’ results. They will have several available communication tools to establish an active dialog between the school and its educators.

3. **Professors:** They will be those that are in charge to manage the calendar and the activities that the students will do, as well as to evaluate the results. Also they will have tools for allowing the communication with the people in charge.

4. **Pedagogue:** He will be the person in charge to evaluate through the activities’ results if some anomaly in the educative process of some student of the school exists; for that he will have statistical analysis of the results, and communication tools with the parents and the professors of the students.

5. **Administrator:** Person that will be in charge of the system management once it is implanted in the school. For that he will have different tools.

Due to the fact that the data model would be complex enough and would affect the final system’s trough output, the distributed data model will be discarded firstly.
4.3.4 Deployment view

Through the system deployment view a reference of the physical nodes that we will have within the virtual classroom and the form that the system configuration will have is obtained. In this view the technical architecture of the system appears establishing the physical nodes that have to exist in order to maintain our system’s operation, as well as the location of the components in the indicated nodes.

The physical distribution of the application could be raised through the existence of physical servers. In one of them we will have the web server (which will present/display the information in HTML format, either to school’s external users like parents who can accede to the system through Internet, or to the users within the local network of the school, like students, professors, pedagogues or administrator) and in another server, the database and all the data administration processes will be running (where the installed applications will process the data to obtain the expected results in the system), as well as the user access administration and the necessary application administrative tools.

Besides to these two servers, there must be tablet PCs for each user of the local network (for the time being, one tablet PC per student and another one for the professor in the virtual classroom) and PCs that are going to be used by the pedagogue and the administrator, all of them with a preinstalled web browser to be able to visualize the application.

Outside the school, we would have to consider if the parent user has access to the application through PCs and an Internet connection. Those PCs must also have a preinstalled web browser, which will allow them to visualize correctly the application that is running.

This infrastructure is shown in figure 8:
Figure 4.8: Infrastructure

**Required technology**

The tablet PCs of the school must have installed a browser that allows them to visualize the developed application, in every students’ tablet PC as well as in the professors’, pedagogue’s and administrator’s corresponding one. Also it will be necessary to consider that the external PCs of the school and the ones which they want to be used by local network outside-users (like for example the students’ parents) must have a browser in order to accede correctly to the application as well as an internet connection that allows them to reach the school’s web server.

The tablet PCs within the school will have a determined IP address, as well as the servers, for which the web server must have a fixed public IP address so that it can be acceded from Internet, apart from being able to access the tablet PCs inside the local network.
4.4 USE CASES

All the use cases identified for the description of our system are presented in this part. The description, the preconditions, the post conditions, the scenarios and the diagrams of each use case are also included.

USE CASE 1: Access to customized user page

The actors involved in this use case is the user actor. This use case shows the user’s page is loading, taking into consideration his personal information and profile.

Preconditions: The user should have made the login correctly.

Post conditions: The user activates the functions corresponding to his type of user.

Use case scenario: After the user has logged in the system, the templates that correspond to this user and his information are loaded so that the user can now use his customized page.

The basic event flow of this use case is shown in figure 9:

Figure 4.9: Access to customized user page (Event flow)
USE CASE 2: Access to user page

The actor involved in this use case is the user actor. This use case describes how can the user access the system and his customized page from the homepage of the virtual classroom.

**Preconditions:** The user must be registered in the system and he must use his username and password.

**Post conditions:** He will access the system and he will load his customized page.

**Use case scenario:** The user is in the system’s home page and wants to log in his customized page. The system asks for his username and password and if it is the right one the system loads his customized user page as it is described in the “Access to customized user page” use case. If the username or password is not correct, both of them are asked again, but if they are wrongly inserted three times, then the user is returned to the system’s home page without logging into the system.

The use case diagram is presented in figure 10:

![Use case diagram for Access to user page](image_url)

*Figure 4.10: Access to user page (Use case)*

The basic event flow of this use case is shown in figure 11:
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Figure 4.11: Access to user page (Event flow)

USE CASE 3: Activity student Tablet-pc

The actor involved in this use case is the professor. This use case establishes the interface from which the professor can load in the students’ tablet-pcs the activity that was programmed in the calendar, with the possibility of changing the activity. He can also load a different activity for a student or group of students. Within this use case the option to finalize the activity in the tablet-pcs that activates the students’ system logout has been included.

Preconditions: In order to automatically load an activity in this interface, it should have been previously established in the calendar of the classroom.

Post conditions: Once an activity performed is finalized, there will be the option of logout in the student’s interface.

Alternative flow: If the professor tries to finalize an activity in the students’ tablet-pcs, which has not been loaded, the system will inform that there is no loaded activity and that this action cannot be performed.

Use case scenario 1: The professor has already established in the classroom’s calendar the activities they have to do and now he wants to load the activity. If he wants he can have a preview of the activity. He can either select the students from whom the activity will be performed or he can select an activity with another subject for some students. Finally, the activity is loaded on the students’ tablet-pc.
Use case scenario 2: If the professor decides to finalize the activity, the system begins to calculate the results and the grades of the students based on the evaluation criteria.

The basic event flow of this use case is shown in figure 12:
USE CASE 4: System access administration

The actor involved in this use case is the administrator. This use case allows the administrator to control the users’ system access, register them with a specific user name and password and be able to handle access rules either by adding or modifying or erasing.

**Preconditions:** The administrator must have available the minimum personal information required before the registry of a user.

**Post conditions:** The user name and password corresponding to each user will be unique in the system.

**Use case scenario 1:** If the administrator wants to register a new user in the system, he fills up the new registry information and assigns a username and a password for him (that can just be modified from the administrator) and finally he saves the changes.

**Use case scenario 2:** If the administrator wants to delete or modify a user that is already registered in the system, he accesses the registry database performing the respective action and finally he saves the changes.

