LetsGameTogether logo was inspired and based on an Office Word ClipArt image.

Note: Ch 4 is not part of this thesis, it was worked out by Antonopoulou Evangelia (151 IK)

LetsGameTogether: An online game authoring community for children

by

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Preface

This thesis is written for our Master of Science in Information Science at the Radboud University of Nijmegen. It is the result of extensive and thorough analysis of related literature on the topics of our interest.

Inspired by issues related to children's education both in a social and academic context, this thesis describes a proposal for an online game authoring community for children between 7 and 11 years old. Beyond presenting the related scientific research, it describes a prototype for designing, implementing and applying the system.

We would like to thank Theo van der Weide for his overall supervision and guidance. He supported us from the very beginning of our thesis, taking into consideration our preferences and guiding us on the formulation of an interesting and challenging topic. Weekly meetings proved to be very beneficial for organizing and structuring our work. He also was willing to bring us in contact with experts in the domains that we were not familiar with. We deeply appreciate his eagerness to help us deal with problems that arouse due to distant collaboration.

We would also like to thank Henny van der Meijden , professor in the faculty of social sciences who kindly offered us with valuable support. She willingly agreed to supervise out thesis from the perspective of an educational scientist.

Additionally, we would like to refer to our effective cooperation. Each one of us contributed equally to the successful completion of this project, providing the needed motivation and support whenever needed. The final outcome of this effort consists of two separate master theses with numbers 151 IK and 152 IK that revolve around the same subject. Their structure is identical except for one chapter that differentiates the two master theses. Though, in both theses there might be found several references to these distinct chapters. In such cases, the reader has to consult both theses to have a complete overview of the final product. Furthermore, tables and figures missing from this master thesis can be found in master thesis with number 151 IK.

Nijmegen, 25 August 2011

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INTRODUCTION

Abstract

The huge evolution of information and communication technologies –defined as the study or business of developing and using technology to process information and aid communications- during the last years, has given society the chance to experiment with a variety of new communication forms and mediums.Web2.0 -used as an umbrella term to include technologies that promote information sharing and collaboration- occupies a central role in every modern society. Creating the sense of a virtual community or 'global village' as others prefer calling it, people are provided with unlimited communication –either synchronous or asynchronous- while enjoying the benefits of interaction that does not face distance constraints.

The tremendous spread of Internet within the past decades has made 'global villagers' seek for new ways of incorporating it into everyday activities to the point that we can now talk for an invasion of ICT to any aspect of people's lives. As the number of people with access to Internet is increasing, new applications are being developed with the aim of facilitating or enriching their living standards. These expand to many different areas –health, business, education, entertainment etc- and range from internet banking and virtual stores to social networking websites and forums.

The impressive expansion of technology could not help affect children, probably the most special and vulnerable group. Thus, influenced by the mainstream forms of entertainment, they tend to get more and more involved with the latest technological achievements. Mobile phones, video games, sports on screen and 3D computer games are replacing traditional recreational activities –sports, reading books or sports exercise. At the same time, the new forms of entertainment can have social impacts on children's academic performance, as often new educational practices incorporate Internet and other technological achievements. In a similar context, communication has also been subject to a great change, since traditional face to face discussions have been replaced by online conversations that take place in chat rooms or virtual communities.

It is true, that never before in history had people so many alternatives for getting together. Nor has it been so simple and easy to access all these different forms of amusement, by just sitting on a chair and connecting to Internet. Though, while simple and easily accessible, at the same time, technology seems intertwined with many concerns, especially when it comes to its utilization by children. What effects can excessive exposure to technology have to children's future lives? Does it contribute to their mental and cognitive development? Which age seems to be the most suitable for kids to begin their engagement with Internet and computer applications? What kind of tools should children be provided with?

Apart from the aforementioned questions, further issues arise, concerning the current movement towards e-learning and digital forms of educational material. The specificity of kids makes both educational and technological communities seek for ways to collaborate so that in the end, their learning is enhanced. Regarded as adults in preparation, they have the potential to participate in the society. This is what makes the involvement of social sciences

indispensable too. In this vein, and recognizing the importance of the social context within which learning is taking place the relation of technology to teaching needs to be investigated. How do children learn? What is the role of collaboration in learning? Can learning be benefited by introducing technology? What is the relation of children to technology? What kind of tools do they prefer using? What specific requirements should computer applications have for being introduced in curriculum? How can collaboration be enhanced when children are engaged with online activities?

Problem Area

The shift of educational methods towards e-learning activities is apparent. A simple search in the Internet for the phrase 'learning tools' will come up with more than 100,000,000 results and suggestions about existing digital learning tools. Educational software can be easily found and sometimes downloaded for free, through Internet. Such tools aim to help children acquire certain level of knowledge on a specific subject area. Thus, there can be found educational applications for maths, arts, music, social studies and other topics that address to different groups of children –for example children of a certain age or children with special needs or capabilities etc.

Educators, adopting the trend that wants technology to be used as a tool to enhance and facilitate learning, are timidly starting introducing educational software within their curricula. Recognizing the role that technology can potentially play in kids' future life, within a globalized environment, they try to accelerate their habituation with it. The truth though lies on the fact that often children do not limit their technology-oriented activities within classrooms. On the contrary, the majority of youngsters tend to incorporate technology in every aspect of their life. For them, Internet functions as the basic mean to spend their leisure time, allowing for entertainment and communication with other children.

In this vein, practices that try to manipulate kids' interest and affinity to web-based activities have emerged. Apart from making use of educational software, many teachers are trying to familiarize their students with the new online communication forms and establish a web-based social context through which children can interact and exchange ideas and beliefs. The fact that such techniques are relatively new, and have not been fully tested and evaluated yet over time seems to increase anxiety and concern within the educational society. Thus, educators are still under dispute, concerning what the results of the increasing usage and introduction of such practices into learning environments will be and they often come to disagreement on the tools and methods that will enhance children's learning.

On the other hand, computer games – video games, MMORPGs, 3D games etc- are considered to be the mainstream form of entertainment, attracting more and more young children who are willing to sacrifice their custom recreational activities for digital gaming. Characteristically, we mention that game development seems to be one of the most prosperous industrial domains, generating huge revenues every year. In this vein and in an effort to become more appealing, many game platforms allow the player not only to play but to intervene on the game story and structure as well, giving him or her the chance to

create his own characters, plots and behaviors and thus providing a chance for constructivist learning.

Experts are observing with skepticism all this transformation that education, entertainment and communication patterns underlie. Main questionings concentrate on the appropriateness of the tools that are used as well as on the extent to which they should be integrated into classrooms. The role of teacher, as well as the way he should communicate with his students needs to be reconsidered. Considerations regarding the quality of knowledge kids ultimately obtain are growing and fears that lack of face-to-face communication will lead to anti-social behaviors emerge.

In this master thesis we tried to delve into the learning process as it takes place to children and investigate the social context and content this can encompass. Online learning was also analyzed. We need to mention that the role of collaboration to learning proved to be of great importance and this is the reason why we suggest that collaborative techniques should be preferred when applicable. We also researched to come up with a framework that would put an end to educators' dissents on the extent to which the tools should replace traditional classroom activities. Within this framework, educator retains an active role, which is clearly described. This part of our master thesis was mainly based on conducted studies and bibliography -mentioned in the References section of this master thesis.

Inspired by game platforms that enable players to construct their own characters and plots, and after a deep analysis of studies and researches on kids' learning process, we came up with the idea of designing a web platform that addresses to children aged between seven and eleven years old. The reasons why we chose this specific age group are explained in chapter 3 of this master thesis. With the aim of designing a flexible website that attracts children we tried to concentrate on their own way of thinking, learning and working and understand their needs and wishes. Parents' and teachers' points of view as well as current governmental policies were also taken into consideration

Our ultimate goal was to give the designed platform the chance to enhance kids' learning, while still being appealing to them. Thus, we decided to give our young visitors the chance to get engaged with game authoring and game playing activities. Incorporating community aspects in the platform was essential as these are closely related to social learning processes. Further characteristics, as these came up during our analysis phase, which also need to be incorporated to the suggested platform, are described in Chapter 6.

In the end we must admit, that we were able to study and analyze many different views and theories about the topics of our interest. This allowed us to encounter and analyze many different needs and aspects that have to be considered when it comes to the association of the three concepts of the triple: children-learning-education. Finally, we devised a plan to satisfy those needs and provide a satisfying answer to the demands of the various stakeholders involved.

Research questions

Main question

What are the requirements to implement a successful online game authoring community facilitating children's learning?

 To be able to answer the main question, we formulated the following sub-questions:

Sub questions

How do existing theories and taxonomies explain the way that children learn?

Literature research revealed the existence of several learning theories and approaches on how do generally humans and specifically children learn. These extensive references have to be studied and carefully reviewed so as to apply them in our project. There are several different aspects in learning; and children certainly do not learn in the same way with adults. These issues have to be addressed in order to form a clear perspective on how do children learn and integrate the emergent knowledge in the design of LetsGameTogether community.

How do social structures and interaction patterns affect learning?

Being the bridge between the different learning theories, social learning theory implies that learning has several social aspects. Thus we have to identify and analyze them in order to form a complete view of learning. In this context we have to elaborate on the current social trends in educational contexts and define the related "best practices" that make them an indispensable part of learning. .

What are the key principles of social networks and Web2.0 technologies and how could these be applied in learning environments?

Social networks and Web2.0 certainly constitute the current trends in online world. The constantly increasing popularity of social networks, asks for a deep analysis on the reasons that lead to this unexpected burst. There is all the more so the need to base the design of an online community on the key features and principles of social networks in order to ensure that it has robust foundations and wide acceptance and success. Furthermore as Web 2.0 emerges and becomes more widespread, users and especially the new "digital " generation are no longer content with just manipulate content on websites - they also need to generate content as well. So we need to deeply comprehend these changing demands and adapt out community to the new "web2.0" concepts.

Are there any adequate methods to design children's technology?

When designing children's technology, you need to build a system in the most efficient and attractive way. So there is the need to focus on key insights into the relationships of new generation of kids with technology and on the resulting top guidelines for making a system that is easier and more enjoyable to use. Understanding these general principles will help us consider design problems in an organized and thorough way, analyze usability challenges

specific to our own project, and proceed with the proper trade-offs when there are contradicting thoughts.

What are the impacts of playing and making games in children's learning process?

LetsGameTogether will support both playing and creating games. These activities will take place in an educational context. So we first have to delve into these two different approaches in game learning and understand how they are currently integrated and applied in the relevant fields. After that there will be a shift of our focus to creating games as the new trend of game-based learning.

How are game design and authoring environments for children currently organized?

Making an overview of how can children be involved in the design process and of the authoring environments currently available in the market is of equal importance. There are several models of children's role in the process of game creation and we have to analyze them, compare them and come up with a model that is the most appropriate for an online game authoring community. Similarly we have to identity the existing environments and the different tools and approaches for game creation so as to suggest an authoring environment that fits best to the needs of children between 7 and 11 years old.

Research Strategy

To answer the questions described in the previous section we will proceed with a thorough review of the related literature. After deciding on the types of information that must be collected, we will choose the most appropriate sources to consult as well as methods to refine it. We will establish quality criteria to guarantee the quality of the derived information.

After the reviews we will start documenting the most important and most relevant points. We will continue with our suggestions that will extend the existing practices and models for designing children's technology as a learning facilitator. This will help us come up with specific requirements that the platform that we are devising should satisfy.

In this vein, current trends in online game authoring market together with the features and non functional requirements of our community will be used for the design of a prototype aimed to make an online game authoring community for children commercially a success.

Research structure

This section describes the different chapters of our thesis, through which we will try to give answers to the aforementioned questions.

How do children learn: In the first chapter we will discuss the different learning theories. Furthermore we will briefly refer to the most important factors that facilitate children's

learning. We will conclude this chapter by introducing one the of the most frequently applied models for categorizing ways of learning and thinking that is Bloom's taxonomy of the cognitive domain. Based on the revised Bloom's taxonomy that we will also briefly describe, we will suggest a new version of the revised model adjusted to the needs of the children of 7-11 years old.

Social aspects of learning: Chapter two discusses the several social aspects of learning. From the theoretical approach of social learning theory and its application in the classroom and online environments we will pass to the high influence and benefits of collaboration and group working in educational context. Under this view we will elaborate on the key features and best practices of social networks and Web 2.0 technologies. We will conclude this chapter by referring to social object theory and its application on social networking sites, presenting also two relevant case studies.

Children's technology: In the third chapter we will analyze the relationship of the new generation of kids with technology. Based on this analysis and on a thorough literature review we will suggest some general principles and heuristics for designing technology for children, focusing on taxonomy of these principles based on the three human developmental areas.

Games and Learning: In the fourth chapter we will analyze the relationship of games with learning. Towards this goal we will present a broad definition of game and a more specific one for digital and educational games. We will proceed with discussing the effectiveness of digital games in learning environments focusing on their impact on cognitive development, their immersive virtual environments and the communities that develop around them. We will conclude this chapter by referring to the three approaches of implementing Digital game-based learning. In this chapter though, we will concentrate on only one of them: designing games to seamlessly integrate learning and game play. For consulting this chapter the reader should refer to master thesis with number 151 IK.

Children as game authors: We will introduce this chapter by making a distinction between the different approaches of constructionism and instructionism. We will continue with presenting a model for children's roles in the process of creating digital games and conclude with a market research on the currently available game authoring environments including end-user programming languages, graphical game-creation tools, rule based programming and conceptual frameworks.

LetsGameTogether: An online game authoring community for Children: The final chapter of our master thesis will present the design of a prototype for LetsGameTogether online community. The design overview will include the application model, the analysis model, the architectural design and finally the user interface basic design (presented graphically in mockups). Concluding, we will try to practically apply the knowledge and models presented in the previous chapters using LetsGameTogether. In this context, we will link skills required for each category of Bloom's taxonomy as presented in the first chapter with LetsGameTogether community activities .Finally we will discuss how LetsGameTogether can be utilized as a powerful means of promoting collaboration and group working in both classroom and online environments.

1 HOW DO CHILDREN LEARN?

1.1 LEARNING THEORY

What is learning? Does is constitute a modification of our behavior or just understanding things? Although, learning has been one of the main subjects of psychologists, policymakers and practitioners for many years, there is no acceptable definition to describe what learning is. An old research carried out by Säljö (1979) in which adult students were asked what they were coming to understand by learning, the latter revealed many different interpretations. More specifically the answers included the following notions of learning:

- Learning as increasing knowledge
- Learning as memorizing or storing information that can be reproduced
- Learning as acquiring facts, skills and methods that can be retained and used as necessary.
- Learning as making sense of things by relating them to what is being learnt and to the real world.
- Learning as comprehending the world by reinterpreting knowledge

The different conceptions of learning- as Ramsden argues -fall into two major categories «knowing that» and «knowing how». Conceptions 1 to 3 view learning in a simpler way. Learning is something external to the learner. The last two conceptions imply a more 'internal' view of learning. Learning is a something that you do in order to conceive the world around you.

Similarly Belkin and Gray (1977) hold the view that learning is a change in the individual as a result of some intervention, either as a process or as the product of this process. The latter views learning as a change in behavior. In other words, learning is approached as an outcome - the end product of some process. It can be recognized or seen. Learning can also be approached as a process. In this way it can be thought of as 'a process by which behavior changes as a result of experience. Such a focus on process takes us into the realm of learning theories - ideas about how or why change occurs. In this the following subchapters we will elaborate on the two different views of learning as a process and as a product and identify the different styles of learning based on Kolb's experiential learning theory and on our five senses involved in the learning process.

1.1.1 LEARNING AS A PRODUCT

This approach as mentioned above focuses on a key aspect of learning that is change. Learning is viewed as something external that just happens or is imposed to individuals by their school or family environment. Under this view learning can be compared to shopping: people choose, buy and possess knowledge; or even with learning to get a good grade or certificate in the context of emulation driven by the inner need for competition.

The behaviorists (see Behaviorism) argue that learning is associated with continual changes in behavior resulting from experience. Several opponents to behaviorism though claim that not all changes that are triggered by experiences are related to learning. Learning is involved

only when these experience-driven changes can prove to be beneficial for the individual in a certain way. Most modern theorists, proponents of Cognitivism (see Cognitivism) concentrate not only to these clear changes in behavior but also in changes in the way that people perceive and form their ideas about the world around them. So contrarily focus is given on the inner mental activities. Mental processes such as thinking, memory, knowing, and reasoning need to be identified in order to define learning. People are not simply "animals" programmed to react to environmental stimuli .Thus changes in behavior are observed, but only as an indication of what is occurring in the learner's mind.

1.1.2   LEARNING AS A PROCESS

From Säljö comments we can drive the conclusion that in all the five conceptions identified (see Learning Theory) learning is considered to be a process ; a process, that via experience, changes the behavior of those engaged in it(Maples and Webster). The question that arises from this observation is whether the involved individuals possess a certain level of consciousness regarding their engagement in this process and what are the possible implications of this awareness. Several theories have been developed in order to provide a satisfactory answer.

Surface approaches are usually characterized by the learner's tendency for reproduction without deep comprehension, development of techniques such as memorization and encountering tasks as enforcements. On the other hand, deep approaches are characterized by learner's intent to comprehend the learning material, interacting with the learning content as well as relating new knowledge to previous experiences and ideas. A rather interesting perspective is this of Rogers. By focusing on linguistic learning he introduced two diverge approaches: Task-conscious or acquisition learning and learning-conscious or formalized learning.

Task-conscious An ongoing process, in which the learner is aware of the task but not of the fact that this task entails learning. This kind of learning is considered to be unconscious, direct and constant .It is generally associated with one specific activity/task that the individual cannot observe that leads to a significant increase in knowledge like raising a child or running a home. Accidental events that occurs throughout our lives or incidental events that occurs in the context of performing another task do contribute to learning. The same applies to every-day activities, that are more task-oriented rather than learning -oriented even though we are aware somewhat that we do learn something through this procedure.

 Learning-conscious or formalized learning: The educative process that occurs when people are engaged in tasks with the aim of learning. This approach views learning as a formalized procedure that is characterized by a certain level of consciousness. The participants are aware that the specific activity facilitates learning. Self motivated learning or systematic learning by using all the available means that are also not usually related to teachers or institutions are included in this kind of learning.

These two approaches, even though contradictory, they can co-exist in the same context – for example, both occur not only in the school, but in family environments as well. Their combination could be expressed for example in the form of open or distance education programs that although are formalized they do entail several acquisition features.

1.1.3 LEARNING THEORIES

As aforementioned the approach of learning as a process introduces the area of learning theories. Learning theories can be defined as the set of principles trying to describe how people acquire, enhance or make change in their knowledge skills, attitudes and values, and are concerned with the practical application of education, used to understand the complexity of learning process. Thus, learning theories consist of explanations about what occurs during the learning process for both adults and children. According to Hill (2002), learning theories have two chief values:

- They provide a vocabulary and a conceptual framework to interpret the observed learning examples.
- They indicate solutions to arising problems.

It is admitted that over years, many different theories have evolved trying to explain how people learn, combining knowledge from both psychological and pedagogical fields. All of them are trying to provide instructions and techniques that improvise and facilitate the learning process. Even though psychologists and educators are not in complete agreement, most do agree that learning may be explained by a combination of two basic approaches: behaviorism and the cognitive theories.