**Use case scenario 3:** If the administrator wants to create a new access rule, he inserts the new rule information, sets the priority and saves the changes.

**Use case scenario 4:** If the administrator wants to delete or modify an access rule that is already created in the system, he selects the specific rule from the stack and he performs the respective action. Finally he saves the changes.

The basic event flow of this use case is shown in figure 13:
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User accesses “System access administration”

Users

What to do?

Selects user

Deletes or modifies user

Deletes user registry

Action

Modifies

Modifying user registry information

Save changes

Right action?

NO

YES

Put a new user

What to do?

Filling up new registry information

Inserts new access rule

User and password assigning

User and password assigning

Kind of action with?

Rules

Action?

Modifies or deletes rule

Selects rule

Modifies

Deleting access rule

Delete access rule

Priority assigning

Delet es access rule

Modifying access rule

Save changes

Right action?

NO

YES

The user will be unique inside of the system and is going to have an associated password that could not be modified by himself, just by the administrator

Figure 4.13: System access administration (Event flow)
**USE CASE 5: Private activities administration**

The actor involved in this use case is the professor. This use case shows the possibility of the professor actor to create, modify or delete activities of private type to which he only has access. In addition, it shows the possibility of publishing the activity and giving access to this activity.

**Preconditions:** There are not any preconditions for this use case.

**Post conditions:** There are not any post conditions for this use case.

**Alternative flow:** In case a professor tries to access to a private activity to which he is not authorized, the system will indicate that he cannot modify this activity and will inform the activity author.

**Use case scenario 1:** The professor wants to make a private activity and this is described in the “Make private activities” use case.

**Use case scenario 2:** The professor wants to modify a private activity (provided that he is the owner); he selects the activity, chooses if he wants to have a preview or not and then he can either modify the interface or change the evaluation criteria or even grant permission to the administrator for modifying or making it public but always appearing as the original author.

**Use case scenario 3:** The professor wants to delete a private activity (provided that he is the owner); he selects the activity, chooses if he wants to have a preview or not and then he can access to the registry and delete the activity.

**Use case scenario 4:** The professor can also publish a private activity that belongs to him, by accessing his private activity and publishing it copying its structure that cannot be modified.

The use case diagram is presented in figure 14:

![Private activities administration (Use case)](image)

**Figure 4.14: Private activities administration (Use case)**

The basic event flow of this use case is shown in figure 15:
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Figure 4.15 Private activities administration (Event flow)
USE CASE 6: Public activities administration

The actor involved in this use case is the administrator. In this use case, parallel to the Private activities administration use case, we allowed the administrator to handle the activities that all the professors can use. The administrator can create, modify or eliminate an activity. In this use case the option to publish some activity taken from the private activities’ stack of one of the professors who wants to give public type to that activity is available.

**Preconditions:** In order to be able to copy the registry of a private activity (to paste it and to create a new public activity), the author of the private activity has to make it public type and to put the administrator as the activity co-author.

**Post conditions:** There are not any post conditions for this use case.

**Alternative flow:** If the administrator tries to access a private activity that the initial author (professor) has not indicated as public type, the system will inform the administrator that he does not have the privilege to modify that activity and it will also inform his author about it.

**Use case scenario 1:** The professor wants to make a public activity and this is described in the “Make public activities” use case.

**Use case scenario 2:** The professor wants to modify a public activity (provided that he is the owner); he selects the activity, chooses if he wants to have a preview or not and after that he can either modify the interface or change the evaluation criteria.

**Use case scenario 3:** The professor wants to delete a public activity (provided that he is the owner); he selects the activity, chooses if he wants to have a preview or not and after that he can access to the registry and delete it from there.

**Use case scenario 4:** The professor can also publish a private activity that belongs to him, by accessing his private activity and publishing it copying its structure that can be modified on the copy.

The use case diagram is presented in figure 16:

![Diagram](image)

*Figure 4.16: Public activities administration (Use case)*

The basic event flow of this use case is shown in figure 17:
Use case "Make public activity"

User accesses "Public activity"

- Make activity
- Deletes or modifies activity
- Selects subject
- Selects activity

Activity preview?
- YES
- NO

- Public private activity
- Delete public activity
- Modify public activity
- Copy the activity
- Modify public activity
- Change evaluation criteria
- Modify interface
- Changes evaluation criteria
- Saves changes in registry
- Correct?
- YES
- NO

If the administrator tries to modify a private activity of which he is coauthor, the system will not allow him. He will have to work on the copy that was created as public activity. The fact of being coauthor only allows him to copy the registry of the activity not to modify it.

The administrator will be able to access to the public activities and those private activities that the professors have given permission to publish them.

Figure 4.17: Public activities administration (Event flow)
USE CASE 7: Classroom administration

The actor involved in this use case is the administrator. This use case shows the possibility that the system administrator has, to administrate the virtual classrooms by registering or deleting the students or the professors in each classroom.

**Preconditions:** In order to register or delete a student or teacher, he should be already registered in the system as user. In addition, the user must not be registered in another classroom.

**Post conditions:** When the user is registered in a classroom, he cannot be registered in another classroom unless he is deleted from the first one.

**Use case scenario 1:** The administrator wants to create a new classroom; he registers it, saves the changes and finally he has to confirm that the information included is correct.

**Use case scenario 2:** The administrator wants to insert a user in the classroom; he selects the classroom, decides the kind of user to insert (teacher or student), fills up the relevant information and inserts the new registry in the classroom.

**Use case scenario 3:** The administrator wants to delete a user from the classroom; he selects the classroom, decides the kind of user to delete (teacher or student), selects him from the registry and confirms the deletion.

The basic event flow of this use case is shown in figure 18:
User accesses to "Classroom administration"

Does the classroom exist?

YES

No

Selects classroom

Register a new classroom

Save changes

Right information?

YES

No

Insert which kind of user?

Teacher

Student

Inserts new registry in classroom

Right?

YES

Delete which kind of user?

Teacher

Student

Deletes registry from the correspondent classroom

Accept deletion?

YES

Figure 4.18: Classroom administration (Event flow)
USE CASE 8: Calendar administration

The actor involved in this use case is the professor. This use case shows the necessity to be able to programme the calendar of the students, including an activity in every lecture day. This activity is the one that the system will load in the interface of the student, if the professor does not change the selection.

**Preconditions:** There are not any preconditions for this use case.

**Post conditions:** There are not any post conditions for this use case.

**Alternative flow:** If the professor tries to load a private activity of which he is not the author, the system will indicate that it cannot load this activity and will also inform the author.

**Use case scenario:** The professor wants to program the calendar; he selects the lecture day or days that are already defined by the school center, selects the subject and the relevant activity (public or private) as well as if he wants to have a preview of the activity or not, and sets an activity or activities for each one of the students.

The basic event flow of this use case is shown in figure 19:
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User accesses "Calendar"

Selects lecture day or days

Selects subject

Selects activity

Activity preview? 
- YES
- NO

Right selection? 
- NO
- YES

Save the changes

Load more activities in the selected days?
- YES
- NO

The calendar with the lecture days of the year is already defined by the school center. The teacher could select one or more days to modify at the same time.

The teacher can select either private activities, meanwhile he is the activity owner; or public ones.

Gives the option to the user to preview an image of the activity in a reminding way.

The teacher can load just one activity in the selected lecture days or many activities.

Figure 4.19: Calendar administration (Event flow)
USE CASE 9: Communication tools administration

The actor involved in this use case is the administrator. This use case shows the possibility of administrating the different implemented communication tools in the system (forums, mail lists, mail accounts) whose responsible is the administrator.

**Preconditions:** There are not any preconditions for this use case.

**Post conditions:** There are not any post conditions for this use case.

**Use case scenario 1:** The administrator wants to manage the mail lists; this is described in the “Mail lists management” use case.

**Use case scenario 2:** The administrator wants to manage the mail accounts; this is described in the “Mail accounts management” use case.

**Use case scenario 3:** The administrator wants to manage the forum; this is described in the “Forum management” use case.

The use case diagram is presented in figure 20:

![Communication tools administration (Use case) diagram](diagram.png)

*Figure 4.20: Communication tools administration (Use case)*

The basic event flow of this use case is shown in figure 21:
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User accesses options
"Interactive tools"

Which tools to manage?

Forum management

Mail lists management

Mail accounts management

Use case "Forum management"

Use case "Mail lists management"

Use case "Mail accounts management"

Figure 4.21: Communication tools administration (Event Flow)
USE CASE 10: Statistics consulting

The actors involved in this use case are the professor, the parent and the pedagogue. This use case allows the actors to consult the students’ statistics.

**Preconditions:** There are not any preconditions for this use case.

**Post conditions:** There are not any post conditions for this use case.

**Alternative flow:** If the user who accesses the statistics is the parent, he will just be able to see his child’s statistics. If he tries to access to another student’s statistics, the system will inform that this action is not possible.

If the user who accesses to the statistics is a professor, he will be able to access to all the statistics of his students and classrooms that he uses. If he tries to access to another classroom, the system will inform him that this action is not possible. The same will happen if he tries to see the results from a student who does not belong to his classroom.

If the user who accesses to the statistics is the pedagogue, he will be able to see all the statistics of the students and classrooms.

**Use case scenario 1:** The parents want to consult their child’s statistics; they access the classroom to which they belong and select their child’s name for getting the results. Any other selection of a student who is not their child cannot be made. They can also consult their child’s classroom statistics.

**Use case scenario 2:** The professor wants to consult his student or students’ statistics; he has to access the classroom where they belong and select his students in order to get the results. Any other classroom selection where he is not the professor cannot be made. He can also consult his classroom’s statistics.

**Use case scenario 3:** The pedagogue wants to consult the students’ or classroom’s statistics; he has to access the statistics consult and select the classroom or the student from whom he wants to consult the statistics.

The basic event flow of this use case is shown in figure 22:
The user could consult the classroom or student statistics. For the parent, he can just consult his son and classroom to which he belongs (if he has many, he could access many registries). The teacher can just consult his classroom and all of its students. The pedagogue will have access to every available statistics.

Figure 4.22: Statistics consulting (Event flow)
USE CASE 11: Creating a private activity

The actor involved in this use case is the professor. In this use case, the professor can define a new activity, which will be of his property as long as he does not change the activity type to semi-public.

Preconditions: There are not any preconditions for this use case.

Post conditions: There are not any post conditions for this use case.

Use case scenario: The professor wants to create a private activity; he selects the subject and he can choose if he wants to paste the public activity content for another public activity. Then he defines a name and an interface (he also has the option to define a preview, capturing an image from the activity) and finally he inserts the comments and the evaluation criteria.

The basic event flow of this use case is shown in figure 23:
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User accesses to "Make private activity"

Selects subject

Paste public activity contents?

YES

NO

Defines activity name

Defines interface

Captures preview image

YES

NO

Right image?

YES

NO

Set preview

Insert comment

Set evaluation criteria

Save changes?

YES

NO

Figure 4.23: Creating a private activity (Event flow)
USE CASE 12: Creating a public activity

The actor involved in this use case is the administrator. This use case initialised by the administrator, shows the possibility of creating new activities of public type (this means that all the professors can use them) or of changing a private activity into public by making a copy of the private one and making it public type.

Preconditions: There are not any preconditions for this use case.

Post conditions: There are not any post conditions for this use case.