1.1.3.1 BEHAVIORISM

Behaviorism is the learning theory which holds that learning is just the acquisition of new behavior as a result of environmental conditions. It operates on the 'stimulus-response' principle that all behavior is caused by stimuli. Thus, as experiments have proven there can be defined two types of conditioning each resulting to a different pattern: classic and operant conditioning. Classic conditioning refers to natural responses to specific stimuli, such as school phobia or fear of failure. Operant conditioning is dealing with reinforcing responses to specific stimuli by means of rewards or punishments. It is based on our tendency to reproduce behaviors that have previously received positive feedback, and avoid or eliminate behaviors that they are related with the experience of negative condition.

According to this worldview –that takes learner as passive responding to environmental stimuli- learning can be defined as a change in learner's behavior, of which the learner itself does not have control. This discounts any activity of the mind and takes contiguity- how close in time two events must be in order for a bond to be formed- and reinforcement –

means for increasing the likelihood that an event will be repeated- as the basic principles that can explain the learning process.

Behaviorist theories can have multiple implementations. On the one hand, learning can be increased when immediate positive reinforcement occurs, while on the other hand, retention of a learned item can be achieved by continuing providing positive reinforcement to the learner. Thus, when studying behavior in relation to the environmental events, focus is shifted on observable behavior rather than independent activities of the mind, and what individuals are coming to learn is determined by the environment.

As Hartley (1998) asserts, there are four basic principles, in regard to the learning process that can be summarized to the following phrases:

1. Activity is important.
2. Repetition, generalization and discrimination are important notions.
3. Reinforcement is the cardinal motivator.
4. Learning is helped when objectives are clear.

Such behavioral principles are quite efficient with small children, and are used by many teachers in their effort to achieve class management. In particular many educators have adopted methods of instruction that conform with the Hartley's principles, such as encouraging students to self-evaluate their progress on a specific activity or assigning homework, which is considered to be teaching students time management while giving them the chance to practice. Furthermore, behaviorist theories manage to give a satisfactory explanation to task-based learning as well as mastery learning, including math facts. They fail though to explain more complex phenomena that occur in adults' learning, leaving thus space for further criticisms, such as the fact that mental activities are disregarded, or that they do not explicate learning that does not include reinforcement mechanisms.

1.1.3.2 COGNITIVISM

Cognitivist theories of learning assume that humans are logical beings and thus try to explain human behavior by appealing to mental activities. In regard with the learning process, as Gagne put it '*Learning is something that takes place inside a person's head – in the brain',* a view that takes learning as the product of thought process, which can be explained only by looking beyond behavior. Thus, the role of the human mind in understanding how learning occurs is very important, while focus is shifted on the patterns and not on environmental events. Two assumptions form the basis of cognitivist approaches to learning:

1. The memory system is a processor of information.
2. Previous knowledge has a crucial role in learning process.

What should be further mentioned is that the structure of learning material is very important, because as cognitivist theorists assert well-organized information is more easily memorized. Furthermore, the differences between learners and their approaches to learning are also taken into account while as the second principle of cognitivism dictates,

associating new with prior knowledge is of equal importance. Taking individuals as rational beings whose actions are the result of thinking, makes us look at behavioral changes with the aim of understanding the mental activities that have caused them.

Two critical processes can be distinguished when adopting a cognitive approach to learning: assimilation and accommodation, both mentioned as complements of adaptation, according to Piaget. Assimilation refers to activities that integrate newly received information into the internal world without changing its structure. New experiences though, might need to modify or extend preexisting categories so as to fit into them. Accommodation on the other hand, is considered to be a more difficult process, since it requires the change of internal structures – sometimes even the creation of new ones- to account for new experiences and knowledge. In order to internalize awareness of the surrounding world both aforementioned processes are required.

An important aspect of cognitive approaches in learning is the assumption that learners themselves control learning, by deciding on the learning strategies that help them the most. They are the ones who decide what is important to be learnt. This implies that since every person has a unique representation of the information possessed and thus unique structures for interpreting the surrounding environment, students will all select a different curriculum that will best fit their needs. Furthermore, having an active role in the learning process, student is challenged to self-evaluate and self-direct his progress, lacking reinforcements – positive or negative ones. This is the reason why self-paced training, including task based activities in which students get actively engaged, might be the most appropriate option when cognitive approaches are adopted.

In this context, emotions, perceptions, experiences and memory as well, are the basic principles on which learning, as a cognitive phenomenon, evolves. What gains attention is the way in which knowledge is transferred rather than behavioral changes. After all, unlike behaviorism, reinforcements arise through evaluation of the results and not through rewards and reprimands. Mistakes can help in having a deeper understanding of the world and the learning material, something that forces educators to reconsider the goals of classroom activities and look for methods of alternative assessment, such as open-ended questions or portfolios. In the end, assessment must be considered as a way to gather information that will help improve learning rather than a pass or fail test that increases anxiety and stresses students.

As a result, the relationship between teacher and students is redefined, since the latter ones are encouraged to get actively engaged to problem solving situations, in which they must be able and free to investigate and question. The opponents of cognitivism though, have come up with a strong argument against it: Cognitivism parallelizes human beings with a computer system that receives input, performs a certain processing and produces output. Unlike computers though, people are able to alter their beliefs, emotions and feelings and thus the ways they process information. In the end, we must admit that cognitivist theories prove to be very efficient for problem solving activities –of mathematical, philosophical or sociological type- but seem less effective when learning aims at memorization or remembering for example history dates, goals for which behaviorist approaches seem more

appropriate. In the last years though, there is a trend to merge those two learning theories into the so called cognitive-behavioral theory, which gives rise to new techniques that can facilitate learning process and achieve learning goals.

1.1.3.3 CONSTRUCTIVISM

Lying on the assumption that rules, ideas and beliefs help individuals perceive experiences in a real-world context, constructivism is viewing learning as the process of constructing meaning. More specifically, knowledge cannot be transferred but built, when individuals combine previous experiences, beliefs and perceptions. Thus, concepts and not isolated facts can contribute to learning and help people construct their own models of their experiences – their unique set of experiences as some call it- through which they can make sense of the world.

According to this view, learning is the natural process of acquiring new experiences by adjusting existing concepts. Active engagement of learner with his environment is the key concept in this learner-centered theory in which the person is encouraged to interact with the real world in order to accommodate new meanings and understandings of the surrounding environment. This implies that learning becomes a personal endeavor and students are free to explore their own meanings of a given framework. Educator is undertaking the task of facilitating this discovery process, by engaging students to cooperative hands-on problem solving activities and posing open-ended questions that will trigger learners to analyze and predict information.

Learning to learn becomes the goal of the classroom activities and in this context, curriculum as well as assessment forms need to be revised. Thus, learning material is adjusted to students' needs. The teacher takes into account learners' prior knowledge, while tests and grades are eliminated in favor of a process in which students evaluate their own progress. Self-directed learning and experiential learning are only some examples in which constructivism finds practice.

Experts can distinguish between two different types of constructivism: individual or personal constructivism and social constructivism. In the former, we create our own knowledge representations while in the latter we build meaning by interacting with others – this is where social learning is also integrated. The concept of sharing knowledge becomes fundamental, as students are often working in groups that foster dialogues applying reflective practices.

1.1.3.4 KOLB'S EXPERIENTIAL LEARNING THEORY

Experiential learning theory defines learning as "the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience. According to Smith there are two types of experiential learning:

1. Learning by yourself

2.   Experiential education

Learning from experience by yourself is the "natural" way of learning. Under this view learning is not offered by an institution or a teacher but by people themselves. It is an intrinsic way of human being to learn since it is associated with our everyday activities and our engagement in the events of life. It is also known as informal learning as it is not formally structured and is generally related to low-level processes of our Selves like perception through our senses.

Experiential education on the other hand is the experiential learning through programs & activities structured by others like educators or institutions. The principles of experiential learning in this case are used to formulate the relevant educational programs (by taking into account the relative variety of the participants' experience) and provide support for professionals of several fields like for social workers or professors. Learners thus are able to gain knowledge and develop skill and capabilities in a direct environment with explicit and clear educational purposes.

Contrarily to didactic education, in which teacher is responsible for "providing" learner with the corresponding information, an experiential educator's role is to enhance and structure the perception of the phenomena in the world that will ideally result in learning. The former kind of education expectedly requires individual study and practice of the presented by the teacher material whereas the latter has as prerequisite the appropriate preparation from students beforehand and practice through relevant brainy exercises.

Despite the existence of several approaches to experiential leaning the most centric and innovative remains the one of David A. Kolb. His work has undoubtedly been the central pillar for most of the theorists and the practitioners interested in experiential learning. Kolb provided one of the most useful descriptive models of the adult learning process available based on learner's intrinsic cognitive processes. His theory includes a four stage cycle of learning from which derive four different learning styles.

Kolb argues that learning entails the acquisition of abstract concepts that can be applied in several cases. His theory presents a cyclical model of learning, consisting of four stages, which actually show the initial transformation of experience into concepts via reflection; these new concepts subsequently drive the individual in the paths of novel experiences and testing various ideas, methods, or activities. According to his theory the comprehension of the basic idea is followed by the action in order to apply it through generalization in different situations. This continuous application of the principles in new circumstances does look like a set of circles since the proposed model is circular with the corresponding variable effects of learner's activities. The key aspects of Kolb's ideas are the direct and active experience and the use of the constructive review of the newly introduced principles and practices so as to proceed with their assimilation. As in the diagram below, Kolb's model is based on two preference dimensions; a vertical perception and horizontal processing dimension providing the four different stages and learning and styles of learning. Although it is possible to start at any stage it is important to follow them in the sequence:

- Concrete experience (or "DO")

- Reflective observation (or "OBSERVE")
- Abstract conceptualization (or "THINK")
- Active experimentation (or "PLAN")

ACCOMODATORS	**Concrete Experience**	*DIVERGERS*
	^	
	Perception	
	|	
Active Experimentation	<------ ---- *Processing* ---- ------>	**Reflective Observation**
	|	
	|	
	V	
CONVERGERS	**Abstract conceptualization**	*ASSIMILATORS*
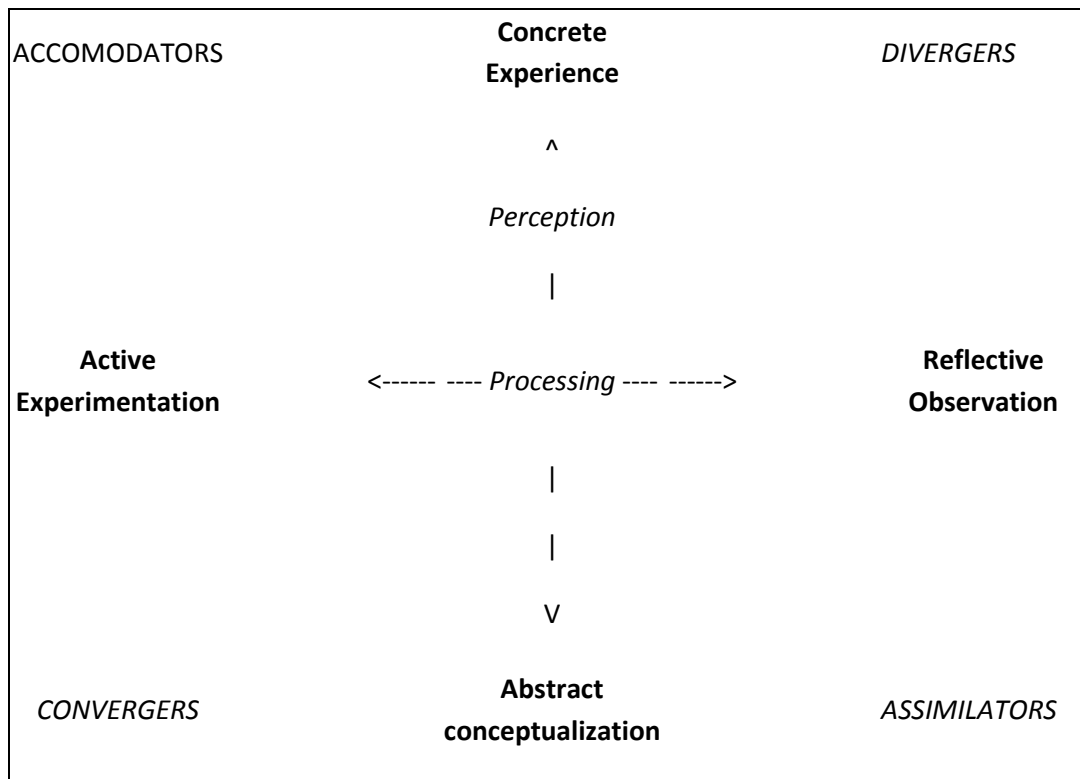
TABLE 1: VERTICAL PERCEPTION AND HORIZONTAL PROCESSING DIMENSION

Concrete experience (CE): In the first stage the learner actively experiences a new task or reinterprets an existing one. He just views things as they actually are in every detail and without any distortion.

Reflective observation (RO): In the second stage the learner with the appropriate level with awareness reflects on that experience. The challenge in this change which is of high importance is to keep constancy between the actual experience and its comprehension.

Abstract conceptualization (AC): In the third stage a new idea or a modification of an abstract concept arises from the reflection of the previous stage. The learner tries to define and formulate a theory or model of the observed phenomenon,

Active experimentation (AE): in this last stage the learner proceeds with planning the testing of the conceptualized theory in a new experience and expects the results of the application of the newly acquired concepts in the world around.

1.1.4   ACTIVE ENGAGEMENT AND ACTIVE LEARNING

Active learning refers to the learning process in which learners are given the opportunity to interact with the learning material while they are encouraged to produce rather than simply receive knowledge. Researches prove that when individuals are motivated to get actively involved in the learning process, they are engaged to activities that yield immediate feedback and thus they achieve deeper conceptual understanding of the learning material. Furthermore, learning is of superior quality and retained for longer time. Other studies, moving a step further, explain this more efficient learning as a result of the fact that experience increases the quality of functioning of the brain and thus produces more substantial learning.

Active learning, as its name also implies, is intertwined with the concept of active engagement, in which learners are invited to undertake responsibility for the learning subject itself, as well as for the way they will interact with it. Active engagement helps individuals process and retain the received information, fostering self-questioning and problem-solving. It includes activities that encourage persons to pose questions and experiment with trial and error techniques, which promote the constructivist learning, while, giving time for developing strategies of repetition, it also allows to associate prior with current knowledge. Thus, learners are capable to better assimilate the information they receive and store it to long-term memory. In addition, when actively engaged to the learning process, people are able to stay on-task and thus complete work on time. While practicing, they develop a higher self-esteem and a belief in their ability to improve, but above all they are encouraged to construct their own knowledge rather than just absorb the information they are being taught. To the aforementioned clues in favor of active engagement, we should add recent studies revealing that in a school environment, students when acting as passive recipients, fail to attend more than 40% of what is being said during the class, while in the first ten minutes they absorb 70% of the information but only 20% of the information transmitted during the last ten minutes.

Adherents of active engagement have come up with a variety of approaches to motivate and encourage their students to get actively involved in the learning process. These strategies might include project-based activities, problem-solving activities, collaborative tasks or even formation of learning communities as we usually call the groups of students that take the same classes together. Especially, as far as problem-based learning is concerned, this aims to engage students in individual and cooperative activities of interrelated themes and it is considered to increase critical thinking and enhance students' motivation, especially when they are engaged in real-life tasks. Group problem solving is referring to a collaborative approach of problem-based learning, in which students collaborate to deal with a problem relevant to a subject area, an activity that incorporates high interaction and sense of responsibility as well as enhances decision-making.

What all of the aforementioned techniques share in common though, is that they make students set goals, apply knowledge and allow for immediate feedback. Thus, learners can evaluate their performance, while they are given the chance to reflect on their mistakes and improve them. In the end we have to admit that the basic reason for the success of active

learning is the fact that students are encouraged to assess their own roles and locate their own deficiencies, weaknesses as well as their strong points.

1.2   CHILDREN'S LEARNING

1.2.1   LEARNING ENVIRONMENTS AND THEIR ROLE

The fact that environment, through which individuals are acquiring new experiences is affecting their learning is unquestionable. What we will try to delve more into though, is the effects that specific environments can have on specific individuals. In this context, we should first of all mention that learning habits are surely dependent on learner's culture and background. Thus, while in most European countries students are encouraged to get actively engaged to the learning process and educator's role is eliminated to supervise this process and foster critical thinking, in China the situation is completely different. Learning takes place in a much more controlled environment in which different learning strategies are adopted.

Recent studies have proved that the environment in which students learn, has a tremendous influence on their performance and success. As it has already been mentioned, fostering a climate in which individuals feel safe, accepted and comfortable –this is what some call a productive learning environment- enhances learning, and increases their desire to focus on the curriculum, get acquainted with new experiences and absorb new knowledge.

But what exactly do we mean when using the term learning environment? Many different opinions have been expressed trying to identify what a learning environment includes. All of them agree on the fact that it is a concept broader than physical environments, their architecture and design. Thus, the most popular view, asserts that a learning environment is comprised of four distinct factors: physical, relationships, structures and expectations. For others, learning environments also incorporate aspects like students' collaboration, teacher's teaching and assessment method as well as social, cultural and psychological elements. Galbraith (1989, 1990) espoused the view that educational climate consists of both the physical environment and psychological or emotional factors. Furthermore, with the technological evolution during the past decades, learning environments have extended to include virtual learning environments that make use of technological achievements and are not restricted to school premises or initiatives.

In any case though, learning environments, including organization of space, daily schedule as well as established emotional and social atmosphere, must adhere to learners' needs. In our analysis we will focus more on non-physical factors, since these are also present and have to be taken into account when designing online learning environments that have become very popular during the last years.

 In this context, creating an environment, in which the sense of order is fostered, is very important for students, so that they will know what to expect as well as how they should act

in a given content. This will give them the opportunity to focus on their learning activities without being distracted from external factors. Furthermore, as studies reveal, the relationship between students as well as between students and teacher, are both of great importance. More specifically, a learning environment, that promotes a positive social climate, is much more appealing to students and as such it enhances their learning. Moreover, teaching and learning approaches must also be taken into account when designing learning environments. Researchers have come to the conclusion that when educators make use of varied interactive teaching strategies and engage their students to many different activities, motivation is increased, and as a result learning of higher quality is achieved. After all, constructivist learning environments seem to be the most appropriate ones for facilitating students in their effort to construct their own interpretation and build new knowledge.

According to the Open Learning Environments theory developed by Hannafin, Land, & Oliver (1999), critical thinking as well as heuristics-based learning are the main goals of learning environments, while in the model they are proposing, they assert that learning environments consist of the following four components:

- enabling context, aiming to motivate students and help them retrieve appropriate prior knowledge and adopt learning strategies
- resources, that will help students understand and elaborate on the problem they are confronted with
- tools, that will enhance learning and thinking activities –these can include processing, manipulation, communication and scaffolding tools
- scaffolds, aiming to guide and provide directions to students.

Thus, OLEs provide specific problem solving tasks, that students should elaborate on, aided by resources, tools and scaffolds, with the goal of enhancing self-directed learning. Giving students the opportunity to have hands-on experiences in solving problems, OLEs – as typical constructivist environments- help them develop the sense of responsibility as they are encouraged to evaluate their knowledge and come up with ideas which they have to implement, test and assess, an approach that is in conformity with Piaget's view of active discovery learning environments.

 In the end, we should admit though, that such technology-driven learning environments, with little or not at all monitoring might prove to produce learning of lower quality than traditional classroom learning environments do. The lack of interaction between trainer and trainee does not allow for the evaluation of psychological factors that might influence the learning process and need to be taken into account. After all this is an issue that is more thoroughly analyzed in the second chapter of this master thesis.