Use case scenario 1: The administrator wants to create an activity; he defines a name and an interface (he also has the option to define a preview, capturing an image from the activity) and finally he inserts the comments and the evaluation criteria.

Use case scenario 2: The administrator wants to create a public activity from a private one; he pastes the content from the private activity into the public one, he defines a new name for the public activity and changes the name of the author.

The basic event flow of this use case is shown in figure 24:
Since now the public activity, which is made like an image from the private one, is going to be exclusive of the administrator (and its modification).

Figure 4.24: Creating a public activity (Event flow)
USE CASE 13: Login

The actor involved in this use case is the user actor. This use case shows the process of identifying and verifying the user name and password when the user tries to access to the system.

**Preconditions:** The user must insert the corresponding user name and password in order to make the login correctly. He must also be registered in the system’s database.

**Post conditions:** There are not any post conditions for this use case.

**Use case scenario 1:** The user wants to change his password; he inserts his username and password and if they are correct and they exist in the database, he is allowed to insert the new password and save the changes.

**Use case scenario 2:** The user wants to log into the system; he inserts his username and password and if they are correct and they exist in the database, the access rules are surpassed and his customized page will be displayed.

The basic event flow of this use case is shown in figure 25:
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**Figure 4.25: Login (Event flow)**

1. **User is in the system home page**
2. **User inserts user name and password**
3. **Action to do?**
   - **Password change**
   - **Log into the system**
4. **Exist user in the data base?**
   - **YES**
   - **Match with the stored user password?**
     - **YES**
     - **Match password with data base?**
       - **YES**
       - **Was the user inserted?**
         - **YES**
         - **Customized page is accessed**
         - **Surpasses access rules?**
           - **YES**
           - **If the user does not surpass the access rules defined by the administrator, it is going to be displayed a message saying to the user that the login was not correct and he can report to the administrator**
           - **If the user does not surpass the access rules defined by the administrator, it is going to be displayed a message saying to the user that the login was not correct and he can report to the administrator**
         - **Surpasses access rules?**
           - **NO**
           - **If the inserted user is not in the data base, he is going to be warned by a message that this user does not exist in the system**
           - **If the inserted user is not in the data base, he is going to be warned by a message that this user does not exist in the system**
           - **Save new password changes?**
             - **YES**
             - **Insert new password**
             - **NO**
             - **Log into the system**
       - **NO**
       - **Save new password changes?**
         - **YES**
         - **Insert new password**
         - **NO**
         - **Log into the system**
   - **NO**
   - **Match with the stored user password?**
     - **NO**
     - **Log into the system**

If the password does not match with the data base stored password for that user, the user is going to be warned by a message that the password is not correct.

If the inserted user is not in the data base, he is going to be warned by a message that this user does not exist in the system.
USE CASE 14: Performing an activity

The actor involved in this use case is the student. This use case shows the student’s possibility to perform the programmed activities within the virtual classroom system.

**Preconditions:** It is necessary that the student has logged in the system (the login process of each student user in the system can be done by the professor, if the student cannot do it on his own, in each student’s tablet-PC before starting the activity so that the student profile is loaded). It is also necessary that the professor loads the activity from his interface.

**Post conditions:** When the professor decides and finalizes the activity from his interface, the system will automatically generate each student’s activity result and will give the option of logging out to the student user.

**Use case scenario:** The student is in the classroom with an activity running on his tablet-PC which he can perform by interacting with the interface elements.

The basic event flow of this use case is shown in figure 26:

![Interact with interface elements](image)

*Figure 4.26: Performing an activity (Use case)*
USE CASE 15: Mail list register

The actor involved in this use case is the parent. This use case allows the parent actor, to register himself in the mail list of the professor responsible for his child. This use case also shows the option to delete himself from a mail list in which he is already registered.

**Preconditions:** In order to be registered in a professor’s mail list, the parent’s child must be a student of this professor. Otherwise he will not have the possibility of being registered.

**Post conditions:** There are not any post conditions for this use case.

**Alternative flow:** If the user tries to register himself in a professor mail list in which his child is not included, the system will inform the user that this action is not possible, and will indicate the possible mail lists to which he can be registered.

**Use case scenario 1:** The parent wants to be registered in the classroom’s mail list where his child belongs; he has to write his name and mail address in a template and this information is sent to the administrator.

**Use case scenario 2:** The parent wants to be deleted from the mail list; it is checked if he is already registered in it and if he is, he can send the deletion request to the administrator.

The basic event flow of this use case is shown in figure 27:
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User accesses "Mail list registry"

Selects classroom in whose list he wants to be registered

User already registered?

YES

Write name

Send insert information to the administrator

Correct information?

YES

Send delete request to the administrator

Delete?

NO

Write mail adress

Send delete request to the administrator

Delete?

YES

Send delete request to the administrator

Delete?

NO

Write mail adress

Send insert information to the administrator

Correct information?

YES

The user will be able to register in every mail lists of the virtual classrooms which some of his children are attending

If the user is already inserted he will be able to request the deletion from the mail list.

Figure 4.27: Mail list register (Event flow)
USE CASE 16: Results’ review

The actor involved in this use case is the professor. In this use case the system allows the professor to review the results obtained by the students in the activities (the results that the system automatically generates according to the associated evaluation that the activity has) so that he can modify them according to his criteria.

**Preconditions:** The activity must be performed by the student and finalized from the professor' interface (so that the system has already automatically generated the result).

**Post conditions:** The reviewed results will be the ones including the students’ and classrooms’ statistics.

**Alternative flow:** If the professor tries to access the results of a lecture day that has not even been marked in the calendar, or that does not include activities with grades, the system will inform him about that.

**Use case scenario:** The professor accesses the results, he selects the lecture day and if he wants to modify some results, he can select one or more students, modify their results and then save them.

The basic event flow of this use case is shown in figure 28:
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The professor will visualize the results that initially (if he did not modify them previously) the system generates in an automatic way, taking in consideration the activity associated evaluation criteria.

The professor can modify the result of an exclusive student or several simultaneously.

**Figure 4.28: Results review (Event flow)**
USE CASE 17: Exit from the system

The actor involved in this use case is the user actor. This use case indicates the possibility of the user to log out from the system.

**Preconditions:** There are not any preconditions for this use case.

**Post conditions:** There are not any post conditions for this use case.

**Use case scenario:** The actor user wants to exit from the system; he presses the exit button (if the user is the student this button will just be enabled when the professor will finalize the activity) and he is asked for confirming this action. If he agrees, the virtual classroom home page is loaded.

The basic event flow of this use case is shown in figure 29:

![Figure 4.29: Exit from the system (Event flow)](image-url)
USE CASE 18: Using the forum

The actors involved in this use case are the professor and the parents. This use case establishes the forum tool like a way of communication between the parents and the student’s professors, so that they can insert commentaries, which the rest of the users can access.

**Preconditions:** Be a registered user with a professor or student’s parent profile.

**Post conditions:** There are not any post conditions for this use case.

**Use case scenario:** The professor or the parents access the forum, select the desired classroom and after that they can either read the forum’s comments or write comments (adding also the name) in it.

The basic event flow of this use case is shown in figure 30:

![Figure 4.30: Using the forum (Event flow)](image-url)
USE CASE 19: Using the mail list

The actor involved in this use case is the professor. This use case allows the professor to use a mail list so that he will be able to send e-mails in a massive way, giving him the possibility to select the destinations.

**Preconditions:** The administrator must have defined a mail list for the professor. Moreover, the parents must be registered in the mail list.

**Post conditions:** There are not any post conditions for this use case.

**Use case scenario:** The professor wants to send an email or some emails; he accesses the mail list and selects the destinators from it. He writes the mail subject and text and finally he sends the mail/s.

The basic event flow of this use case is shown in figure 31:

![Figure 4.31: Using the mail list (Event flow)](image)

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USE CASE 20: Using the meeting module

The actors involved in this use case are the professor, the parents and the pedagogue. This use case shows the possibility of a direct communication between the actors, through the direct sending of meeting requests and answering these requests so that a new communication tool is established.

Preconditions: There are not any preconditions for this use case.

Post conditions: There are not any post conditions for this use case.

Use case scenario: The professors, the parents or the pedagogue want to do a meeting request; they select the user to whom it will be sent, the meeting purpose and the meeting date. Finally they send it to the corresponding user or users.

The basic event flow of this use case is shown in figure 32:

Figure 4.32: Using the meeting module (Event flow)
4.5 PROTOTYPE

Based on all the information gathered so far and the description of the system, we came up with a prototype. Different technologies were used for developing our prototype:

- **JSP (Java Server Pages):** a programming language in order to develop the interfaces and the functionality.
- **Jakarta-tomcat-5.5.7:** a web server for storing and letting the system work.
- **MySQL:** a database system for storing the information of our system.
- **Flash:** multimedia technology in order to develop the activities.
- **HTML:** the authoring language used to create documents on the World Wide Web in order to browse our system.

Some of the interfaces of our prototype and their functionality are presented below:

**Log into the system:** In the home page of our system a login box is going to appear where the user has to insert his username and password. Depending on the user kind (administrator, teacher, pedagogue, parent or student) a different and customized profile will be loaded.

![Login Interface](image)

### 4.5.1 Administrator profile:

The available options in this profile are in the left-side buttons and they are: “System access administration”, “Private activities administrator”, “Activities administration”, “Communication tools administration” and “Log out”. Their functionality will be explained. When we grant access like an administrator, the interface shown below will be presented:
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- “System access administration”

By clicking this option, a list of the registered users in the system appears, as well as a few options for editing and deleting these users and another button for creating the new ones.

- The new user option

When the “new user” button is clicked, the following page will be displayed. In order to create a new user, the boxes are filled with the relevant data. For the “profile” option, there is a combo box list where the available profiles are shown.
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- The edit option:

With this option the information of the user that we would like to modify will be displayed in order to change it and submit the updated one in the database:

- “Private activities administration”
Through this option, the administrator can control the private activities.

- “Activities administration”
This option will be used for the administration of the activities.

- “Communication tools administration”
The communication tools administration includes the options: “Forums Management”, “Mail list management” and “Mail accounts management” as it is shown below:
4.5.2 Teacher profile:

When we grant access to the system like a teacher, the following profile will be shown:

The available options in this profile are in the left-side buttons and they are: “Mail list”, “Private activity”, “Activity”, “Meetings”, “Results”, “Statistics”, “Calendar”, “Forum” and “Log out”.

- “Mail list”

When we click this option, a list of the registered users in the system appears as well as a box for deciding which users are going to be the destinations of the e-mail (one or more). For sending the e-mails, we must write the subject and the body and finally click the “Send mail” button.
- **Private activity**

When we click this option, a list of the private activities available for the teacher appears as well as options for editing, deleting, publishing and creating new activities.

- The new activity option:

When we click the “New activity” button, the following page will be displayed. We can either fill up the boxes, press “submit” and create a new private activity or press “back” and return to the previous page.
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Virtual Classroom

- The edit option

When the teacher clicks this option, the information of the activity that we would like to modify will be displayed. The teacher can either change it, submit it and the database will be updated or go back to the previous page.

Virtual Classroom

- “Activity”

When we click this option, a list of the activities available for the teacher appears, as well as some options for editing, deleting, loading, finishing and creating new activities.
- “Meetings”
It will be used for arranging meetings between the different users involved.

- “Results”
It will be used for checking the students’ results.