1.2.2   CATALYTIC FACTORS IN CHILDREN'S LEARNING

When coming to analyze children's learning and investigate factors that affect –in a positive or negative way- this process, we must take into severe consideration their development

process. Answering to questions about children's development can provide us with a basis to elaborate on, when analyzing the learning process, as this takes place in kids. Thus, according to researchers, there are four fundamental pillars on which children develop - physical, mental, social, emotional - and on which learning must also rely on. This implies that learning –occurring either at school or in a different environment such as family – should incorporate strategies and activities that aim at facilitating and encouraging the aforementioned aspects of children's development. Another issue that needs to be taken into account, when talking of ways to improve children's learning, is that they form a peculiar and very vulnerable group, and as such they call for special treatment. This implies that common practices used for adults' efficient learning do not apply for kids, or need to be reconsidered and adapted to their particular needs. In many cases, different children might even adopt different learning orientations, complicating thus even more the problem of coming up with a common approach of kids' enhanced learning.

Beginning with the out-of –class environment, we could say that family is one of the most significant factors, with crucial influence on the way children learn and encounter learning in general. First of all, being the first form of social community of which a person becomes part, family should arm individuals with all the necessary personality characteristics that will help him or her to become a good learner. Independent thinking and acting, self-confidence, high self-esteem, are only some of the traits that a good student should be equipped with, all fostered within a family environment. But how can parents help their children become good and efficient future learners? It seems that when parents spend quality time with their children trying to engage them to effective learning activities from their early years, kids are predisposed positively towards learning. This positive attitude seems to be enhanced when children live in a peaceful family environment, which reduces stress and does not distract them from their learning activities.

Furthermore, as studies reveal, parents' beliefs and perceptions seem to be influencing children's personality as well. This implies, that if kids grow in a family environment in which a positive climate towards learning and school is fostered – for example if parents spend time studying or try to give their kids the chance to have learning experiences- they also adopt an assertive stance towards the concept of studying, something that can only benefit their learning process. After all, the child-parents relationship has a determinative role on kids' development and progress. Respect, love and willingness to please parents can act as motivators for kids to remain active and perform well at lessons.

Continuing with school environment, we should firstly point out that in order for learning to be effective within a classroom, students' attention must be gained. They must set their own goals and undertake the responsibility of directing their own learning, giving their own interpretation to the information they are confronted with. Mistakes must be treated as situations to be corrected and avoided in the future, providing opportunities for self-regulation. Observation, memorization and discovery of the learning material are the basic activities required, and it is true that they cannot be developed if students are not actively engaged in learning problems, leaving under the responsibility of the tutor, the task of integrating such activities to the curriculum. Furthermore, when actively engaged in learning, children become more concentrated, enthusiastic and willing to try and interpret

the learning material. After all, high levels of engagement are associated with increased attendance and better performance.

Starting thus with the role of educator, the one who is guiding and in a way leading learning in a classroom, we should firstly say that he must reinforce learners' memory and enhance their critical thinking, by actively engaging them in problem solving tasks. In an effort to trigger curiosity, motivate and help students shed stress, educators should come up with enjoyable and varied from routine activities –such as experiments or observations- , in which they should integrate audio visual aids and frequent breaks – the role of which is very important in helping students restore energy and absorb received information. It should be mentioned though, that engaging activities, should be selected carefully, so that students understand their actions as well as the purpose of these actions. In this context, cultural, developmental and individual differences between students should be respected and tasks should be designed in a way that does not make different groups feel embarrassed or less comfortable.

Factors that distract students from their tasks should be eliminated as much as possible, while discussion and dialogues should be used as techniques to retain attentiveness and help students activate or make connections to prior knowledge. This will help them relate what they learn with what they already know, and thus better understand the learning subject or even reconstruct existing knowledge, if needed. Another important factor that should be promoted within classrooms is collaboration. As studies have proved, students tend to be more focused on their tasks and work harder to achieve better results, if these will be shared with other peers. Learning to cooperate and not compete with their peers will help children reap the benefits of collaboration – which have been analyzed in previous chapter- and finally achieve learning of better quality. Furthermore, if working groups are successful, then children appear more motivated, since they find much more enjoyable and interesting working with others than on their own. After all, the aspect of motivation is central to the learning process and much conversation is being done on how this can be increased.

During the last years, technology evolution has pointed out new ways for triggering children's interest and attentiveness in classroom. Teachers have started introducing online games to help them teach maths, physics, reading and other subjects while they try to create virtual collaborative learning environments, in which students will use the web to communicate with each other and with the teacher as well. This trend is expected to gain popularity in the future years, when children will become even more familiar with technology and, by modeling learning to systems of the real world, will most probably contribute to bridge the gap between class and real life.

1.3 BLOOM'S TAXONOMY

Bloom's taxonomy, also known as taxonomy of educational objectives, was published in 1956, by the American educational psychologist Benjamin Bloom, whose primary interest was lying on what we call 'operationalization of educational objectives'. In fact, it constitutes an attempt to classify the types and levels of learning as well as the learning objectives, as

these are defined by the tutors. It was initially created in order to accommodate the faculties of various universities in the exchange of test items that measure the same educational objectives and eliminate the effort of preparing annual examinations. As such, it can be considered to be a classification of sentences of what we expect from students to learn, linking specific outcomes and verbs to each level of taxonomy. Till now, it has been translated to 22 languages and it is being widely used even today by educators who want to organize structured frameworks to induce into their classrooms.

According to Bloom, there exist three psychological domains of educational activities to which learners can be involved, resulting to three types of learning –one for each domain. The domains are listed below:

- Cognitive domain: including intellectual skills and knowledge.
- Affective domain: including feelings and attitudes.
- Psychomotor domain: including physical skills.

This aspect of learning, is proposing a more holistic view of the instruction process, in which educators are motivated to center upon all three kinds of activities. After all, the goal of learning is to help learners acquire new skills, knowledge, ideas and attitudes.

Each of the aforementioned domains, is subdivided in categories, ordered from the simplest to the most complex behavior. What needs to be noticed though is the fact that categories are ordered in cumulative hierarchy, which means that mastery of a simpler category is a necessary precondition for a more complex one to take place. In other words, it could be claimed that in the model that Bloom proposed for classifying thinking and learning processes, a chronological basis is assumed to exist, in such a way that each level is subsumed by the higher ones. However, this does not imply that individuals can only enter the learning process at the lowest level. On the contrary, learning can start at any stage, but in any case previous, less complex stages will be integrated into that learning.

Bloom's taxonomy is focusing on the cognitive domain, in which thinking skills and goals are orderly categorized, with the development of critical thinking over a particular subject being one of the main objectives. A graphical representation of the taxonomy can be found below:
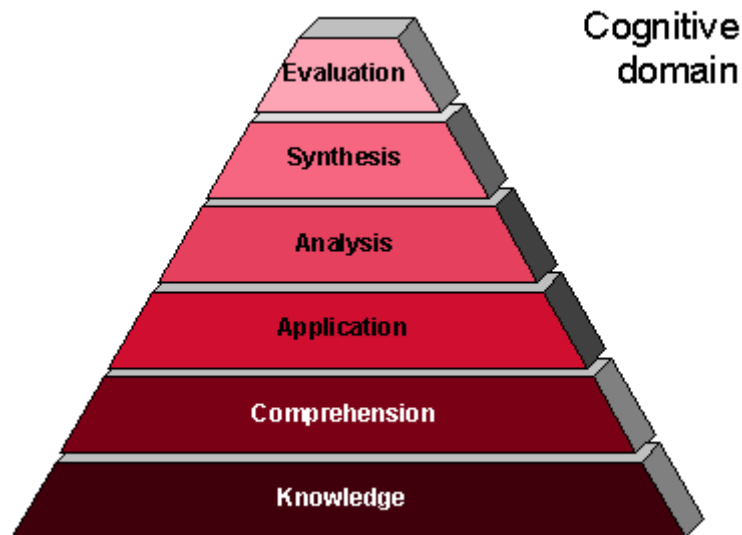
FIGURE 1: BLOOM'S TAXONOMY

As we can see, there can be defined six categories or levels within the cognitive domain, each one identifying a certain degree of cognition and mental skills that the learner needs to develop and acquire in order to proceed to the next level. These skills develop from Lower Order to Higher Order Thinking Skills – terms that emerged from thorough study of Bloom's taxonomy. In the following table, a definition together with key words for each category can be found:

Category Definition	Key Words (verbs)
Knowledge: Recall data or previously learned information.	**Key Words**: defines, describes, identifies, knows, labels, lists, matches, names, outlines, recalls, recognizes, reproduces, selects, states.
Comprehension: Understand the meaning, translation, interpolation, and interpretation of instructions and problems. State a problem in one's own words.	**Key Words**: comprehends, converts, defends, distinguishes, estimates, explains, extends, generalizes, gives an example, infers, interprets, paraphrases, predicts, rewrites, summarizes, translates.
Application: Use a concept or previously learned information in a new situation to solve problems. Applies what was learned in the classroom into novel situations in the work place.	**Key Words**: applies, changes, computes, constructs, demonstrates, discovers, manipulates, modifies, operates, predicts, prepares, produces, relates, shows, solves, uses.

Analysis: Separates information material or concepts into component parts so that its organizational structure may be understood. Distinguishes between facts and inferences and develops conclusions by identifying causes and making generalizations.	**Key Words**: analyzes, breaks down, compares, contrasts, diagrams, deconstructs, differentiates, discriminates, distinguishes, identifies, illustrates, infers, outlines, relates, selects, separates.
Synthesis: Apply prior knowledge and skills to build a structure or pattern. Put parts together to form a whole, with emphasis on creating a new meaning or structure.	**Key Words**: categorizes, combines, compiles, composes, creates, devises, designs, explains, generates, modifies, organizes, plans, rearranges, reconstructs, relates, reorganizes, revises, rewrites, summarizes, tells, writes.
Evaluation: Make judgments about the value of ideas or materials, based on individual values and opinions.	**Key Words**: appraises, compares, concludes, contrasts, criticizes, critiques, defends, describes, discriminates, evaluates, explains, interprets, justifies, relates, summarizes, supports.

TABLE 2: BLOOM'S CATEGORY AND RELATED KEYWORDS

Furthermore, we should mention that each category, except 'Application' is divided to subcategories. Thus the structure of the original taxonomy table can be found below:

1. Knowledge

    1.1   Knowledge of specifics

        1.1.1   Knowledge of terminology

        1.1.2   Knowledge of specific facts

    1.2   Knowledge of ways and means of dealing specifics

        1.2.1   Knowledge of convention

        1.2.2   Knowledge of trends and sequences

        1.2.3   Knowledge of classifications and categories

        1.2.4   Knowledge of criteria

        1.2.5   Knowledge of methodology

    1.3   Knowledge of universals and abstractions in a field

        1.3.1   Knowledge of principles and generalizations

        1.3.2   Knowledge of theories and structures

2. Comprehension

    2.1   Translation

    2.2   Interpretation

    2.3   Extrapolation

3. Application

4. Analysis

    4.1   Analysis of elements

    4.2   Analysis of relationships

    4.3   Analysis of organizational principles

5. Synthesis

    5.1   Production of a unique communication

    5.2   Production of a plan or proposed set of operations

    5.3   Derivation of a set of abstract relations

6.	Evaluation	
	6.1	Evaluation in terms of internal evidence
	6.2	Judgments in terms of external criteria

What needs to be pointed out is that Bloom's taxonomy provides educators with a framework to structure their trainings, as well as with a template to evaluate the quality of learning achieved, whether this is part of a course at school, or part of a training being held in an organization. Lastly, it should be mentioned that many associations have been done with Bloom's taxonomy and problem solving skills or technology integration issues. Andrew Churches' 'Bloom's Digital Taxonomy' is an example of how technology can be combined with Bloom's classification of thinking process so as to incorporate elements of modern online learning environments, something that will be further analyzed in following subchapter.

1.4   BLOOM'S REVISED TAXONOMY

Bloom created the original taxonomy of the cognitive domain for categorizing ways of learning and thinking as seen above back in the 1950s'. His taxonomy, as a means of expressing qualitatively distinct types of thinking still continues to be one of the most frequently and universally applied models. A revised model of his attempt to define the functions of thought, coming to know, or cognition was introduced in the 1990s' by Lorin Anderson to assist educators in comprehending and using a standardized course of studies. Anderson who was Blooms' former student enhanced the original model in cooperation with one of the Bloom's partners in the original work, David Krathwohl. The new model that was the product of five years works and of the collaboration of scientists and experts in several fields (educational testing and, psychology etc) was named after its creators "Anderson and Krathwohl"

Bloom's taxonomy was adjusted to be more compatible with educational practices. For the educator the revised model provides a complete and detailed set of classifications and for the learner the associated with the primary educational goals cognitive processes. The revised model provided solution to two main concerns regarding the original model. The first one was about the difference between comprehension and application. Clearly comprehension has a very broad definition which makes it rather hard to identify which parts were cascading. Anderson mapped those two categories with verbs that are explicit and simpler and do not cause any further confusion. The second preoccupation was related to the vagueness regarding the exact meaning of evaluation. The source of this confusion was the fact that evaluation as a concept is much less complicated than synthesis and thus it was difficult to distinguish the potential activities and products that would represent evaluation.

Obviously, the revised Bloom taxonomy gives different names to the six levels of the hierarchy by changing also their form from noun to verb in order to represent that thinking whose different types of functions the taxonomy in fact describes, is not a passive process,

but on the contrary it does require the active engagement of the individuals. The same was applied to the subcategories of the basic categories, some of which were further restructured.

COMPARISON OF 1956 BLOOM'S VS REVISED 2001 TAXONOMY BASED ON THE WORK OF ANDERSON AND KRATHWOHL)		
Levels of thinking from highest to lowest	Bloom's 1956	Revised 2001
1	Knowledge	Remember
2	Comprehension	Understand
3	Application	Apply
4	Analysis	Analyze
5	Synthesis	Evaluate
6	Evaluation	Create

TABLE 4: BLOOM'S VS REVISED 2001 TAXONOMY

- Remember: The original name was knowledge, which was rather inappropriate for describing a function of thought, since knowledge is what is derived though the process of thinking; a final product and.
- Understand: The original name of this category was comprehension. Understanding represents better the nature of thinking of this category.
- Apply (original: application)
- Analyze (original: analysis)
- Evaluate (original: evaluation)
- Create: The original name of this category was synthesis. Creation represents better the kind of thinking of this category. Being creative is not a prerequisite for being critical. i.e., judge and idea and justify choices). However In order for someone to be creative has to be also critical (i.e., accepting and rejecting ideas on the path to creating a new idea, product or way of looking at things).

What differentiates the revised model from the original is not merely the transition from nouns to verbs or the change in the sequence of the categories. The revised model is more understandable and even more utilitarian than the original version. Teacher assessment of the students and teacher self-assessment became a manageable and activity that is based on specific guidelines. This was the result of the mapping between specific instructional activities, the related cognitive processes and the different types and levels of knowledge (factual, conceptual, procedural and metacognitive). These dimension except for the "metacognitive" were referred also in the original version of the model but were never used in practice by the teachers, who were in most cases unaware about their existence. A widely

used and rather simple approach to identify the relation and impact of the instructional tasks in the cognitive processes of the students and in the same time on the different dimensions of knowledge is to design a simple table like the one below with axes the knowledge dimension and the cognitive process and fill it in with the used instructional activities.

THE KNOWLEDGE DIMENSION	THE COGNITIVE PROCESS DIMENSION					
	REMEMBER	UNDERSTAND	APPLY	ANALYZE	EVALUATE	CREATE
FACTUAL KNOWLEDGE						
CONCEPTUAL KNOWLEDGE						
PROCEDURAL KNOWLEDGE						
METACOGNITIVE KNOWLEDGE						

TABLE 5: KNOWLEDGE AND COGNITIVE PROCESS DIMENSION

Below is a brief description of each of the knowledge dimensions:

Factual Knowledge is knowledge that is basic to specific disciplines. This dimension refers to essential facts, terminology, details or elements students must know or be familiar with in order to understand a discipline or solve a problem in it.

Conceptual Knowledge is knowledge of classifications, principles, generalizations, theories, models, or structures pertinent to a particular disciplinary area.

Procedural Knowledge refers to information or knowledge that helps students to do something specific to a discipline, subject, or area of study. It also refers to methods of inquiry, very specific or finite skills, algorithms, techniques, and particular methodologies.

Metacognitive Knowledge is the awareness of one's own cognition and particular cognitive processes. It is strategic or reflective knowledge about how to go about solving problems, cognitive tasks, to include contextual and conditional knowledge and knowledge of self.

As mentioned many times in the previous chapters the reason that Bloom's taxonomy is universally used several decades after its introduction in 1950s' is the elegancy of his work and its high relevancy with education. However as Andrew Churches, who is behind the development of the digital Bloom's taxonomy claims: 'The revised version still does not address the objectives, skills, processes and actions produced from information and communication technologies'. Students nowadays are familiarized with using technology and digitalized activities are gaining ground every day in the field of learning processes.

There have been several attempts to 'update' revised Bloom so as to be more compatible with the new technologies and tools introduced in the current century. The most popular one is the work of Andrew Churches: "The Bloom's digital taxonomy" in 2008. Bloom's digital taxonomy is not merely about the tools and technologies, it is about using these tools to achieve, recall, understanding, application, analysis, evaluation and creativity. What Churches wanted to pointed out is that students have changed. The modern "Net generation" or "digital natives" as many prefer to call them are not only surrounded and acquainted by all kinds of digital media they also have differentiated way of thinking and processing information compared to previous generations. On the contrary since teachers are "digital immigrants", which according to author Marc Persky means that they do not speak fluently the language of computers, digital games and internet, they and subsequently their practices are out of date. Effective pedagogical practices though have no age. What is required is to identify and use the proper tools and activities that would assist students in gaining and validating knowledge, which is what Churches managed to do.

Churches updated the Bloom's revised taxonomy to compromise with the activities, behaviors and opportunities that emerge from the wide introduction of technology in every aspect of modern life. What differentiates Digital Taxonomy from its predecessors is that is not focused only in the cognitive domain but also in specific guidelines and tools and the increased impact of collaboration involved in digital media. Thus this work promotes technology integration and its best practices in the learning process and lays the foundation between Bloom's Taxonomy and web 2.0 technologies. It's not only students that are familiar with Web 2.0.; the number of educators and parents that develop skills and gain knowledge in a variety of application designed to assist the instructional activities and inside and outside the classroom and satisfy all the different learning styles constantly increases.

With this valuable information in mind and based on the Digital Bloom's Taxonomy we will try to indentify the activities and web 2.0 applications and tools that fit better to the needs of children between 7 and 11 years old . We will provide a framework that will support teachers in aligning objectives with content, activities and practices not obsolete but adjusted to the real-world experiences of the students within this age range and their different learning preferences. Furthermore children will be able to experience novel activities and relate them with their real life world.

But before proceeding with presenting our updated model it is essential to identify the idiosyncratic features of the age of 7-11 years. A popular theory developed by Piaget argues

that children's cognitive processes do not develop entirely smoothly: instead, there are certain points at which it "takes off" and moves into completely new areas and capabilities. He identified four developmental stages and the processes by which children progress through them: the s*ensorimotor stage,* the *Preoperational stage,* the *Concrete operations* and the *Formal operations stage.* The third stage "concrete operation" which refers to the age range of 7-11 years is the one in which the child starts due to the accumulation of physical experience, to conceptualize, creating logical structures that explain his or her physical experiences. According to extensive research this period is also related to the development of bimanual coordination that is the cooperation between the two hemispheres of the brain. Successful interaction between the two parts of the brain results in the activation and further development of the psychomotor activities including motor qualities like speed accuracy and flexibility but also in important cognitive activities. Creativity and innovative decision making is proven to be related not only with high activity in the right hemisphere but also with connection between the right and the left hemispheres.