- “Statistics”
It will be used for checking the students’ statistics.

- “Calendar”
It will be used for scheduling the activities during the lecture days.

- “Forum”
It will be used as a place available for comments from the different users.

- “Log out”
This option is for exiting from the system. Once the button is clicked, the teacher will be transported to the “Log in” home page.

4.5.3 Pedagogue profile:
The available options in this profile are in the left-side buttons and they are “Meetings”, “Statistics” and “Log out”. When we grant access like a pedagogue, the following interface will be shown:
4.5.4 Parent profile:

The available options in this profile are in the left-side buttons and they are: “Mail lists”, “Meetings”, “Statistics”, “Forum” and “Log out”. When we grant access like a parent, the following interface will be shown:

![Parent profile interface]

4.5.5 Student profile:

The available options in this profile are in the left-side buttons and they are: “Start activity” and “Log out”. When we grant access like a student the following interface will be shown:

![Student profile interface]
- Start activity

It will display the previously-loaded activity by the teacher in order to be performed by the student. The option for starting an alternative activity is not developed in this prototype.
CHAPTER 5 CONCLUSIONS

This chapter contains our final conclusions after completing our thesis. In addition, our suggestions for future work associated with the topics discussed throughout the thesis are presented.

5.1 FINAL RESULTS

The purpose of our thesis was to achieve our aims which were presented in the problem statement. Below, our final results and conclusions for each one of the aims stated will be presented.

The first aim of our thesis was to provide the theoretical background concerning virtual learning environments and computer-based education. This happened through our literature study. In our literature study we tried to investigate the invasion of computers in education and their development to virtual learning environments. We also tried to find similar VLEs with our system and to present some of the related work that has been already done in this field. Various books, journals and internet sources were used in order to obtain our theoretical background. Below, we will summarize the most important conclusions from our literature study:

- The main place where students use the computer applications is at home and not at school. In addition, they obtain most of their computer knowledge through personal effort and friends and not through the school. Computer learning is most of the times symptomatic and not planned because it is acquired by various activities related to computers like a chatting community or installing some software.

- People choose between the different sources of learning to use computers based on the characteristics of knowledge sources (e.g. how close these sources are to their learning preferences), the characteristics of the field (e.g. if the source is a word processor or something more complex) and the characteristics of the person (experiences, preferences, gender, age, self-confidence).

- The computer as a teaching medium provides a lot of advantages for the teachers and the students and it composes an effective motivation for learning. However, some disadvantages can be seen especially if we compare computer-based education to the traditional school system. The main question to be answered is if the use of computers in education will finally add knowledge to the students in comparison to the traditional system. It is very difficult to give a straight answer to this question since a lot of research is required.

- There are different kinds of software used in computer-based education. Before choosing which software to use, the teacher has to take into consideration various characteristics of the software like how friendly and effective this program will be for the student.

- Various definitions and words have been used to describe a “Virtual Learning Environment”. We could say that VLEs are “education web platforms providing interaction of various kinds between learners and tutors.”

- Different reasons have lead to the spreading of VLEs in education and these reasons compose their advantages. We believe that the VLE is one of the
technological tools, which can contribute in the solution of some educational problems and in the improvement of the productivity and the competition of organizations.

- During our literature research, we could not find any other VLE having the same characteristics as the one we are designing: referring to the ages of 5-8 years old, using blended learning and an online environment and aiming to be used for various activities and not focusing on only one subject like mathematics.
- Two VLEs were identified as being very close to our system: “Moodle” (a widely used virtual learning environment focusing on different educational levels which has also been tested in a primary school) and “Assimilate” (a learning platform providing computer-based education in primary and secondary schools in the UK). We also presented other widely used VLEs focusing on higher level education like “Blackboard” and “First class”.

The second aim of our thesis was to make research and get feedback from the involved parts in our VLE through questionnaires and interviews. This happened through our empirical findings. Through our empirical findings we obtained a lot of useful information concerning various aspects of VLEs and the design of our system. The interviews with our stakeholder gave us the guidelines for designing our system and all the system requirements and functionalities were described. These interviews were the standpoint on which the description of our system is based.

The questionnaires distributed to the students of a high school in Castilla-La Mancha (Spain) and their parents concerning various aspects of VLEs in general and of our system drove us to some conclusions among which the most important are:

- According to the students’ opinion, their level of computer knowledge is enough for using our system provided that there will be a short tutorial at the beginning. On the other hand, some parents seem to have an opposite opinion.
- The parents’ level of computer knowledge for using the functions of our system (email, forum) is not adequate. However most of them are willing to use these functions and to participate in our VLE.
- Both students and parents think that the use of computers in education is effective and attractive but at the same time there is a tendency towards the traditional way of teaching.
- Among the disadvantages of our VLE mentioned by the parents and the students, we believe that the most important ones that should be taken into consideration are:
  - The communication between students will be restricted.
  - Lack of parent’s knowledge for using the email and forum.
  - The problem of economical support.
  - Parents’ availability of computer.
- Among the proposals for our VLE mentioned by the students, the most interesting one which should be taken into consideration is to try to find a way to connect our VLE with the traditional way of teaching.
Chapter 5 – Conclusions

The interviews with Martin Stigmar and Kjell Johansson gave us two professional perspectives about computers and education. The main conclusions from these two interviews are:

- Our conclusion from the “Related Work” chapter that very little work is done on VLEs using blended learning in lower level education was confirmed.
- The effectiveness of VLEs is very hard to be measured and it is difficult to say if our system will add knowledge to the students or not. The most effective measurement is to develop the system and to test it in a school.
- Our VLE should be used for some parts of the education and not for all the courses of the students. It should be a complementary teaching method, otherwise it will not be that interesting for the children.
- The main problem with VLEs is not implementing them and integrating them in a classroom. The key point is the economical support. In addition, it is important that each student will have his own computer and they will not be sharing.
- There are different opinions about which of the involved parts will be an obstacle for the integration and acceptance of a VLE in a preliminary school. It could be the parents because of their conservatism or the teachers because of their fear that some students will have a higher level of computer knowledge than them.
- An introduction and presentation of the system in the school before integrating it is essential.
- Not more than two channels of communication should be used in a VLE.
- The interfaces of our system should have nice graphics and be attracting for the children.

The third aim of our thesis was to describe a virtual learning environment for students aged 5-8 years old taking into consideration handicapped students and other educational aspects. As we said before, the standpoint for doing this was the interview with our stakeholder. However, different sources of information were used for designing our system in an effective way like the rest of our empirical findings and the background acquired through our literature study.

Five different parts were recognized in our system: the students, the teachers, the parents, the pedagogues and the administrator. For the communication of the users, we decided to use the forum and the email. We also thought that statistics should exist which the teachers, the pedagogues and the parents can consult. The architecture of our system, the use cases general view, the data model, the different classes, the distribution, the deployment view, the vision, the characteristics and the use cases of our system were described. Finally, we came up with the presentation of a prototype.

Some of the characteristics which we believe that make our system different from the rest of the existing VLEs are that it refers to lower level education, it uses blended learning and an online environment and it aims to be used for various activities and does not focus on only one subject like mathematics. Among the benefits that our system can offer to education are the motivation offered to the student through the use of computers and the colorful interfaces for learning, the interaction of the student with the computer, the solution to the problem of the shy students who are scared to
answer a question, the statistics which will provide a global view of the students’ performance, the individualized learning, the lack of subjective grading and others. One of the pedagogical ideas of our system is that the handicapped students will be taken into consideration which can help them in various ways – for example the reading ability can be stimulated through the computers if you have problems with seeing. Some of the disadvantages that we think our system could have are that the requirements for colorful and attracting interfaces are very high, the acceptance of the system from the different involved parts, the economical support for integrating our system in a school, the lack of parent’s knowledge for using the email and forum and that the teachers might not have the necessary computer and pedagogical knowledge for using the system in an effective way.

5.2 SUGGESTIONS FOR FUTURE WORK

In order to write our master thesis and to manage to complete our initial aims, a lot of work and research has been done. During our research journey, we were coming up with new proposals connected with our project which we did not have time to go through due to time limitations. Some of our suggestions for future work related with our project are presented below.

- In our project we fully described a VLE and we came up with a prototype. The implementation of the whole system is required in order to test how effective it is and to integrate it in a preliminary school.
- If the whole system is implemented, then a test on real users could give us a lot of conclusions and the opportunity to compare these results with the results of our empirical findings and literature study. If this test would be successful which means that it would be proved that our system adds knowledge to the students and that it is an effective teaching tool, then the system can be integrated in a preliminary school on an experimental basis (for example for one year). If this experiment will be successful as well, then it can be officially integrated and used by preliminary schools. Some important points here are that a presentation of the system has to be done before integrating it and that financial means have to be found for the economical support.
- As we have already mentioned, the kids of the age 5-8 years old are already used to very attracting interfaces through the computer games and the TV, so the requirements for the interfaces of a VLE referring to this age are very high. We only moved to a small implementation of the system so we did not pay so much attention on that but it is suggested that the final system will have high level interfaces.
- More features and choices for the home pages of the involved parts can be added but it must be taken into consideration that interfaces with too many different boxes are complex and not friendly for the user.
- There was a very interesting proposal in one of the students’ questionnaire saying that people should find a way to combine traditional learning with VLEs. We believe that our VLE achieves that in a low rate since it is based on blended learning and does not aim to be used for all the courses. However, there should be a better way to achieve that and there is space for a lot of research on this topic.
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COLLECTION OF APPENDICES
APPENDIX 1: FIRST INTERVIEW WITH THE STAKEHOLDER

Inside the system we have identified two information parts where we want to focus the interview with the stakeholder. These parts are: system users and communication users.

- SYSTEM USERS FUNCTIONALITY

**Student User**
- Which functionality must be developed for the students?
- How is this activity going to be loaded?
- How old are the students?
- Are there going to be students with a specific profile?

**Teacher User**
- How many teachers will be in each group?
- Where are the students' activities going to be placed?
- Which information is accessible by the teacher?
- How are the activities going to be graded?

**Administrator User**
- Which functionality is going to be assigned to the administrator?

**Pedagogue User**
- Which functionality is he going to have in the system?
- Which ways is the pedagogue going to have for the communication with the parents and the professors?

**Parents User**
- Which is their access in the system?
- Which tools will be available for them?

- SYSTEM COMMUNICATION FUNCTIONALITY

In the system, different tools must be developed that allow the communication between the school educators and the students' parents.

**Forum**
- Which is the forum’s functionality?

**Mail list**
- Will there be just one mail list?
- What users will be in that mail list?
- Which is the functionality of the mail list?

**Statistics**
- What information will these statistics gather?
- Which kind of statistics are we talking about?
- What users will be able to access it?
APPENDIX 2: SECOND INTERVIEW WITH THE STAKEHOLDER

- SYSTEM USERS FUNCTIONALITY

**Student User**
- How will the students access the system?
- How are the students going to be distributed?
- Where are the students going to access the system from?

**Teacher User**
- How is the teacher going to define the activities schedule?
- What kind of public results are there going to be?

**Pedagogue User**
- Which information is he allowed to access?

**Parents User**
- Are they going to be given an email account besides of the username and the password?

- SYSTEM COMMUNICATION FUNCTIONALITY

**Forum**
- What users will be able to access the forums?
APPENDIX 3: INTERVIEW QUESTIONS FOR THE TEACHERS-PEDAGOGUES

- Could you give us some information about your background?