Thus our model ideally will entail activities and tools that ensure the intensive interaction between the hemispheres. This range of 7-11 years is important in terms of developing creative abilities and the ability for meaningful activity, which is extremely decisive for the students' personal development. In primary school there is lack of up-to-date activities that ensure the children reasoning abilities, creativity and diligence development. So by looking through the field of the available tools and activities and based on Churches work we will try to help instructional designers to design modernistic approaches based on the latest ideas and knowledge compatible with the distinctive characteristics of children between 7 and 11 years old.

Now that the needs are clearly established and an audience has been identified, we will provide the instructional designers with a simple template for activities and assessment. With it the educator will be better equipped and the learners will be given what they want when they want it. To achieve this, the list of verbs that correspond to each cognitive level, was edited and examined for applicability while all lists were refined to comply with the specific needs of the concrete operation stage .The dimension "tools" was also added that includes some really useful and aligned with this model's goals tools .The resulting simple-form table contains four dimensions: Taxonomy level, Activities, Digital Activities and Tools as shown in the corresponding table.

THE MODEL

Remembering: This level engages students at recalling previously learned information, such as dates, places, mathematical types or history facts. Observational skills are needed, so that children are able to define, list or reproduce major ideas and knowledge. In a digital environment, students are involved in retrieval tasks such as google searches, bookmarking and social bookmarking. Thus, the teacher might ask from students to search the web for videos or articles as part of a project. While searching, students can bookmark the information they find interesting and relevant to their topic, so that it can be retrieved effectively later on. Another characteristic activity, related to this taxonomy level, includes

engaging students in quiz or tests in which they are asked to list, describe or identify basic concepts and principles. Gamegoo is an online tool, in which kids, in a specially designed environment that includes metaphors, colors and audiovisual effects, are involved in tasks such as defining synonyms or antonyms of given words, structuring sentences in the correct order etc. Other websites are giving children the opportunity to locate definitions as part of a game activity (for example the Merriam-webster website http://www.merriam-webster.com/). Watching videos, taking online tests and labeling parts of a picture –such as the parts of human body- are also considered to help students develop and demonstrate remembering skills. It must be mentioned that there exist several online tools aiming at facilitating or developing remembering skills. A list of such tools – adapted to kids' needs- is presented in table below.

Understanding: At this level, students are asked to organize previous knowledge so as to prove their comprehension. Thus, they can be involved in activities such as retelling – or writing in a Word document- previously learned information in their own words, comparing, paraphrasing, categorizing or even interpreting information they have collected. For example, while bookmarking, students can tag and comment the resources they have found, demonstrating understanding skills. Using advanced searching is another activity that requires children to have developed understanding of the keywords as well as of the Boolean logic and features of advanced search. Several tools exist online that help kids evolve skills required at this taxonomy level. For example, '*Into the Book*', a website designed for kids, is motivating children to make connections, synthesize, summarize, visualize, evaluate, infer or make use of prior knowledge to understand something new. Children are guided by metaphors and aided by audio visual effects and in the end they come to accomplish tasks through which they exhibit and foster their understanding strategies.

'*Treasures*' is another example of online tool, that again through metaphors and audiovisual effects is engaging students to activities that require them to make associations and connections of objects and concepts. Students are also encouraged by the metaphors to collaborate with their peers as they are given sufficient time to about the activities they are engaged to.

Applying: Solving real-life problems, executing tasks using prior knowledge of methods or concepts and use learned material to create models or presentations are some of the activities in which children develop and exhibit skills required at the 'Applying' level of the taxonomy. Since at this level students must learn how to use information in new situations, asking them to continue a fairy tale or a story or to summarize a sequence of events, could be some tasks that would promote this level of understanding. In a digital environment, kids should learn how to use applications to complete a project. In this context, they start investigating how each tool is working and they are involved in activities such as playing games, uploading or downloading files and sharing content. Especially as far as game playing is concerned, we should mention that successful operation of games demands

understanding of the process and this might be one of the reasons why they have been largely applied to educational activities lately. Online tools, such as Scholastic are teaching to students methods to elaborate on specific problems –from the domain of Maths, Science, Language arts etc. Later children are asked to take tests in which they will have to apply the learned techniques in real problems. We should once again mention that the existence of metaphors, colors, big buttons and audiovisual effects are prominent in such environments, so that kids' motivation is kept during the whole activity. Other tools, such as the 'Comic Creator ReadWriteThink' or 'GoAnimate' are using a children-friendly environment through which students are instructed how to come up with their own comic or video correspondingly. Last, we mention the Kerpoof Studio, a platform that gives kids the opportunity to select among different activities such as spelling a picture, make a movie/card/drawing or tell a story.

Analyzing: In this level of Bloom's revised taxonomy, students should be able to structure ideas, decompose learning material to constituent parts and be in a position to identify the relations between those parts, tasks that require them to foster and demonstrate organizational and analytical skills. The instructor – whose role is to guide, evaluate and observe- can ask children to identify the causes of real-life situations, to prepare and perform an interview, or even to draw a graph in which relations of basic concepts are depicted. Students must be able to verify the information they are making use of and this can be achieved if they are engaged in discussions and debates, in which they are challenged to argue, examine, question and actively participate in the analysis of the information they are confronted with -pointing out the significance of collaboration and interaction. Students can experiment with tools that allow the creation of mindmaps which they can also share with their peers in an online environment. Using word processing tools, students are enabled to analyze and organize their ideas, while other visual learning tools -such as '*Kidspiration*'- allow students to create stories, express and share ideas and thus better understand and organize the learning material – whether this is mathematical concepts, reading or writing skills etc. Tom Synder's '*Timeliner*', is another powerful tool that also helps students to collect information, visually organize it on a timeline, cycle or sequence and share it using modern presentations. Lastly, we should also mention '*ReadWriteThink*', a software program combining fun with multiple interactive tools that engage students in tasks varying from organizing and summarizing data to learning about languages.

Evaluating: In this taxonomy level, students need to demonstrate skills such as testing, arguing, critiquing, judging and even defending their judgments and arguments, based on specific criteria and standards –selected either by themselves or defined by the teacher. Thus, they are often asked to evaluate the appropriateness of a process, product or procedure for a certain problem, justify a solution, or create and conduct a debate about a learning subject, in which they might also present their view. Such activities entail the aspect of collaboration and can be enhanced with the use of digital media such as blogs, wikis or audio/video conferences. For example, teachers can post students' assignments and

projects on a wiki or blog, and invite their peers to comment on them using certain objectives – Think Quest is a tool promoting such kind of interactive tasks. Another exemplary activity could be encouraging students to judge certain actors' behavior to online games' fan sites, a task that is well combined with kids' entertainment forms. Many instructors are also proceeding with the development of simulations that engage students in online environments in which they are invited to evaluate aspects and perform specific tasks. The '*NDSU Geology Explorer*' is such a tool, that involves kids to certain mission with the goal of finally creating a geologic map. Collaborative online tools, such as '*Palaver Tree*' and '*Nota*' are also being used to foster skills required at this level. Special attention should be paid to teacher's role, which should be reduced to accepting/rejecting opinions and guiding students to the activities they are engaged. Finally, it should be mentioned, that it is quite hard for the age group we are referring to, to develop and demonstrate skills required at this level, since in most cases these require enhanced mental development, achieved at later stages of children's development.

Creating: At the highest level, focus is given on designing, inventing, constructing, planning and producing. All the processes involved in the lower taxonomy levels are embedded in the thorough processing represented in this level. As aforementioned the age range of 7-11 years is crucial for the development of creativity. Based on this remark and given the fact that via the design and implementation of complex and demanding projects children will be able to reach the highest level of cognition that can develop and acquire, it is easy to understand why we should give greater emphasis on the activities and tools of this level. Children are asked firstly to explore ideas and resources, then examine and assess the available information and finally proceed with implementing an innovative project. In this level technology is tangled up with creativity through audio and video means in the form of films, animation, and hypermedia programs or web Design environments. Churches also suggests more complicated forms of creation representation like program application or the development of a game .The latter is obviously directly related with this thesis ultimate goal, which is the designing of an online game-authoring community for children. Using Microsoft Word to write a paper using an outline, publishing in a blogging Website, creating maps, puzzles, and brochures or even using a digital camera to take pictures related to a specified learning objective could constitute purposeful activities of this level. *PicLits* is a creative writing site that matches beautiful images from a library with carefully selected and inspiring keywords .The goal is to associate sentences ideally in the forms of poems to capture the essence, story, and meaning of the picture. The child is guided via three different "help" sections:"Write it", "Rhyme it" and "Master It". *Zimmertwins* is a film watching and making site in which a user can create and direct a movie from the beginning , modify existing movies (e.g. give a different ending) rate others movies and save his own movies. Similar functionality offers the *Creaza* site which based on cloud computing principles is developing a wide range of SaaS products and services to enable users to collaboratively produce, stream, share and store user-generated video. *Kerpoof* studio goes a little bit further and gives the user the possibility to "make a drawing", "make a movie", "spell a picture", "take a picture", "make a card" and "tell a story". The team behind *Edublogs* claims that they provide safe and reliable, student friendly and customizable blogs that host education

related. Finally via *Wikispaces* children can create their own wiki page via a user friendly visual editor that requires no technical knowledge. Evidently all these tools and environments are a powerful vehicle for children to formulate their ideas in an actual and easily accessible from while developing and bolstering their creativity.

Taxonomy level	Activities	Digital Activities	Tools
Remembering	Answer to questions such as: what, who, where, why.	Quiz/tests, social networks adapted to kids, bookmarking, google searches, view DVD or online streaming video, locate definitions online, type a Word document, take online test, locate and read articles.	Lexipedia, GameGoo, Youtube, Discovery streaming, Starfall, Merriam-webster, Spelling City.
Understanding	List events of a story or information on a specific subject, use symbols to draw a method.	Search for a specific subject on the web and evaluate the findings or create a categorized list of the findings, locate a specific picture related to a topic of study, locate a cartoon as	Into the Book, Treasures, Book Adventure.

		part of a project, use Paint to draw an object for specific learning goals, perform an advanced search.	
Applying	Continue a fairy tale, summarize a series of events, keep diary, write a journal, prepare an interview	Play games, upload or download files, share content, prepare presentation, create a picture, make a video, make a comic, make a drawing.	GoAnimate, TuxPaint, ReadWriteThink Comic creator, Kerpoof, Google Earth, Fotobabble, Scholastic.
Analyzing	Compare two topics using Venn Diagram, conduct a survey to gather information, classify actions of an actor, depict information using a graph, prepare a report.	Use a word processing tool to organize ideas, express and share ideas online, create stories online, online surveys, construct a timeline with collected data.	Kidspiration, Tom Synder's Timeliner, ReadWriteThink Mindomo.
Evaluating	Assess the appropriateness	Blog commenting, posting,	NDSU Geology Explorer,

		testing, audio/video conferencing, judging a certain behavior in a game's fan site.	Palaver Tree, Nota ThinkQuest.
	of a product or process for a specific task, organize and conduct debate, present a view, report, create a persuasive speech, self-evaluate.		
Creating	Design, invent, construct, plan and produce.	Films, animation, hypermedia programs, web Design environments, program application ,development of a game , Microsoft Word to write a paper using an outline, publishing in a blogging Website, creating maps, puzzles, and brochures ,using a digital camera to take pictures related to a specified learning objective	PicLits, Zimmertwins, Creaza, Kerpoof, EduBlogs, Wikispaces

TABLE 6: DIGITAL AND NON-DIGITAL ACTIVITIES FOR BLOOM'S TAXONOMY LEVELS

Having done a brief introduction to the basic learning theories, we focused on Bloom's taxonomy, mentioned Bloom's revised taxonomy and finally using Bloom's Digital taxonomy we tried to create a model that fits the target age group- children between seven and eleven years old. This model will be used in the last chapter of this master thesis as a framework within which we can examine which specific activities of the designed community website facilitate the development of specific Bloom's cognitive levels.

In the next chapter, we will extend our study to include social aspects of learning. More specifically, we will try to define 'social learning' and examine specific cases in which this can take place. The reason for shifting our interest in social learning is the continuously growing development of social networks and online communities that try to simulate social structures and patterns in their effort to increase the benefits of group working and discussion. After all, the concept of social community should be inherent to the website we are going to design.

2 SOCIAL ASPECTS OF LEARNING

SOCIAL LEARNING THEORY

Social learning theory has its roots to N.E. Miller and J. Dollard who accepted social learning, espousing the view that imitative behavior is a special case of operant conditioning. Thus, in their work, they asserted that both imitation and non-imitation could be increased through reinforcements and punishments. If individuals are inclined to learn a particular behavior, they would do so through observations. The demonstrated behaviors are considered to be the antecedent condition of which the response is the consequences –acting as either positive or negative reinforcements. In 1963, Albert Bandura, whose primary interest was lying in the notion of imitation as this takes place in social learning circumstances, expanded their theory with the principles of observational learning and vicarious reinforcement. More specifically, according to Bandura, social learning theory - or social cognitive theory as some prefer calling it- holds that individuals acquire knowledge through sensorial experiences and observation. Emphasis is given on observing, imitating and modeling behaviors and reactions of others, underlying the need for a social context within which people interact and learning occurs. As Bandura put it "*Most human behavior is learned observationally through modeling: from observing others, one forms an idea of how new behaviors are performed, and on later occasions this coded information serves as a guide for action.*"

Asserting that learning is the result that environmental and psychological effects have on individuals' behavior, social learning theory is considered to be incorporating both behavioral and cognitive aspects of learning, functioning thus, as a bridge between behaviorist and cognitive theories. More specifically, reprimands and rewards, as well as the expectations of such reinforcements, seem to influence both the frequency with which individuals demonstrate a learnt behavior and the learning cognitive processes as well. For example, students' attention, to a specific learning subject, is reduced when they know that it will not be examined in a test. On the other hand, cognitive aspects –such as attention or awareness of response reinforcement and punishment- can also be recognized in social learning. The reciprocal causation relationship between individual, behavior and environment cannot be disputed while modeling is a basic concept of social learning theory that will be further analyzed below.

Bandura is best known for his Bobo doll experiment, through which he proved that children tend to adopt a physically more aggressive behavior when exposed to aggressive models, compared to those who are not exposed to aggressive models. In his social learning theory, he recognizes four stages of imitation:

- Close contact
- Imitation of superiors
- Understanding of concepts
- Role model behavior.

At this point attention should be paid to the distinction between imitation and modeling, concepts that for many may sound similar. Thus, while imitation refers to the duplication of a model's behavior that is being used as a discriminative stimulus, modeling has to do more with the generalization of a certain behavior –that acts as a principle- to other similar situations. Bandura distinguishes between three different types of models: live –actual individuals performing a certain behavior-, verbal instructional - including descriptions of a behavior- and symbolic models- appearing in TV, computer games and other media sources.

It could be said that modeling constitutes a process through which, people can be taught new behaviors, increase the extent to which they exhibit previously learned or forbidden behaviors, or increase the frequency of similar behaviors – for example a child watching his friend playing football might be engaged to another similar sport activity. Furthermore, as it has already been mentioned, social learning theory is trying to explain human behavior by appealing to reciprocal determinism – reciprocal interaction between cognitive, behavioral and environmental factors. In other words, the person –combination of cognitive and biological events-, the environment and person's behavior interact to produce person's following behavior. Environment can be either physical or social and together with cognitive frameworks and individuals' perceptions can affect behavior. Thus, the way people interpret the consequences of actions and behaviors, changes their environment as well as the cognitive representations they have of models, which in turn change behavior. More specifically, reinforcements exist potentially in the environment but are in need of an action for their realization, justifying the aspect that behavior affects environment. After all, what observational learning asserts is that people learn by observing others' actions as well as the consequences these actions have. The environment on the other hand also influences a person's behavior, which in turn interacts with individual cognitive capabilities, confirming the view of a complicated three-way interplay, a graphical representation of which is depicted in the figure below.

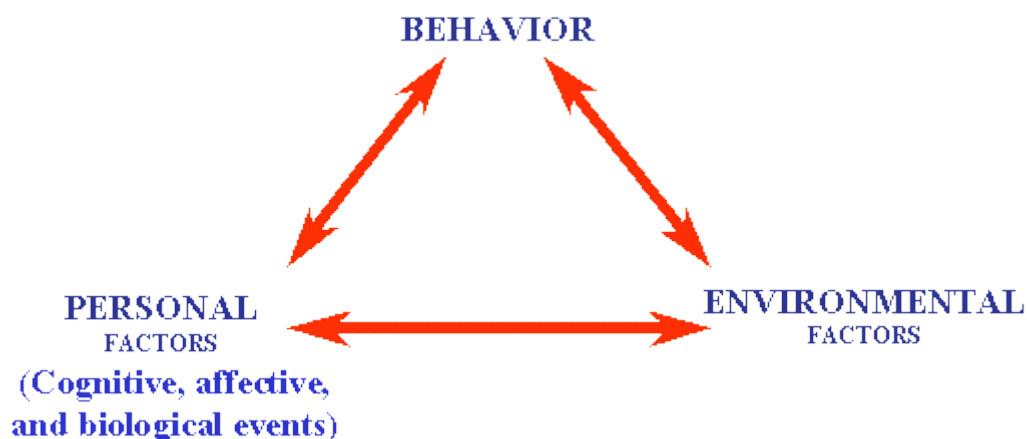
FIGURE 2: HUMAN BEHAVIOR AS A RESULT OF RECIPROCAL INTERACTION BETWEEN COGNITIVE BEHAVIORAL AND ENVIRONMENTAL FACTORS

It should be mentioned that the view that takes human agencies to be both producers and products of the environment is taking for granted the existence of self-beliefs. It is through them, that individuals actively participate in the acquisition of knowledge and can affect and

control their actions as well as the environment. Bandura moved a step further with the definition of 'collective agencies', which share common beliefs and work on these to improve their lives. Thus social learning theory can apply not only to individuals but to societies as well.

According to social learning theory, four fundamental conditions must be fulfilled for learning and effectively modeling a behavior:

- Attention: the potential observer must pay attention to the model. At this process, the distinctive characteristics of both observer and model, such as sensory capabilities, perception and arousal level, are quite significant.
- Retention: the observer must remember the behavior the model has exhibited, something that widows his cognitive capabilities –symbolic coding, mental organization etc- of great importance. There exist two types of remembering: imaginal and verbal.
- Reproduction: the observer must be ready developmentally – and physically- to reproduce the observed behavior. The physical skills the person has acquired play a vital role at this point, while self-observation and accurate feedback might influence this process.
- Motivation: the observer must want to exhibit what he has learnt. In this context the role of reinforcements –direct, vicarious or self-rewards- cannot be disputed. Observers must have a motivation to repeat a certain behavior and reinforcement can help in this by creating expectations for the consequences of a certain behavior. Intrinsic reinforcements –for example self rewards- get also attention. Even though they cannot explain behaviors that are demonstrated for the first time, they do explain what triggers individuals to want to maintain a certain behavior, transforming learning into action.

Since the aforementioned conditions can differ between individuals, it seems quite expected that different people will demonstrate different learning capabilities and mimic or replicate the same behavior differently.

Having mentioned the three types of reinforcements an observer can have, we should delve more into these concepts so as to give a better overview of the ways individuals can be affected. First of all, it should be mentioned that effects can be either inhibitory- individuals watching certain behaviors being punished- or disinhibitory- individuals imitating behaviors as a result of the positive reinforcement related to them. In this context, we should mention that despite the fact that directly experiencing reinforcements is effective –this is what Bandura called direct reinforcement-, observing them can also influence a person's learning. Thus, vicarious reinforcement – observing the consequences of model's actions and expecting similar outcomes when performing them- is also vital in social learning. This vicarious learning is what enables people to adopt new behaviors without performing them - avoiding the trial and error method. Symbolically coding the observed models, individuals can use them as input for their future behavior. Last, Bandura points out the significance of self reinforcement, that is positive or negative feelings expressing pleasure or displeasure for a certain performed behavior.

Social learning theory is thus revolving around three basic assumptions:

- Observational learning: Individuals learn by observing behaviors and consequences of these behaviors.
- Learning may or may not alter behavior.
- Cognitive processes affect learning, since awareness of rewards and reprimands affect people's actions.

In his book 'Educational Psychology: Developing Learners' (2003), Jeanne Ellis Ormrod organizes and lists the principles of social learning theory. Thus, according to his position, social learning is based on the following:

- The highest level of observational learning is achieved by first organizing and rehearsing the modeled behavior symbolically and then enacting it overtly. Coding modeled behavior into words, labels or images results in better retention than simply observing.
- Individuals are more likely to adopt a modeled behavior if it results in outcomes they value.
- Individuals are more likely to adopt a modeled behavior if the model is similar to the observer and has admired status and the behavior has functional value.

Bandura is emphasizing the role of symbols as well. For him, symbolical representation of experiences helps individuals to efficiently store information and retrieve it in later phases of their lives. In the end, this is how modeling occurs. Similarity of observer to the model –or close identification as Bandura calls it- is also considered to facilitate modeling. As the developer of social learning theory claims '*Identification allows the observer to feel a one-to-one connection with the individual being imitated and will be more likely to achieve those imitations if the observer feels that they have the ability to follow through with the imitated action*'.

In his work '*Social Foundations of Thought and Action: A Social Cognitive Theory*', Bandura is introducing a view of human agencies that develop self-efficacy, self-regulatory and self-instruction processes, which help them cope with both environmental and inner forces. The role and significance of the aforementioned factors are analyzed below:

- Self-efficacy: students with good deal of self-efficacy are more motivated and thus more likely to engage in certain actions which they think they can successfully perform. Self-efficacy is influencing the performance, persistence as well as the behavior of the person. This is the reason why, instructors should try and build high self-efficacy in learners by rewarding them and recognizing their achievements.
- Self-regulation: students who have developed self regulatory mechanisms, have their own ideas and values of what is the right thing to do and thus, are more likely to adopt an appropriate behavior. Based on individuals' perception, evaluation and behavior regulatory processes, self evaluation consists of one setting standards and goals for his behavior, based on aspects such as self observation, self judgment and self response.

- Self-instruction: giving students instructions that guide their response to certain circumstances is another important aspect of effective social learning. Self instruction can be achieved by external guidance, self guidance, covert self instruction or even cognitive modeling mechanisms.

- Self-monitoring and reinforcement: Bandura considers that self-reinforcement accounts for most of the behavior people adopt. In order to administrate their behavior, individuals first need to observe or even score it and at a later stage they can affect it by implementing self-controlling rewards and punishments, in the way a student can influence his study schedule and discipline by promising himself to have a large break after completing an assignment. Other means of self reinforcements could be the feelings of satisfaction or depression for demonstrated behavior that is being gauged according to personal standards.

Social learning theory has been widely used to explicate the effects of media on society. Advertisements and spread of TV violence are some of the most popular examples of situations where social learning is promoted. Furthermore, scientists are trying to explain aggressive behaviors and psychological disorders by appealing to social learning theory, while using it as a framework, can provide instructors with a training technique to improve learning. More specifically, teachers should aim to alter the three factors –cognitive, environmental, behavioral- that take part in the reciprocal interaction so that the best balance between them is achieved. Correcting faulty self-beliefs, improving self-regulatory strategies and changing classroom organization and structures could help in this effort.

Finally, before proceeding with a short analysis of how social learning theory can be used in classroom and online learning environments, we should mention some of the arguments that opponents of social learning have come up with. Thus, the main criticism has to do with the ignorance of individuality as well as individuals' biological states. Having a nomological outlook, social learning theory seems to emphasize the similarities between people, and somehow neglect their differences. More specifically, biological theorists accuse social learning theory for not taking into account genetic differences and predispositions of human beings that might very well explicate individuals' different responses. Responses, coming from the nervous system, seem to be affected by the nervous system and as such, partially inherited, according to Jeffery (1990). Furthermore, genetic influences on behavior, such as inherited mental and cognitive capabilities as well as developmental effects, which are more than critical to learning process, seem also to be ignored by Bandura's approach to social learning theory. The deterministic view of human behavior that it takes leaves no space for free will. Even though, emphasis is given on cognitive and motivational factors, we should recall that these are the outcomes of previously executed actions, and thus not truly free. Last, because of its strong commitment to scientific researches, social learning theory is accused for influencing behaviors by artificial settings so as to produce behaviors that experimenters wanted to see – something that some believe that applies in the case of Bobo doll experiment as well.

2.1.1 SOCIAL LEARNING THEORY IN CLASSROOM

Accepting the view that learning is taking place within a social context, and as such it can be characterized a social event, many attempts have been realized to exploit the social aspects of classroom environments, so as to enhance learning. What researchers have come to recognize is that classrooms offer great opportunities for students to interact either with their instructors or with each other. In the end, this is what will make it possible for them to observe behaviors, discuss outcomes and learn.

When applied in classroom environments, social learning theory holds the following postitions (Cunia, 2007):

1. Students often learn a great deal simply by observing other people.
2. Describing the consequences of behaviors can effectively increase appropriate behaviors and decrease inappropriate ones.
3. Modeling provides an alternative to shaping for teaching new behaviors.
4. Teachers and parents must model appropriate behaviors and take care that they don't model inappropriate ones.
5. Teachers should expose students to a variety of other models.
6. Students must believe that they are capable of accomplishing school tasks.
7. Teachers should help students set realistic expectations for their academic accomplishments.
8. Self-regulation techniques provide effective methods for improving behavior.

According to the model of social learning theory, there exist two pillars that form the basis of successful learning. On the one hand students must believe that they are capable to succeed, but on the other hand their success must be of great importance for them. In this context, motivating factors acquire a vital role in the learning process. These can take the form of rewards, grades or recognition and can act as positive reinforcements that will trigger students to work and perform certain behaviors. In other words, children will have to try so as to succeed but at the same time they must know that success is realistic and not utopian.

Giving students the sense that they are free to choose and lead their learning is also important. For example providing several alternative options of projects they can be involved to, or allowing them to choose the group they will participate in, are only some examples of how this sense of free choice can be fostered. Furthermore, relating classroom tasks with real life situations is also considered to enhance effective learning, since it motivates students to apply what they come to learn outside the classroom as well.

Classrooms should function as learning communities within which students should be actively involved in a variety of cooperative tasks that help them foster the development of self-regulatory mechanisms. It is through such mechanisms that learners can control, plan, adjust and evaluate their learning. They self-monitor and can identify factors or circumstances that inhibit their performance and efficiency.

The role of teachers in creating self-regulated learners is very important. They are the ones who can guide children to get engaged to discussions and model self-regulation behaviors, while asking students to reflect on the results of their learning process, they give them the

chance to recognize weak points that need to be improved. Instructors, who choose to apply the social learning theory within their classrooms, should act as participants of a learning community in which the role of communication is vital. In addition, they should recognize and manipulate the different skills and goals of their students and thus come up with different ways of motivating them.

Last, it should also pointed out that interaction within classrooms should follow a set of structured rules and standards, so that learners know what it is expected of them. Students need to have knowledge of these rules so as to be able to participate in conversations with their peers and instructors should help them in this, including teaching of social skills in the curriculum. Students who fail to understand the requirements of the 'Classroom Language' fail to participate in classroom activities, something that affects their performance to school as well as their later academic achievements. After all, in order for the interaction within a classroom environment to be successful, students need to have conversational knowledge, knowledge of classroom language, situation specific abilities as well as non verbal communication skills.

2.1.2   SOCIAL LEARNING THEORY IN ONLINE LEARNING ENVIRONMENTS

Prevalence of computer-mediated communication in educational fields has led scientists from both educational and technological domains search for ways that students would benefit the most from this integration. Technological evolution and scientific researches advocate the need for incorporating technological achievements into the domain of education so that learning is enhanced. Thus, new terms –including this of online learning environments- have emerged to represent the changes undergone by traditional learning practices as well as the migration to a computer oriented form of education.

According to the American Society for Training and Development (ASTD), online learning – term synonymous to e-learning- can be defined as the broad set of applications and processes, including web-based learning, computer-based learning, virtual classrooms and digital media. An alternative definition of online learning refers to the delivery of a learning, training or education program by electronic means (Derek Stockley 2003). This can involve the use of a computer to provide training, educational or learning material. It should be admitted though, that when learning online, we mainly refer to an 'in-time' instructional learning approach that makes use of technologies - such as chatting, video/audio conference, instant messaging, e-mail etc- that revolve around Internet, the dominant medium of communication during the last years.

Online learning theory is dealing with ways to apply and use in practice traditional learning theories to online learning environments, a challenge that needs to take into account not only ways students perceive and process information, but special characteristics of web based learning environments as well. It is a fact that knowledge can be acquired following many different strategies in different environments. Online learning environments though, because of their increasing popularity, are the ones that call for special caution.

Trying to implement social learning theory to web-based learning environments, presents us with both opportunities and challenges, that should be analyzed. Social learning theorists

see many ways in which social learning could be enhanced and become more effective by making use of online learning environments that incorporate media for synchronous or asynchronous communication. The main issue, that seems to preoccupy experts though, is how such an integration can take place, without compromising the existence of social presence – a fundamental factor of social interaction that forms the basis of social learning theory models. Since interaction is the basic precondition for social learning to take place, experts are seeking for ways to implement educational programs that integrate a socially constructed prototype. After all, social learning is in need of cognitive and environmental factors to occur, while social presence is a precondition for the key concept of social learning theory, social interaction. In this subchapter, we will try to delve into ways in which web-based learning environments integrate social learning theory. In this attempt, four important factors can be distinguished: context, culture, community and learner characteristics.

Context is considered to be integral to how cognition facilitates understanding (Brown, Collins, and Duguid 1989). Thus, since cognition is not an individual process, interactions with other humans as well as environmental resources, functioning as stimulus, are the main aspects that should be considered. As far as interaction is concerned, it should be pointed out that web based learning environments and their resources are equipped with features that provide learners with many different opportunities to interplay. The sense of active engagement is fostered by allowing students to interact with their peers, the teacher or even the content. In this effort several tools trying to simulate real life learning communities have been developed and integrated to the web based learning environments. These include discussion boards, blogs and forums, as well as synchronous digital media –such as instant messaging or chatting- which give the opportunity for immediate interaction and feedback, central components of social learning theory.

Giving students the chance to initiate new online discussions in a discussion board or comment on existing topics is just an example of how online communication is achieved. There exist several factors that seem to be influencing the quality and results of such types of online interaction. Characteristically, we could mention a recent research proving that students perceive greater social interaction when creating and sharing in-depth online messages (King 2002), while as a different study has revealed, when engaged to blogging activities, students seem to obtain better learning results, than what they do when they are participating in instructor-directed asynchronous discussions via discussion boards. Thus, new questions emerge, seeking for answer. These concern the type and degree of interaction that is required as well as the technologies and tools that need to be adopted by instructors.

The other fundamental principle of social learning theory, modeling, is also found to be affecting learning that takes place in online environments. In real life face-to-face situations, models have effects on observers' perception and understanding while they encourage them to adopt or neglect certain behaviors. Similarly, models seem to have an impact on online learning. For example, online discussions conducted via discussion boards, seem to be more effective and meaningful when there exists an example or template –model- on how to initiate or comment on a topic, while high teacher presence, acting as a model, is also benefiting learning process. Group size as well as the types of resources is also determining

the quality of online interactions. Many researches are being conducted to identify the ideal number of students a group must consist of as well as the effects different resources might have on interpreting and memorizing the material to be learnt.

Culture, is the second factor that we will try to analyze in order to identify how it can support online learning environments in the construction of knowledge. It could be defined as the pattern of thought, action, beliefs, customs, behaviors and values that characterizes the members of a society or a social group. As already mentioned, cognition needs a social context to develop. It is through this social context that culture leaves its mark on learning, as this takes place in both online and offline environments. Focusing on web based learning though, we should mention that gender and ethnicity are considered quite important when evaluating the learning results. According to recent studies conducted by Jeong (2006) and Rovai (2002), female students tend to need more support and have a stronger sense of learning community. Furthermore, students' attitudes, approaches to learning as well as their relations with technology seem so be dependent on the culture of the society within which they have grown. In this context, ethnical characteristics also play a significant role. Characteristically, we mention a research of Petrides (2002), in which he revealed that asynchronous discussions allowing more time to reflect, can facilitate learners with lower language fluency.

Continuing, we will analyze the relationship between the learning process and community as this is perceived by students so as to come up with ways to apply approaches that promote community building to online learning environments. Thus, strategies –such as group working and collaboration- that aim to increase collaborative knowledge, are present in online learning environments as well. Engaged students can communicate and/or collaborate to complete a common project or assignment, under instructor's supervision. This results to a community-building within which students, working together towards a shared goal, gain community knowledge and evolve their communication skills. The significance of online collaboration is also underlined by relevant studies, proving that working in a group using computer results to better quality of learning than one working alone, aided by technology.

Last, we will analyze the fourth factor, learner characteristics, and find ways that these could be used to enhance online learning. The phrase learner characteristics, is used as an umbrella to include epistemological beliefs, individual learning styles, self-efficacy as well as learner's motivation. Starting thus with epistemological beliefs, we should mention that, as Hofer (2002) put it, they consist of '*one's beliefs about the definition of knowledge, how knowledge is constructed, evaluated, how it is constructed and how it occurs*'. Taking into account such aspects of learners' mentality can be useful when designing online environments so that they better represent learners' expectations of learning process. Learning styles may also vary among individuals, while it is also possible for the same person to adopt a different learning style when encountering settings of different learning environments. Design of such environments presupposes complete and in depth understanding of the distinct learning styles, so that a variety of interaction forms – corresponding to the different learning styles- are embraced.

As we continue, we will try to come up with techniques that will foster the development of self-efficacy to students, when they are engaged with online learning environments. As studies reveal, students tend to have less anxiety and better performance when they are familiar with technological means, used in online environments. Thus, the main point that we should delve into, is how this sense of comfort can be promoted so as to relieve students from the stress of being confronted with unknown digital media. Providing multiple alternatives for interaction will at least give students the sense of free choice that will exempt them from the anxiety of how to deal with a specific technology of which they might be unaware. Having different options to perform a single task, will also promote the development of self-regulatory mechanisms to students, the role of which has been analyzed in previous chapter. Last but not least, motivation –either intrinsic or extrinsic- in online environments, can be ensured by providing a variety of interchangeable and authentic activities that will trigger learners' curiosity and desire to learn.

2.2 THE DISTINCTIVE MEANINGS OF SOCIAL LEARNING AND ITS RELATION TO INDIVIDUAL LEARNING

Salomon and Perkins, acknowledging the contribution of society to a person's learning can be considered to be adherents of social learning theory. In their work (Salomon & Perkins, 1998) they admit that until recently, the role of social groups in solo learning was underestimated. They distinguish between individual and social learning, and try to examine the interrelationships between these two kinds of learning. As they claim '*individual learning is rarely truly individual; it almost always entails some social mediation, even if not immediately apparent. Likewise, the learning of social entities (e.g., teams) entails some learning on the part of participating individuals. It is such variations in kind and balance that we mean to examine*'. For them, the skills and capabilities of learning entities – including the ability to build representations and participate in learning process- are defining what they call the 'critical conditions' of learning. These conditions together with the learning systems are used as the basis for identifying the 6 distinct meanings of social learning:

1. **Active social mediation of individual learning**, referring to learning occurring when a group or person-acting as a facilitating agent- is helping an individual to learn – e.g. a teacher teaching reading or arithmetic or children working together to solve problems in mathematics. In this case –which might be considered very similar to instruction- two important processes are taking place: internalization –information being transferred from the agent to the learner- and active construction of knowledge – active solutions to problems with help of guidance.
2. **Social mediation as participatory knowledge construction,** referring to learning that occurs as the result of participating in a group effort towards knowledge construction –participatory knowledge construction. Interaction and participation are vital factors in this type of learning, acting as the means to jointly construct knowledge.
3. **Social mediation by cultural scaffolding,** referring to learning that derives from cultural or social artifacts, which in the form of tools act as social mediators of learning. Cultural environment can affect learners in two ways. On the one hand,

acting as an information source of opportunities to act, individuals can select the most appropriate one –effect of tools-, while on the other hand, acting as a space of action and source of feedback, individuals can experiment and try things seeing them succeeding or failing –effect with tools.

4. **The social entity as a learning system,** referring to collective learning as a result of participation to a large group or organization. It must be pointed out that this type of learning is focusing on the group which acting as a learner –collective learning system- can improve its performance by acquiring knowledge that might be useless for any of the individuals that constitute the group, when functioning alone.

5. **Learning to be a social learner,** referring to the special case of learning ways to increase knowledge from social participation. Learning to learn is considered to be a basic aspect of learning that helps individuals –especially underaged ones- acquire learning skills and improve their capabilities over basic concepts such as language use.

6. **Learning social content,** referring to learning in a social context. Getting along with others, collaborating or acting as part of a group are fundamental aspects involved in this learning category.

In the end, we have to acknowledge the supremacy of social to individual learning. As Salomon and Perkins conclude '*Virtually anything one learns, according to the socio-cultural view, comes deeply embedded in a cultural context, involves culturally informed and laden tools, and figures as part of a range of highly social activity systems, however alone the learner may be at particular moments*'. As they add '*Solo learning is most sensibly viewed not as learning utterly naked of social contexts, influences, and participations but rather learning where the factors discussed earlier have relatively lesser rather than greater presence*'. This gives rise to issues of degree of analysis and acts as a stimulus to identify the relationship between individual and social learning.

Finally, three propositions are articulated concerning the relation of solo and social learning:

1. Individual and social learning mark the ends of a continuum of degrees of social mediation. Thus, although individual learning is achieved within a social context, the degree to which social aspects are entailed can vary.

2. Individual learning and social learning mark the ends of a continuum from individuals learning for themselves through individuals also learning in behalf of collective entities to collective entities learning with knowledge distributed throughout the participants.

3. Solo and social aspects of learning in both senses (1) and (2) can interact over time to strengthen one another, in what might be called a reciprocal spiral relationship.

Considering the aforementioned aspects when designing instructional practices of learning can benefit students in many ways. Learning systems interacting to produce knowledge suggest overcoming the obsolete approaches adopted by many educators even nowadays. Having in mind that classes are collective groups that want to increase their knowledge by developing auto regulatory mechanisms can foster individual learning of better quality. After all, this is exactly what Salomon and Perkins imply when speaking of reciprocal spiral relationship between individual and social learning.

Collective IQ is a vital factor for the success of any organization or team. It refers to the shared intelligence that emerges from the collaboration of the group members when they work with a strong sense of consensus and not as individuals that just gather together. It could be said that it acts as a measure of how well and effectively people are working together in order to solve complex and important problems. According to Don Tapscott and Anthony D. Williams, collective IQ is synonymous to mass collaboration and as such, is based on openness of information, peering, sharing and global action. It is considered to benefit business since it allows for cost reduction, utilization of manpower that organizations cannot employ as well as for the creation and direction of the market and demands.