- Have you ever been involved or heard of another Virtual Learning Environment that has similar characteristics with our system (used in preliminary school, in face-to-face classroom etc.)?

- What is your opinion of Virtual Learning Environments used in face-to-face classroom (blended learning) in comparison to distant learning environments?

- How easy do you think it would be to integrate our Virtual Learning Environment in a preliminary school?

- How much effective do you think our Virtual Learning Environment would be from an educational point of view?

- Do you think students aged 5-8 years old will have adequate computer knowledge for effectively using the functions of our system?

- Do you think that the parents of the students will be willing to participate and able to use the functions of our system (forum, email)?

- Do you think that the teachers-pedagogues will have the knowledge and abilities to effectively use our system?

- For the communication between the different parts involved in our system the forum and the email are used. Do you think the communication between the parents, the students, the teachers and the pedagogues will be efficient in that way?

- Based on the theoretical presentation of our system that we made, which do you think its disadvantages are?

- Based on the theoretical presentation of our system that we made, do you have any proposals for improving the functionalities of our system?
APPENDIX 4: QUESTIONNAIRE FOR STUDENTS

Below the description of a virtual school system for students of 5-8 years old is presented. Please take some time to go through it and understand it and then answer the questions based on your true opinions. You have already been through that level of education so your opinion will be taken into consideration for the design of this system.

The system we are designing aims to invade technology in lower level education and more specifically in the first classes of preliminary school. According to this system, there will be a room in the school which will include one tablet-pc for each student. The students will have to log in the tablet-pc using their own username and password. The teacher will have his own pc and he will be able to choose one of the available activities for the students to perform. Once he makes his choice, the activity will be automatically loaded to the students’ tablet-pc. There will also be specific activities for students with specific handicaps. The results of the activity will be automatically generated by the system when the student finishes the activity. The results will be stored in statistics that teachers, pedagogues and parents can access. There will also be a forum by classroom so that the users can read and write visible commentaries for the rest of the users. The forum will be accessible by the professors and the student’s parents. An email address will also be available for the parents of the students so that the professor will be able to exchange information with them. This is a general presentation of our virtual school system although more detailed functions are included.

QUESTIONS

1) Have you ever used a system similar to this one before in your school or in another educational field?

☐ Yes  ☐ No

If the answer is yes, please make a short description of it:

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2) Do you think that students aged 5-8 years old have adequate computer knowledge for using a system like that?

☐ Yes  ☐ With a little practice  ☐ No there shouldn’t be any problem

3) How much do you support the invasion of technology in education nowadays in comparison to the traditional school education?
I think it is a necessity and I strongly support it
I think it is effective but we should stay close to the traditional way
I think the traditional way is more effective

4) How much effective do you think that a virtual school system like the one described above would be from an educational aspect?

☐ Very effective  ☐ Not very effective  ☐ Not effective at all

5) How much attractive does the idea of a virtual school system sound to you?

☐ Very attractive  ☐ Not very attractive  ☐ Not attractive at all

6) What problems or disadvantages do you think this system will have?

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7) Can you think of any other functions which you think this system could include? (Please feel free to make any kind of proposals)

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THANK YOU VERY MUCH FOR YOUR TIME!
APPENDIX 5: QUESTIONNAIRE FOR PARENTS

Below the description of a virtual school system for students of 5-8 years old is presented. Please take some time to go through it and understand it and then answer the questions based on your true opinions. Try to think the application of this system on your own children and answer based on this idea. Your opinion will be taken into consideration for the design of this system.

The system we are designing aims to invade technology in lower level education and more specifically in the first classes of preliminary school. According to this system, there will be a room in the school which will include one tablet-pc for each student. The students will have to log in the tablet-pc using their own username and password. The teacher will have his own pc and he will be able to choose one of the available activities for the students to perform. Once he makes his choice, the activity will be automatically loaded to the students’ tablet-pc. There will also be specific activities for students with specific handicaps. The results of the activity will be automatically generated by the system when the student finishes the activity. The results will be stored in statistics that teachers, pedagogues and parents can access. There will also be a forum by classroom so that the users can read and write visible commentaries for the rest of the users. The forum will be accessible by the professors and the parents. An email address will also be available for the parents of the students so that the professor will be able to exchange information with them. This is a general presentation of our virtual school system although more detailed functions are included.

QUESTIONS

1) Have you or your children ever been involved with a system similar to this one before?

☐ Yes  ☐ No

If the answer is yes, please make a short description of it:

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2) Do you think that your children have adequate computer knowledge for using a system like that?

☐ Yes  ☐ With a little practice  ☐ No

there shouldn’t be any problem
3) How much do you support the invasion of technology in education nowadays in comparison to the traditional school education?

☐ I think it is a necessity and I strongly support it
☐ I think it is effective but we should stay close to the traditional way
☐ I think the traditional way is more effective

4) How much effective do you think that a virtual school system like the one described above would be from an educational aspect?

☐ Very effective
☐ Not very effective
☐ Not effective at all

5) How much attractive does the idea of a virtual school system for your children’s education sound to you?

☐ Very attractive
☐ Not very attractive
☐ Not attractive at all

6) Are you familiar with the functions and the use of an email account and a forum?

☐ Yes
☐ No

7) For the proper function of our system, the parents of the students should be willing to use an email account and the forum for an effective communication with the teacher and pedagogue. Are you willing to use the email account and the forum (for parents who do not have the necessary knowledge, a tutorial can be organized)?

☐ Yes
☐ No

8) Do you think that the forum and the email address will be an effective way for your communication and feedback with the teacher and the pedagogue?

☐ Yes
☐ No

If the answer is no, please explain why:

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THANK YOU VERY MUCH FOR YOUR TIME!