Talking of 'New Social Learning approaches' and the tools they have in their hands, we could say that collective IQ is fostered with the use of collaborative tools such as wiki platforms or GoogleDocs in which people can share, organize and use their knowledge. Characteristically, we could refer the CIA example – the most secretive agency of the world- which has incorporated the Wiki model to '*capture, share and cross-reference reports of situations in the world*'. Intellipedia –this is how the internal CIA wiki is called- aims to abolish the geographic constraints of intelligence, allowing people to share information worldwide.

Apart from collective intelligence though, collective EQ is also important for effective collaborative groups. At a personal level, emotional intelligence includes the ability of individuals to recognize, understand and manage their own feelings as well as the ability to understand the feelings of others. In other words, EQ is considered to include both personal –self awareness, self management, self motivation- and social –social awareness and relationship management- competences. Such capabilities are critical not only for individual success but for the realization of group's goals as well. Collective EQ, on the other hand, is considered to include notions such as the way the group sees itself and function as well as how responsibilities are distributed among its members. After all, as Goleman put it, collective EQ is what makes the top-performing teams differ from the medium-performing ones.

Having identified the four fundamental elements of EQ- self-awareness, self-management, social awareness and relationship management- we should point out that unlike IQ, all the aforementioned skills can be trained and improved. Thus, people, who practice those competences in everyday life, can enhance their EQ. But as each individual team member increases his emotional intelligence, the collective EQ of the group he/she belongs to improve as well. But what other ways exist to increase collective EQ, apart from improving individual emotional intelligence? Creating an environment of openness is a very important factor, since it makes individuals feel free and safe enough to discuss appearing challenges and opportunities. Giving individuals the chance for continuous education as well as encouraging them to undertake responsibilities is also increasing both personal and collective EQ, while by interacting and collaborating with their peers, people can practice their social awareness and relationship management skills.

Interactive teaching and learning approaches – e.g. showing a video instead of saying/describing a story that has taken place, or following tags and navigation history of others, both strategies adopted by CIA- and collaborative tools do facilitate relationship management and help people recognize and interpret the emotions of their peers. Taking into severe consideration aspects like the quality of relationships between the group members –levels of respect and recognition- as well as the way they receive feedback could help further enhance an organization's collective EQ. After all, self awareness and self management are skills acquired when individuals are involved in social learning, and as such they cannot be acquired in the absence of social context –whether online or offline.

2.4   GROUP LEARNING

2.4.1   COLLABORATIVE LEARNING

Collaboration is har an effective co-working style in which interactions are characterized by harmony and efficiency.

The value and importance of collaboration is becoming more and more obvious in modern societies in which people are encountered with hard-to-solve tasks and have a variety of resources and information at their disposition. This is the reason why many organizations are adopting models of working that engage individuals in collaborative activities and projects. Characteristically we could mention the example of Google, which having identified communication skills and team-player capabilities as the key traits that employees should possess, is organizing its projects so that they are run by small teams. Furthermore, UNESCO's publication 'The four pillars of Education, Learning: The Treasure within', is holding the view that collaboration is a key element for learning to know, learning to do, learning to live together and learning to be, associating thus the various aspects of learning process with collaboration.

More specifically, lately, within the educational community, the concept of 'collaborative learning' or 'group learning' has emerged, referring to learning strategies based on collaborative techniques. The term refers to an instruction method that involves the grouping of learners in order to achieve a common goal. It is an approach in which learners share their skills and become accountable for one another's learning as well as their own, as the success of one group member contributes to the success of other members, and thus of the whole group as well. Collaborative learning techniques refer to students working together with the purpose of understanding, finding solutions or creating an artifact, and can incorporate joint problem solving, study teams, debates, group projects and even more activities.

It must be pointed out that even though collaboration is not considered to be an integral part of learning process, it facilitates learning and higher order thinking skills. Having their roots on the view that there exists an inherent social nature of learning, collaborative techniques are trying to boost learners' achievement and enhance their cognitive activities – attention, observation, memorization and understanding- by actively involving them in

meaningful group tasks. The position that individuals work harder for a better result when knowing that this will be shared with their peers is coming to verify the need for a fruitful collaborative environment while learning. Assigning students to work in groups or creating workspaces within the classroom where students will be able to share resources are some exemplary activities that teachers could implement in order to facilitate social participation and collaboration.

The espousal of collaborative learning approaches though, requires us to reconsider the traditional teacher-centered or lecture-centered techniques and make a shift towards more student-oriented methods based on discussion and interaction with the learning material. As Barbara Leigh Smith and Jean T. MacGregor, in their article 'What is Collaborative Learning?', argue '*Teachers who use collaborative learning approaches tend to think of themselves less as expert transmitters of knowledge to students, and more as expert designers of intellectual experiences for students-as coaches or mid-wives of a more emergent learning process*'. This redefinition of the traditional student-teacher relationship is what has caused several controversies over the new paradigm and is still considered as the main point of juxtaposition between adherents and opponents of collaborative learning.

The adherents of collaborative learning base their arguments on evidence that when cooperating, group members tend to retain information for longer periods of time as well as to the fact that learners are given the possibility to discuss and argue for their own ideas, something that helps them develop self esteem. Furthermore, collaborative approaches increase the interest of students, trigger their motivation and promote higher order thinking skills, which are necessary for the development of critical thinking. Giving students the opportunity to converse and face different perspectives, construct their own meaning - rather than limiting them on just memorizing information- and get actively engaged in practicing challenging tasks are key elements of collaborative approaches. After all, group learning is considered to foster involvement and cooperation of students, while preparing them to be responsible and democratic citizens who know how to respect the rules of democratic dialogue and deliberation.

2.4.1.1 TYPES OF GROUP WORK

As we continue we will try to identify the different types of groups that can be formed as part of a collaborative learning approach. In general, groups are formed to achieve a certain goal, which might be either the completion of a task or the promotion of relationships among the group members. A first classification of groups thus, could result by differentiating between social groups, having a more social orientation, such as families and friends, and work groups, being more task oriented, such as workplaces and organizations.

Collaborative learning though is based on groups that are performing in both social and task dimensions, encouraging team members to execute activities within a social content and context. Thus, comprising aspects of both social and work groups, collaborative learning is calling for a further classification of teams that is based more on their structure rather than their function. Focusing on the hierarchy duration and composition of the groups, the following group types can be distinguished:

1. **Informal learning groups** are temporary cooperative learning groups that are usually formed within a single class session so as to motivate and intrigue the interest of students or to test their understanding over a certain subject. For example, tutors while direct teaching, can ask students to discuss a certain topic with their neighbor. Such groups can be formed at any time and even though they might consume lecture time they contribute to better quality of learning as well as to building relationships between students. Furthermore, they constitute a break from the monotony of lecture which in some cases can become boring and flat- some argue that during a lecture, people can pay attention for about 12 to 15 minutes, requiring a break to process what they have learnt so that their learning is efficient.
2. **Formal learning groups** are clusterings of students that are working together for a single or multiple class sessions in order to achieve a certain goal, such as complete a project, write a report or perform an experiment. Because of the fact that they tend to have a static composition and might last for more than one class sessions, they need planning and organization. Fostering interaction between team members, they provide a chance for communicating, testing ideas and evaluating new points of view.
3. **Study teams** are gatherings of students who meet on a regular basis to exchange ideas on a specific topic and assist other group members in the completion of course activities, projects and assignments. They are offering practitioners the opportunity to deepen their understanding of the learning subject while enabling them to achieve higher performance levels. Study teams tend to have static membership and are designed to exist over a whole term or year, while they prove to be quite beneficial especially for courses with increased level of difficulty and complexity.

2.4.2   ELEMENTS INVOLVED IN COLLABORATIVE LEARNING

Until now, we have tried to define collaborative. We delved into the different types of work groups that can be formed aiming to enhance collaboration and the benefits associated with it. As we continue, we will investigate the elements that are involved in group learning as well as the factors –often described as 'the heart of cooperative learning- that according to Johnson's work 'Learning Together and Alone: Cooperative, competitive and individualistic learning', are required for the success of learning groups.

What distinguishes collaborative learning from other more traditional learning approaches – that usually stress the learning of facts- is its ability to take place and develop higher-level reasoning skills whenever students work together –even out of class, when for example they collaborate for completing homework. We must clarify though, that cooperative learning is something more than a concept synonymous to students working together in groups. In collaborative efforts, group members benefit from each other's success, share a feeling of common fate, are aware that their performance is to a great degree caused by their teammates and are happy with other group members' attainments.

Inherent to the concept of collaborative learning is the increased excitement with which students face the tasks they are engaged to. According to Smith, this will increase their learning, since students tend to learn more when they are engaged in activities they like. Furthermore, within the learning community that is created, learners work harder and practice interpersonal skills, with the condition that the groups are something more than a gathering of students who work together. Finally, Johnson et al, determined five factors that

are vital for successful collaborative learning. These together with some advice on how to implement them are represented in the following table (source http://edtech.kennesaw.edu/intech/cooperativelearning.htm) :

Positive Interdependence
(sink or swim together)

Each group member's efforts are required and indispensable for group success

Each group member has a unique contribution to make to the joint effort because of his or her resources and/or role and task responsibilities

Face-to-Face Interaction
(promote each other's success)

Orally explaining how to solve problems

Teaching one's knowledge to other

Checking for understanding

Discussing concepts being learned

Connecting present with past learning

Individual
&
Group Accountability
(no hitchhiking! no social loafing)

Keeping the size of the group small. The smaller the size of the group, the greater the individual accountability may be.

Giving an individual test to each student.

Randomly examining students orally by calling on one student to present his or her group's work to the teacher (in the presence of the group) or to the entire class.
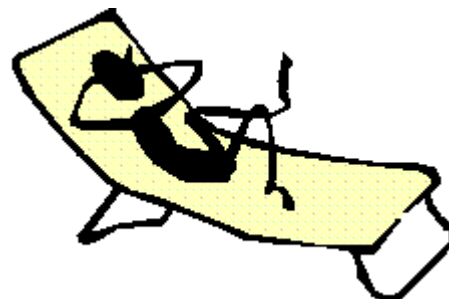
Observing each group and recording the frequency with which each member-contributes to the group's work.

Assigning one student in each group the role of checker. The checker asks other group members to explain the reasoning and rationale underlying group answers.

Having students teach what they learned to someone else.

Interpersonal & Small-Group Skills

Social skills must be taught:

Leadership

Decision-making

Trust-building

Communication

Conflict-management skills

Group Processing

Group members discuss how well they are achieving their goals and maintaining effective working relationships

Describe what member actions are helpful and not helpful

Make decisions about what behaviors to continue or change

TABLE 7: FACTORS AND SUGGESTIONS FOR COLLABORATIVE LEARNING

Finally, we suggest that teachers who are really interested in implementing effective collaborative learning methods within their classrooms should ensure that the aforementioned factors are present in the approach they have selected. Unless they do so, the benefits associated with group learning cannot be guaranteed.

2.4.3   KEY CONDITIONS FOR EFFECTIVE GROUP LEARNING

Collaborative learning is not always efficient. In some cases cooperative techniques are not suitable for meeting the learning objectives or satisfying learners' needs, while other times these techniques are wrongly implemented. It is a fact that there are no clear guidelines and instructions for a model that will guarantee effective cooperation. What is well known though, is the fact that in order for students to collaborate they need a task, a group to belong to, assistance for skills that are not available within the group members, time to interact with each other and assessment of progress.

Creating a safe and at the same time challenging cooperative learning environment, forming small groups and explicitly defining tasks are some aspects that benefit the learning process. Creating the appropriate conditions, tutors can increase students' motivation to prepare for and engage in group activities and discussions. Experts have moved a step further and identified three key conditions that instructors need to take into consideration when designing collaborative activities. These can be classified into three categories: group composition, task features and communication media.

GROUP COMPOSITION

Group composition can be defined by many different parameters such as the age and level – educational, developmental and/or social- of participants, the size of the group –in general larger groups tend to harden the completion of collaborative tasks- as well as the heterogeneity between the group members. As far as the latter is concerned, we should point out that there exists an optimal degree of heterogeneity that can contribute to efficient cooperative learning. Thus, on the one hand, different perspectives and viewpoints are more than welcome within a group so that interactions, discussions and even conflicts emerge. On the other hand though, such differences must be within the boundaries of mutual interest so that a common ground for interaction and discussion is ensured.

TASK FEATURES

The type of task students have to complete can also affect the effects of collaboration. There can be distinguished the following types of tasks:

- Distributed tasks, in which students work on their own tasks and collaborate to assemble the results of multiple sub-tasks to the one main outcome.
- Straightforward tasks, leaving no room for misunderstanding
- Tasks not involving planning
- Tasks relying on processes like perception that leave no room for introspection

Interaction is a prerequisite for collaborative learning to occur and can take place either when students of a single group work together on a task or when they are gathered trying to combine the partial products of the sub-tasks they have undertaken. Furthermore, environmental factors can also affect interaction and are included within the task features. Thus for example, when students are engaged in computer-oriented tasks in which they are

provided with immediate feedback on their actions, interactions and conversations over the consequences of their actions cannot take place. Last, tutors must make sure that the activities, students are involved into during a semester, are linked and mutually reinforcing – address the same problem and require students to use concepts they have been taught to make a specific choice.

COMMUNICATION MEDIA

In collaborative learning, communication is taking place mainly between people. It can be either online or offline and this will result in the use of different communication medium. Thus, in a classroom environment, communication can be facilitated with the usage of tools –such as powerpoint presentations, slides etc- that make it easier for the instructor and the group members to exchange ideas and interact, while within such an immediate environment, body language signs are not overlooked. When communicating offline, group members can make use of either synchronous or asynchronous tools –such as e-mails, instant messaging etc. Voice and video conferences are used when individuals want to take into account body language, but even in such a case, members can see their peers but ignore where the peer stares.

2.4.4 BENEFITS OF GROUP LEARNING

There exists extended literacy analyzing various aspects of peer learning. Most relevant articles agree on its effectiveness and superiority over other traditional learning methods, at every age level, in every subject area and with any task. Presenting themselves as pleasant activities, group tasks promote students' socialization, while through their engagement into the organization, summarization and even elaboration of those activities, students learn better – as it was revealed learning is increased for the ones who perform the intellectual work and this is something that students' involvement in the organization of activities tries to exploit.

Continuing, it is important to note that the benefits of group learning can be either immediate or long term and might not be the same for all group members. Celebration of diversity, respect of individual differences, interpersonal development and active involvement of learning are the most important advantages gained when cooperating learning approaches are followed and will be further analyzed. The table below represents the 44 benefits of group learning as these were posted on Co-Learn mailing list by Ted Panitz.

1.	Develops higher level thinking skills
2.	Promotes student-faculty **interaction** and **familiarity**
3.	Increases student **retention**
4.	Builds **self esteem** in students

5.   Enhances student **satisfaction** with the learning experience

6.   Promotes a **positive attitude** toward the subject matter

7.   Develops **oral communication skills**

8.   Develops **social interaction skills**

9.   Promotes positive race **relations**

10.   Creates an environment of **active, involved, exploratory** learning

11.   Uses a **team approach** to problem solving while maintaining **individual accountability**

12.   Encourages **diversity** understanding

13.   Encourages student **responsibility** for learning

14.   Involves students in developing curriculum and class procedures

15.   Students explore alternate problem solutions in a safe environment

16.   Stimulates **critical thinking** and helps students clarify ideas through discussion and debate

17.   Enhances **self management skills**

18.   Fits in well with the constructivist approach

19.   Establishes an atmosphere of **cooperation** and helping schoolwide

20.   Students develop **responsibility for each other**

21.   Builds more **positive heterogeneous relationships**

22.   Encourages alternate student assessment techniques

23.   Fosters and develops **interpersonal relationships**

24.   Modelling problem solving techniques by students' peers

25.   Students are taught how to **criticize ideas**, not people

26.   Sets high expectations for students and teachers

27.   Promotes **higher achievement** and class attendance.

28.   Students stay on task more and are less disruptive

29. Greater ability of students to view situations from **others' perspectives** (development of empathy)

30. Creates a stronger social support system

31. Creates a more **positive** attitude toward **teachers**, principals and other school personnel by students and creates a more positive attitude by teachers toward their students

32. Addresses learning style differences among students

33. Promotes innovation in teaching and classroom techniques

34. **Classroom anxiety** is significantly reduced

35. **Test anxiety** is significantly reduced

36. Classroom resembles **real life** social and employment situations

37. Students practice modeling societal and work related roles

38. CL is synergystic with writing across the curriculum

39. CL activities can be used to **personalize** large lecture classes

40. **Skill building and practice** can be enhanced and made less tedious through CL activities in and out of class.

41. CL activities promote **social and academic relationships** well beyond the classroom and individual course

42. CL processes create environments where students can practice building leadership skills.

43. CL increases **leadership skills** of female students

44. Develops higher level thinking skills

TABLE 8: BENEFITS OF GROUP LEARNING

CELEBRATION OF DIVERSITY

When found in groups with diverse types of people, students learn to work with them and benefit from their difference. They develop conflict management mechanisms to resolve discordances and disputes that might appear –this is also considered to promote their ability to defend their views- and become open to hear, evaluate and espouse different viewpoints. It is important to note that bio-diversity can also be exploited when working in groups, enabling teammates to divide workload and focus on tasks and activities they can perform

better. Furthermore, a group that provides a variety of different responses and attitudes to a specific subject has more chances to create a more complete and comprehensive product.

RESPECT INDIVIDUAL DIFFERENCES

Individual differences can stand as a synonym for diversity, analyzed above. It is important to add though, that when students are facing cultural, ethical and developmental differences with their peers they do not only find ways to benefit from them but they also learn to respect them. This characteristic, for us considered to be a qualification, is an indication of a balanced person and can be very helpful for students' further professional career, where individuals might need to work together with people of different nationality, religion or culture.

INTERPERSONAL DEVELOPMENT

Students, working in groups learn how to relate to their peers and benefit the most from their interaction with others. In modern interconnected and interdependent world, students need to learn how to build positive social relationships with a range of people in a range of contexts. This is the way for them to realize their connection to the society they are members of, and learn how to live with others, trying to align group's norms with their own needs.

ACTIVE INVOLVEMENT IN LEARNING

Getting actively engaged into tasks, especially in small groups, students practice higher order thinking skills and develop a strong sense of responsibility, especially when they are asked to take more ownership. They are encouraged to apply prior knowledge and make use of past experiences into the learning process, which offers them the opportunity to reexamine this experience taking into account new information.

2.5   SOCIAL NETWORKS

Social networking is the formation of specific groups of individuals like small localized communities or segregation based on municipality or even neighborhood. Social networking can be divided in two major categories; social networking in person and online social networking. High school is an excellent example of how social networking functions in real life. There are several, differentiated groups with idiosyncratic characteristics like the nerds, the popular, the athletics, the musicians, the snots e.t.c. These small teams of individuals are considered to be social groups. The participation and engaging in the activities of a "clique" is based on the interests and incentives of the individuals. The intrinsic characteristics of the individual influence at an important degree his joining and acceptance of a group. Friendly and outgoing children tend to be more enthusiastic about joining groups than the shy ones, who seem unable to successfully socialize and interacts with others. Our classmates inevitably are an indispensable part of our childhood and they do continue to be fellow group members throughout our lives. The same applies for all the people that sometime in our lives belonged to the same group with us like our colleagues or our co-players in sports.

From a high level perspective the whole society can be regarded as social network consisting of groups: high-schools, universities, workplace, sport teams e.t.c.

The last few decades there has been a significant increase of attention paid to social networks as the principal designator of several aspects of social life including incentives, ideas and thoughts, social mobility, group composition, communication and organization, allocation of resources, decision-making, innovation and autonomy blueprints e.t.c. The basic idea behind these the "social network" theory is centering on the social order relationally and competes for becoming the foundation of social organization. Under this view it is deservedly considered to be the driving force of technology and economy as well as biology and physiology.

There are two basic approaches to networks: the interactionist and the structuralist. The former argues that social processes (conflict, cooperation and identity formation) are the result of human interaction (Wikipedia). It considers direct and real relations as the key determinants in producing results and focuses on studying of individuals and how they act in society and on topics like equilibrium, power of suggestion, coherence, small groups and focus groups. The latter focuses on mutual integration and interconnection of societies. It addresses what the various elements of social functions of the social system perform with regard to the system as a whole.

Structures (social) are placed in the center of analysis and social functions are deduced from these social structures. Structuralist approach focuses on concepts like structural equivalence, roles, blockmodelling, and brokerage. The shift from the individualism common in the social sciences towards a structural analysis is reflected in Social Network Analysis, a set of methods for the analysis of social structures, methods which are specifically geared towards an investigation of the relational aspects of these structures.

2.5.1   SOCIAL NETWORK SITES (SNS)

Social networking as mentioned above although possible via personal contact it is most popular via Internet. The reason that renders online social networks a magnet for millions of people worldwide is the intrinsic need of human beings to communicate with others while sharing valuable information about their interests, daily activities, hobbies or any subject they find appealing, developing friendships or professional alliances and even finding employment. The most widely used form of online social networking is websites or social sites. Accessing the website gives individuals the opportunity to create their own profile and start socializing. There are dating sites, friendship sites, business-oriented and hybrids that offer a combination of the above ,all allowing members to communicate with each other via a variety of ways including blog-like format , e-mail, instant messaging or photos and videos.

Social networking services offer friends a space where they can create their own online public or a semi-public with biographical data, pictures and any other information they choose to post, chat with each other or even extend their circle of acquaintances by finding and inviting other members into their personal network. Other users of the system have access to the uploaded personal information, which is also used to identify friends on the network and to add them to a list of acquaintances. In most systems members have also

access to the profile of the second degree friends (friends of their friends). Another approach that is known as "invitation only" approach ensures every person in the system is automatically connected to at least one other person.

The principal goal of social network sites is to allow individuals to manifest their real-life social connections rather than connect to strangers. If the latter is the case then it is usually proved that even those connections that seem accidental are usually dormant ties between actors that have an offline connection that is they share some common element. The naming of this sites does reflects that their member are actually connecting to with actors that are already part of their real life rather and bolding these pre-existing social relations as opposed to trying to make to create new relationships. Although this is not a explicit rule, the available research suggests that most SNSs like Facebook are used to maintain existing offline relationships or solidify offline connections. This is a key feature that differentiates Social Network Sites from other kind of online groups. Relevant study by , Lampe, Ellison, and Steinfield (2006) proved that Facebook users search more for people with whom they have an offline connection more than they "browse" for complete strangers to meet. Similarly, Pew research found that more than 90% of U.S. teens who subscribe in Social Network Sites are appealed by the opportunity to connect with their existing friends.

Danah M. Boyd defines social network sites as web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site.

Won Kim in his article *On social Web sites* gave another interesting definition of social network sites."*We define social Web sites as those Web sites that make it possible for people to form online communities, and share user-created contents (UCCs). The people may be the users of the open Internet or may be restricted to those who belong to a particular organization (e.g. corporation, university, professional society, etc.). The community may be a network of offline friends (whose friendship is extended to online), online acquaintances, or one or more interest groups (based on school attended, hobby, interest, cause, profession, ethnicity, gender, age group, etc.). The UCC may be photos, videos, bookmarks of Web pages, user profiles, user's activity updates, text (blog, microblog, and comments), etc. The sharing of the UCC includes, at the minimum, the posting, viewing, and commenting of the UCC, and may also include voting on, saving, and re-transmitting of the UCC.*

Roughly, we regard social Web sites as a union of social networking sites and social media sites. The terms ''social networking sites'' and ''social media sites'' have already been loosely and widely used in press articles, blogs, press releases from the sites, etc., and the features of such sites are rapidly evolving. As such, we do not feel that efforts to define social Web sites (for that matter, social networking sites and social media sites as well) more precisely than above are warranted.Roughly, social networking sites are Web sites that allow people to stay connected with other people in online communities. Some of the most widely used social networking sites in the world today include MySpace, Facebook, Windows Live Spaces,

Habbo, etc. Social media sites are Web sites that allow people to share UCCs. Some of the most widely used social media sites include YouTube, Flickr, Digg, Metacafe, etc. "

Facebook dominates the market of social networking, counting up for more than 60 percent of the relevant traffic in United States and more than doubling its share the past few years. In parallel its predecessor MySpace saw its share being halved in just one year. Despite increase in the share of visits of Twitter by an huge percent per year, it still cannot compete both Facebook and MySpace with respect to the total share of social networking traffic.

Searching and contacting potential friends is governed by different rules and use different methods. MySpace has the most loose restriction since everyone is allowed to seek and communicate with anyone they want ,no matter if they are part of their social network or not. There is though the restriction of access to their full profile unless they accept to become their friends. Facebook on the other hand because it was originally a college social network is much more closed and access is relatively restricted. In Facebook, users are able to search for people that belong to their circle of acquaintances including school, workplace, and university. Users can also create their own group either imaginary or based on real- life groups. LinkedIn that is business -oriented is a social network for professionals that gives its members the opportunity similarly to MySpace to search for anyone but full access to private profiles is allowed only the relevant members have accepted the invitation to join their network. However a member can invite and present himself to "two degree away' contacts or even use a paid service that is called InMail to directly contact anyone.

2.5.1.1 CORE FEATURES OF SNS

Online social networking goes beyond the strict teenage stereotype looking to expand his/her network of online friends. There are several sites that vary a lot in respect to details, user interface and services so as to ensure that they conform to the changing and variant demands of people of different ages and backgrounds. These features are usually also used for evaluating SNSs. Moreover it is obvious that in such a challenging and technologically evolving environment SNSs have to evolve as well; and they do so by constantly adding new features or modifying the existing ones. So there is no meaning in trying to pore over details of the features. However if we try to focus on the principal goals of SNSs that is search, interact and share data then it is rather easy to identify the basic features of these websites. All SNSs do possess the features that will be presented here but as explained above in different degree and in different ways. So this section goes over crucial features of social networking sites. It discusses important features and concepts behind SNSs designs and explains why they are important with examples from top sites.

1. **Profiles**: The central feature of social networking sites are user's personal profiles. It's is their home page ,a place where they can express their thoughts and feelings, post photographs and show off their network of friends. The most popular social networks emphasize on the user's profile, which must be serviceable yet still reflective of the user's personality. What differs in a significant degree among SNSs is the amount of information that the profile includes. If we take a closer look in the dominant SNSs and Social Media Networks (although they distinction between those kind of networks

is actually not noticeable) we can easily see that the personal profile on Twitter simply includes the name and location of the member. The user profile on YouTube, a social media site, includes basic information, such as name, photo, birthday, gender and e-mail address, whereas the personal profile on Facebook is the most detailed one and includes not only basic information but also personal information, contact information, and education & work information.

2. **Search:** The primary goal of a social network is to find friends and expand relationships. Common search functions include search by name, city, school, employers, physical location and email address. The e-mail address and contact lists of widely-used instant messaging applications like MSN, yahoo or Gmail or even friends of friends, are automatically used from friend recommendation engines in order to suggest new friends to the user. Those engines usually inform the user that there are some users that he might know.

3. **Socialize:** Many social networks allow users to communicate with friends and other members either by private e-mail-like correspondence, public message board-like posts, or both. This way the users can stay in touch with contacts and reach out to new people. Moreover several of those sites send notifications and updates to user's friends if there is a change in the user profile. Indicatively, Facebook provides user with a space in their account called "wall" that the user himself and his friends (or everyone depending on the privacy setting) can write any comment on. Twitter users can any time inform their followers about their current activities and Linkedin users reply to questions made by other users.

4. **Vote and Comment:** The majority of SNSs allow users to comment or even vote on the uploaded data by ranking or expressing likeness or dislike. You tube users for example can comment via text on video, "thumb-up" or " thumb-down" videos e.t.c..

5. **Share:** Members of Social Network sites are allowed to upload a variety of content like photos, images, videos, text or blogs. Their friends can read, watch, comment on this content or even share it with their own online and offline friends. Youtube users can post and view any kind of videos including music, tv, short movies, funny videos and add tittles of videos to them. Twitter is based on the sharing of text messages and MySpace on the sharing of photos, videos, playlists, or songs.

6. **Find information:** SNSs use sophisticated search engines or simple browsing in order to provide their member with the opportunity to search for any kind of information they want. Users are able to search for individuals, groups or even restrict the retrieved results in a specific category. For example, Twitter supports search of only people's names. LinkedIn supports keyword-based simple and advanced search for several types of information like jobs, companies, professional and groups. YouTube supports keyword-based search for the three categories ''all,'' ''channels,'' and ''play-lists and finally Facebook displays the retrieved search results classified by people, pages, groups, events and applications.

7. **Forums:** Several SNSs support internet forums, where members can enter a discussion about specific activities, information and experiences. Several SNSs provide their users with the opportunity to join existing groups or form new ones. Facebook for example allows users to create public or private groups, that anyone can view but only member

can post or suggests groups for new users based on their background, interests, workplace, college, university e.t.c.

2.5.1.2 COMMON USABILITY AND UI FEATURES AMONG SNS

Simple User Interface: Simplicity concerning colors and graphics of the user interface is a shared feature of all the available in the market social networks. The huge amount of the exchanged information requires a clean-cut user interface. At this point we have to point out that simple interface does not mean a poor visual design. It simply means that all the components are set in a way that does not call for attention; in fact many of them are visible only after user demand. This way, users are not overwhelmed with information that is not relevant to them unless they are really interested in a particular challenge. The graphical elements and the visual design are subtle in order to provide an aesthetic and minimal environment that allows the smooth communication and interaction of the users. The intense colors and the excess in the usage of graphics can cause undesired confusion or distraction to the users. Thus the colors in most SNS are usually toned down, relaxing and affirmative. The color scheme is restricted only to few colors and the background is in most cases white with only a few intense colors indicating warnings or updates. Moreover, important actions should be emphasized like for example down-played the Cancel button and put more emphasis on the Save button.

Effective action buttons and links: Button and links are an indispensable part of an SNS since they act as the interface between the social application and the user. Thus they take up a large part of every page. Buttons are usually used to communicate user actions and process data. They are bigger in size and more vibrant so as to be noticeable. On the other hand links are not that active and are usually as a vehicle of navigating through the parts of the site. Current trends dictate the detectable placement of the action buttons (call-to-action) so as to emphasize their important role and the subtle design of other not so substantial elements. A noteworthy aspect of buttons and links is the visual feedback after interaction of the user with the SNS as a proof that indeed something has been performed.

Effective Search Functionality: The huge amount of information necessitates the existence of effective search functionality. Besides the placement, the design of a search box and the existence of advanced search in order to identify the complex relations between people, groups and other kind of content, the filtering of the retrieved results is of equal importance. A drop down list with the most relevant results in the top of the list(relevance is the default sort option in the majority of search engines) helps the user to find with a glance what he is looking for. Sorting results by different criteria like date and popularity is also possible.

Easy-to-use Web Forms: Web forms and inputs are probably the most frequently used feature for social media and networking sites since are used in everything from sign-up to search, log-in, replying to a post or adding some other content. Their wide use requires also high usability. In order to achieve this goal a general practice is first minimize the number of fields of the form and placing their label above the form –this have proven to require the least eye-movement and cognitive processing). For example most of the SNS keep the sign-

up form as simple as possible by including only the essentials like password and username, allowing the user to freely surf thought the site.

Effective organization of UI components: A visual and clean separation of all the different elements of the design is very important. In most SNSs there is a division of the layout in distinct parts referring to different kind of content and information. These sections are also separated in a subtle way with simple lines and light colors so as to be easy to scan and comprehend. The number of the different part is usually small so as to support them in scanning text lines and not confuse them.

Real-Time interaction: The real time distribution of updates to users is one of the most distinctive features of SNSs. The users are constantly informed about the "happening-now" activities of people of their own social network without having to be engaged in a two-way interaction (like in instant messaging applications). This means that by the time a new post, message or an update is submitted from a user it is automatically presented to the other users in a direct but not obnoxious way.

Usage of conventions: Innovation and autonomous creativity are indeed crucial when designing user interfaces but there are some cases where could be proven to be really risky or even harmful. Users of modern technology-oriented society do have formulated a very specific visualization of how a SNS looks like. For example there are common conventions about where to place the "sign-up" link or the search box or about labeling boxes, form and links. Diverging from this informal rulebook might be misleading for the users. This is why most SNSs place and label all the elements in a way that does not surprise the users.

Profile Pictures: People tend to be appealed by faces. So expectedly most of the SNSs link profile pictures with content. Extra attention is paid concerning the result of clicking on the profile picture, which confuses a large portion of users. People tend to pay more attention to content that is combined (surrounded) by a picture than content without faces so SNS user interface does usually comply with this preference.

2.5.1.3 DIMENSIONS OF USERS ACTIONS IN SNS

The analysis of the most popular SNSs and the identification of their key features offer a fertile ground for classifying the users' actions based on the common functionality of these social web applications. There are three major dimensions detected: self management, self-organization and self-regulation.

Self-Management: describes the functionality to manage and create user's profile, groups, and tags, pictures/videos e.t.c. Self-management actions give users the opportunity to

- State and present their personal information and interests to others.
- Enhance the communication and interaction with the other users
- Receive comments and feedback from other users
- Keep a status of their actions
- Create a lest/view of their circle of acquaintances

- Exchange and use common information with other users.
- Create groups/communities
- Watch the activities of other users/friends
- Relate themselves to activities in the network through tagging
- Classify, explore and organize their activities via tagging

Self-organization: includes functionality that allows users to

- Suggest content
- Comment on other user's activities or profile
- Rate content or groups
- Search for any kind of content including groups
- Create a list of favorites
- Visualize/ browse relationships between users, content and groups

Self regulation: Includes functionality that allows users to

- Control the level of privacy of activities
- Restrict access for member or groups
- Restrict the opportunity to rate content or activities fro members or groups.
- Define who can join their self-created groups
- Modify features of their self-created groups
- Add more activities or post content on their self –created groups

2.5.2   SOCIAL OBJECT THEORY FOR SNS DESIGN

The interest about designing SNSs around social object is constantly increasing. The most currently successful social networks are those which form around such social objects. Engeström argues that "Think about the object as the reason why people affiliate with each specific other and not just anyone…." He just considers objects to be the centre of all the successful media interactions. Similarly social object could be defined as the core element of a dialogue since when people talk they usually do so about a specific a subject

In order to be able to identify the usability of social object theory in SNSs' designing we first have to elaborate on some basic concepts and make the needed distinction between the two different types of social networks in respect to their centerpiece. Typically analysts define two types of social networks ego-centric and the object-centric. An ego-centric social network considers the individual to be the center of the network experience (Orkut, Facebook, LinkedIn, and Friendster) and users are defined by their particular connections with ego while the object-centric network places a non-ego element at the center of the network. Examples of object-centric networks and their respective social object are Flickr with social object photograph, Dopplr with social object travel instance, MySpace with social object music, delicious with bookmarks and Digg with social object "news item"). The linkage among all these networks is that people connect and share through 'social objects', pictures, books, or other shared interests. Many claim that human himself can be defined as a social

object but this distinction between object and ego-centric, that in fact do share some common features, is basically based on the different experiences they offer.

In his post *"Why some social network services work and other don't"* Jyri Engestrom of Jaiku talks about the important role of object in interactions and relations between people. He claims that *"Russell's disappointment in LinkedIn implies that the term 'social networking' makes little sense if we leave out the objects that mediate the ties between people. Think about the object as the reason why people affiliate with each specific other and not just anyone. For instance, if the object is a job, it will connect me to one set of people whereas a date will link me to a radically different group. This is common sense but unfortunately it's not included in the image of the network diagram that most people imagine when they hear the term 'social network.' The fallacy is to think that social networks are just made up of people. They're not;* social networks consist of people who are connected by a shared object."

John Breslin presents a more practical view of social object in SNSs in his article T-SIOC, object-centered sociality; *"I've extended my previous picture showing a person being linked across communities to this idea of people (via their user profiles) being connected by the content they create together, co-annotate, or for which they use similar annotations. Bob and Carol are connected via bookmarked URLs that they both have annotated and also through events that they are both attending, and Alice and Bob are using similar tags and are subscribed to the same blogs"*

One of the most interesting remark about the subject comes from Hugh MacLeod in his article "cartoons drawn on the back of business cards": more thoughts on social objects" :"*The most important word on the internet is not "Search". The most important word on the internet is "Share". Sharing is the driver. Sharing is the DNA. We use Social Objects to share ourselves with other people. We're primates. we like to groom each other. It's in our nature".*

2.5.2.1   PRINCIPLES FOR SUCCESSFUL SNS$_S$ DESIGN BASED ON SOCIAL OBJECTS

Social objects vary a lot in form and are not always acclaimed. What actually makes them so popular is an effective marketing strategy. A social network can be based on just one social object or multiple social objects. The real challenge in the context of advertising is to decide on an innovative but simple social object. As soon as the object is chosen the next step is the identification of those features that make it social or of those means to make it social like tagging and sharing. Substantial prerequisite for the social object is to be the unique, innovative and address to a specific target group (audience). Similarly important is to maintain the sociability of the social objects. For some it may last for a long period but other SNS may be just a transient buzz.

To generalize according to Jyri Engestrom there are five key principles involved in a successful social network built around objects:

1.   Clear definition of the social object your service is built around
2.   Definition of the verbs that users perform on the objects. For instance, eBay has "Buy" and "Sell" buttons. It's clear what the site is for.

3. Description of the way that share the objects?
4. Turning of invitations into gifts
5. Charging of the publishers, not the spectators.

2.5.3   WEB 2.0 AND LEARNING

The concept Web 2.0 has enticed web developers, designers, bloggers, and even major media outlets since its first introduction in a conference brainstorming session between O'Reilly and MediaLive International. Dale Dougherty in the ashes of the dot-com collapse identified the rapid emergence of exciting new applications and sites. Although the term with the familiar version number is linked with several software applications the truth is that is does not refer to any specific technology .Instead Rather, Web 2.0 acts like a "nickname" for an emerging set of Internet-based tools and the corresponding guidelines concerning their usage.

Web 2.0 technology does not encompass the passive activities of consuming media, accessing the Internet and using the provided services but it rather refers to an active engagement of people who are willing and aware of customizing applications so as to meet not only their individual needs but also the community needs and goals. Web 2.0 concepts differentiate a lot from the respective concepts of the Web 1.0 that focused on static web-pages developed merely by people with the needed technical skills. It is generally accepted that Web 2.0 signals a new era in technology and that it is not just a new bubble expected to burst in the next decade. The technologies encompassed by Web 2.0 are briefly analyzed in the following section.

2.5.3.1   BASIC PRINCIPLES AND APPLICATIONS

BLOGGING

Blogs (or Web Blogs) are online journals with subjects that range from personal diaries, fashion and music stuff to political analysis and hints for computer geeks. Their author could be an individual, a group or organizations. Blog postings could be either text or media content including pictures, videos, audio and links. They are usually updated daily or once a week and are classified/archived by date or by category. Blogs can be used from organizations to provide a status update concerning projects and their content can be maintained by more than one person so as to keep the communication channels and the discussions open.

Linking is also an important future of blogging since it enhances referencing and retrieval of information of different blogs. There are several kinds of links among them:

- Permanent link that is a permanent URI generated by the blogging system and applied to a particular post. The modification of removal of the post does not change or

removes respectively the post. So there is no guarantee between the link and the post.

- Trackback (or pingback) allows a blogger (A) to notify another blogger (B) that they have referenced or commented on one of blogger B's posts.
- The blogroll is a list of links to other blogs that a particular blogger likes or finds useful. It is similar to a blog 'bookmark' or 'favourites' list.

RSS

RSS is a set of formats which allow users being informed about updates to content of RSS-enabled websites, blogs or podcasts without browsing the site. Instead, content from the website (typically, a new story's title and synopsis, along with the originating website's name) is gathered within a feed (which uses the RSS format) and 'pushed' to the user's desktop.

Really Simple Syndication (RSS) feeds provide users with up-to-date news and updates of a website. The user does not have to open a browser or another web –site or send emails-or newsletters to friends, followers and supporters. He first has to customize the RSS Feeder according to his wishes by entering particular keywords or information .Then by acquiring the aggregator (available on free software that will distribute the content that he wants to his own desktop) he is able to receive content adjusted to his needs and wishes. RSS currently is used to "push" not just notices of new blog entries, but also all kinds of data updates, including stock quotes, weather data, and photo availability.

TAGGING AND SOCIAL BOOKMARKING

A tag is a keyword that is linked to a digital object (e.g. a website, picture or video clip) to describe it, but not as part of a formal classification system. Tags are a powerful vehicle for organizing and finding URLs, photos, concepts or projects by linking the available information with relevant keywords. This linkage is based on the simple way a user would classify information for future browsing or use. Tags can also be used to attract viewers in a blog, gather information and share knowledge. People that show interest in the same field can choose a representative, unique, memorable and not vague keyword and start tagging (using for example del.icio.us) relevant URLS. ," Alexandra Samuel in a Toronto Star article about the Web 2.0 tool claims that "*By allowing people to share information effectively, tags create and support a growing number of online communities. And by bringing communities together around common interests, tags add value to the information those communities gather".*

The first widely-used applications of tagging was the identified in the introduction of 'social bookmarking' phenomenon (see del.icio.us website). Social bookmarking systems allow users to create lists of 'bookmarks' or 'favourites', to store these centrally on a remote service (rather than within the client browser) and to share them with other users of the system (the 'social' aspect). An interesting trend is the combination of social bookmarking with RSS. Frequent updates on websites are rather costly so by using an RSS feeder customized on a particular content, useful and up-to-date information can be presented in

any website with minimised allocation of resources. Social bookmarking may also prove to be rather useful for tracking and control of the critical issues.

NEWER WEB 2.0 SERVICES AND AJAX APPLICATIONS

AJAX is the key element of the Web 2.0 technologies is AJAX. It includes a set of Web page coding technologies (JavaScript, XML, HTML, and CSS used in conjunction) that allows pages to respond to a user's input without processing or reloading the page. *Ajax is a group of interrelated web development methods used on the client-side to create interactive web applications. With Ajax, web applications can send data to, and retrieve data from, a server asynchronously (in the background) without interfering with the display and behaviour of the existing page*. [http://en.wikipedia.org/wiki/Ajax_(programming)]

The difference between traditional Web and AJAX driven lies in the response time after user's interaction with the application. Without AJAX programming when user performs an action he must wait for the request to be sent to the Web Server with a blank page in his display indicating the processing of the request. On the other hand in an AJAX-driven application the waiting time is minimised so when the user clicks (or enters an input) on something the relevant results are immediately presented to him.

With traditional Web applications, when a user clicks something, the action triggers a request to a Web server, which renders the page in the user's browser. The user must then wait for the page to load while an hourglass or a blank Web page indicates that the request is being processed. Each action a user performs results in lag time. In an AJAX-driven Web application, when a user performs an action -- say, clicking a map -- the results are immediate, so there's virtually no waiting time. The most well-known application of AJAX is Google maps which support dragging the maps or removing/adding flags without waiting Google Server to send an updated Web page.

During the last years there has been a significant increase of developing new applications and ideas in order to broaden the usage of the current Web 2.0 services. Many companies emerge that base their products and services on Web2.0 transformation. However their success or durability is at the moment rather uncertain since new services are constantly sprouting up. This bombardment undoubtedly asks for a proper classification and organizing of the services preferably in terms of functionality.

WIKIS

Wikis are open web-pages, where a registered user in the wiki can publish to it, amend it, and modify it. Similarly to blogs, they are not as trustworthy as traditional resources. Wikis offer flexibility and free access and are ideal for collaboration and group working. Wiki pages provide the user an" edit button on which he can click so as to access an easy-to-use online editing that allows him to modify, extend or even remove completely the content of the corresponding page. User can navigate through the collection of pages via subtle and simple links. They also provide a history version in order to keep track of the changes of the page or return to previous versions.

2.5.3.2   WEB 2.0 FOR LEARNING

As we have shown in the previous section Web 2.0 tools and technologies provide a stable environments for generation content with the active participation of the user. What differentiates Web 1.0 and Web 2.0 is that the latter encourages the introduction and the incorporation of the social networks principles in this section we will try to apply Web 2.0 concepts that basically reflect this power of the network in an educational context. In order to achieve this goal we will elaborate on the basic principles as described by O'Reilly of Web 2.0 that justify the explosion of the relevant services and applications and analyze them from an educational perspective.

The first basic idea behind the Web 2.0 transformation is the <u>individual production of user generated content</u>. The introduction of these tools allowed the self-publishing and more generalized the self-expression of the users themselves. If we consider how difficult it was to create an actually static website even if you knew HTML we can easily understand the noteworthy impact of the emergence of the blogs. Blogs templates with the pre-formed content overcome the most important difficulty of traditional methods of making websites that was the lack of technical skills needed in order to find the proper way to present the data. Blogging platforms thus liberated users from the need to face the technical skills and allowed them to concentrate on the production of higher quality content.

The personal publishing market evolved even more with the arrival of social networks which reached an even wider audience. The most characteristic example is the self-publishing function of the Facebook "Wall", where the user himself or his friends are able to write in text or upload link, photos and videos. Posting is similarly a self- expression act. Traditional blogging platforms are powerful but still require technical know-how. Thus microblogging has evolved as an intermediate form of self-publishing.

Each form of personal publishing is different and with different target groups and proponents. The variety of the tools that enable and facilitate active participation is highly interesting for educational purposes. The students as users of these tools can develop their self-expression, their creativity and the autonomous generation of unique and original content. Furthermore this user-generation of content accommodates constructionist learning and provides prosperous ground for the development of new teaching methods and approaches.

Undoubtedly the development of the Internet provides individuals with access to a huge amount of data which can be a useful means in more precise and intimate comprehension of their environment. These data must be analyzed and evaluated in order to identify opportunities and to proceed with decision-making. However a severe barrier to this process are the limitations of the human brains .The Web 2.0 term '<u>harnessing collective intelligence</u>' as used by Tim O'Reilly refers to relying more to others in order to find solutions to all kind of problems that we face during the constant decision making. Thank to new 2.0 application organizations and individuals gained useful access to the collective at a maximized degree. The extended usage of wikis, social networks, collaborative software and "wisdom of crowds" or "crowdsourcing" proves that there is a shift of attention from the "individual" to the "crowd".

So the value of the Web 2.0 is rapidly increasing due to its wide acceptance and usage. In an educational context the cooperation principle that is directly associated with the development and usage of its technologies could proven to be very effective when a large number of entities are involved. Students and educators are all part of a large community and as such they are expected to be in direct and continuous contact; and this is where Web 2.0 could be very helpful. This collective intelligence facilitates also collaborative learning since it enhances the group cohesion and communication.

As aforementioned we produce and being confronted with a huge amount of data. Many claim that this overdose could deprive our ability to focus and lead to a feeling of drowning. Tim O'Reily refers to the decisive role of data management for companies like Google:" 'the value of the software is proportional to the scale and dynamism of the data it helps to manage'". Data on an epic scale are gathered and managed from this kind of companies through well-defined data management and networking processes. The ordinary usage of these services leads to their "continuous" learning and the data that they collect can be easily accessed via browsers or APIs. Semantic Web goes a step further. *It inserts machine-readable metadata about pages and information on how they are related to each other, enabling automated agents to access the Web more intelligently and perform tasks on behalf of users.* [http://en.wikipedia.org/wiki/Semantic_Web]. In an educational environment the organization and collection of data is of high importance since there is a wide variety of resources that have to be read and combined. So Web 2.0 under this view facilitates both learning and teaching in real contexts.

2.5.4   CASE STUDIES

Social networking and Web 2.0 technologies have emerged as a valuable tool for websites to engage with users and stay acclaimed. While best represented by the essential MySpace and Facebook, social networking has made significant strides into the development of not so popular but still innovative websites compliant with the emerging social object theory. In this section we will explore the evolution of two pioneering and creative social networking websites -Cloudworks and GoHitchhike -in terms of functionality (what utility do they offer and how is it being applied?) and examine how their design relates with the principles of object-centric networks.

2.5.4.1   CLOUDWORKS

Cloudworks is a social networking site for finding, sharing and discussing teaching and learning ideas and experience. It is "a social networking site for learning design, adopting a Web 2.0-based philosophy. The aim is to create an evolving, dynamic community of users, tools, resources, ideas and experiences associated with learning design" (Cloudworks: sharing teaching & learning ideas & experience, January 2009 (UTC)). Cloudworks is included in an Open University Learning Design Initiative. Its aim is to develop and implement a methodology for learning design composed of tools, practice and other innovation that both

builds upon, and contributes to, existing academic and practitioner research." and the project stakeholders "are interested in providing support for the entire design process; from gathering initial ideas, through consolidating, producing and using designs, to sharing, reuse and community engagement." (Cloudworks: sharing teaching & learning ideas & experience, January 2009 (UTC)).

The site relies on the social object and object-centered sociality (see [Social object theory for SNS design](#)) following Engerstrom notes (Karin Knorr-Cetina's work): "Social networks consist of people who are connected by a shared object ;the term 'social networking' makes little sense if we leave out the objects that mediate the ties between people. Think about the object as the reason why people affiliate with each specific other and not just anyone." As discussed several times in this thesis the howling success of social networking sites in sharing items like YouTube or Flikr and in uploading such items like Facebook proves that the legitimacy of above remark.

The site provides functionality that identifies and enhances the connections/ relations of a complex network of social objects linked with learning design— tools, resources, approaches to design and peopleThe ultimate aim of Cloudworks is to develop a user-driven and self-sustaining site. The development-team provide useful links, guides and how-to section with resources and examples aimed at providing help and support to new users.

 The overall project consists of three parts

- The [Compendium LD](#) editor

- Cloudworks

- Empirical research and evidence gathering

The site includes:

Cloud: An entry in the website is called a <u>cloud</u>. Clouds range from little hints of practice or simple teaching ideas, through to more detailed design plans – which might be in the form of a visual design representation such as a LAMS design sequence or a Compendium LD diagram, or a text-based, narrative case study or pedagogical pattern .

Kind: A kind is simply defined by adding a tag in one of the tool, pedagogy, discipline and other input fields.

Comments: Comments that people can add to clouds

Cloudscapes : collection of clouds, i.e. a set of clouds tagged with the same keyword.

Stormclouds: Stormclouds are requests: expressing thoughts, ideas and arguments concerning an educational problem on which someone is asking for answers. For example a teacher might request help on how to teach introductory statistics across a range of disciplines. Alternatively a teacher might put in a stormcloud ideas about how to assist students in developing their scientific thinking skills by promoting learner-centred approaches to inquiry-based learning .

Resources: These include learning objects, open educational resources, design templates and case studies, but also different ideas and approaches to thinking about design, and links to sites providing information on different tools and how they can be used.

Tools: These include Learning Design tools, which guide the user through the design process, and pedagogy tools, which instantiate particular pedagogical approaches.

People and Communities: Each user has his own profile, and any social objects they are linked to (clouds and cloudscapes) as well as related people are automatically assigned to them. The schematic of their connections/relations increases the value of their profile, contributing to a smart and adaptive way of a constant evolving of the expertise of the system.

2.5.4.2 GO HITCHHIKE

Go Hitchhike is a free access social networking website that user can join networks organized by city and school, and interact with other people. Users are able to add friends, inform them about their travel plans and a relevant timetable and check trips and schedules of others. They can also communicate with the members in order to transfer on their behalf (either bring or deliver) all kinds of things due to their unavailability to travel at the time or for cost reduction purposes. In other words GoHitchhike connect people with friends, share item stories and trip experiences and delver items while saving shipping fee and making earth greener.

The idea of creating the Go Hitchhike site occurred to the author when he was trying to find a way to get candies from his Grandmamma in Taiwan without being obliged to pay the high shipping fees. So he thought about creating a site to find people who live close to him and plan to travel to Taiwan so as to transfer candies for him on their way back. The site was name "GoHitchhike." With "Go" referring to the action of deliver and; "Hitchhike" to the item itself: the package "hitchhikes" its way across the country with the help of travelers, who visit the website. Members post desired items with special meanings from a particular region back to the user's location. Travelers act like couriers by bringing back the desired items and the experience of the trip. They do not only fulfill receivers' desire but also "deliver" nostalgia and sure receivers' homesickness.

The website is the product of the successful combination of ego-centric and object-centric network that additionally encompass the concept of physical interaction, on which the generalizing social concept of an object-centric network like Flickr rarely focus. The identified tasks as described by the creator were:

- Creation of an object focus website
- Merging the site into exciting social network service website
- Cooperating with developers to develop the back-end
- Analysis of the users' behaviors of GoHitchhike
- Analysis of the users' physical face-to-face interactions

- Interaction Design and Information Architecture
- Interface Design and Information Design

The whole concept of the website is around the triple Item-Trip-Share referring to the users' opportunity to add items that they want and find matching travelers, add trip schedules and help requesters transport and share item stories and trip experiences respectively. The three main sections are

- Profile: It includes the information about the user:
    - Some basic profile information of the user gender, birthday, email, cell-phone and address, his hometown Country –City and his education.
    - A list with the items they have shared, the corresponding information about the item (the post-date, item-status, time range, shop location and a potential confirmed traveler) and the story behind the item (item from friend, item from shop ,"leave messages", why would you like this item, does this item has a special meaning for you?)
    - A list with the trips of the traveler, their basic info (post date, trip status, departure/return data, other cities that might visit, confirmed requesters) and the story linked with each trip ("how did you like that trip?", "did anything interest you during the trip?")
- Browse: In this section the users can find item, trip and create bookmarks. They can fill the desired traveler's time schedule in simple search box and/or travel city in order to identify likely "couriers" for their items. They are also given the opportunity to "bookmark" a retrieved via search item/person and sort them wither by date or Status
- Forum: Users are also provided with a forum, a conversation placed divided into several categories (e.g. food & Household). There they can make their comments (reply and Delete). A rather interesting detail is the display of their profile photo next to their comments ("People like faces» design principle). They can also see a list with the other members that posted comments on the specific discussion.

GoHitchhike was based on the analysis of Facebook, Friendster, Hi5 friend search function and on popular Courier sites like the Casual Courier (The Casual Courier brings the world together by connecting senders of packages with independent traveling couriers.) and courier.org (an international association of Air travel couriers serving casual couriers worldwide). GoHitchhike also used as a guide well-known sharing travel experience sites like Dopplr (an online service for traveler that helps users hare their future trips privately with friends and colleagues) and Citiport (an online community based on travel and living where people share their travel and living experiences in each city all over the world.

2.5.5   SOCIAL NETWORKING OR ANTISOCIAL NETWORKING?

As it was previously mentioned, the technological evolution and invasion of digital media into kids' lives –not only when at home but also in classroom environments- is raising concerns that they will be distracted from activities essential for their social and intellectual development. Furthermore, even though technology facilitates kids' communication it is associated with several negative aspects, varying from exchange of messages with sexually-

oriented topics and fears of pedophilia to shifts in the structures and patterns on which friendships are based.

Scientists are concerned whether this kind of communication, including synchronous and asynchronous tools as well as social networks, is contributing to the socialization of kids or is resulting to relationships of diminished quality that lack the immediacy of face-to-face interactions. The main question to be answered is whether kids manage to successfully build and develop their social identity when using a screen to communicate with their peers. While on the one hand using computers and web technology children can easily communicate with existing friends or even create new ones –from all over the world- we cannot be sure that this kind of communication and the relations it involves, is considered to be part of their socialization process. After all, children can stay isolated for hours in their rooms, talking to friends online. But are these discussions of the same quality with real ones? Often kids lie about their identity -age, name, nationality etc. How can trust be fostered? What about physical interaction and body movements that also help people communicate? These are completely lost when using text-based forms of discussions.

 In the end, according to our opinion, close face-to-face interactions cannot be replaced by ones executed online, since they are the ones that help kids form the basis for creating healthy relationships as adults. They are important for kids' balance and emotional expression, but for social welfare and equilibity as well. It is unquestionable that all this shift in communication patterns will result in social changes. At the moment, these cannot be evaluated but for sure, they will change people's ways of living –in either positive or negative way. In the following chapter, we will try to delve more in such issues and more specifically try to analyze the relation of children with technology. This will help us to come up with some general heuristics and guidelines that should be kept in mind when designing technology for kids.

3   CHILDREN'S TECHNOLOGY

3.1   INFORMATION TECHNOLOGY FOR NEW GENERATION OF KIDS

In the following, we will try to analyze the relationship of the new generation of kids with technology. We will refer to some of the most popular technological achievements and current trends, analyze youngsters' main characteristics and focus on aspects such as how technology evolution influences their present and future lives. We will mention results of interesting studies and researches, and try to identify benefits and drawbacks associated with the early introduction of technology to children's life.

Before continuing though, we should have a look at the following table, in which the dates that demarcate the different generations are represented. It is important to note though, that depending on the author those dates might differ. The classification we have chosen to adopt is borrowed by the Pew Research Center's report with title "Millennials: A Portrait of Generation Next."

Generations	Demarcating Dates
Baby Boomers	1946-1964
Generation X	1965-1980
Millennials, Net Generation or Gen Y	1981-1997
Generation Z	After 1997

TABLE 9: CLASSIFICATION OF GENERATIONS

3.1.1   RELATION OF KIDS WITH TECHNOLOGY

The evolution of technology is considered to have a great effect on modern societies' organization and function. Technological achievements have become essential part of people's daily activities, influencing their behavior, action and living style. Especially as far as the more vulnerable group of youngsters is concerned, it should be admitted that they seem to adopt completely different habits, beliefs, ideas and ways of living than their previous generations had, something that makes us speak of a coming transformation of the society in its whole.

Surrounded by digital media and web technology, children seem to adopt a new way of communication and seeking information. They use computers and the web, in their leisure time, as a mean to entertain themselves, communicate with friends, play games or even search for a topic they are interested in. This is the reason why, many believe that the shift in communication and access of information is primarily due to out-of-school activities that

involve the use of digital media and web technology. Students also share this opinion, claiming that technology is changing the way they communicate but do not see how this could affect the learning environments.

The truth though, is that this tendency towards a digital-oriented world, has a strong relationship with the learning process and can have a great impact on educational frameworks. Thus, for example, Massively Multiplayer Online Games give children the opportunity to learn through interaction with software and other players as well. As the mainstream form of entertainment they offer kids chances for communication and socialization, calling specialists to think of ways to incorporate aspects of MOG to online learning environments. Furthermore, social networks – such as Hyves, mySpace etc- can make access to experts easier and permit the expression of personal ideas and beliefs.

Teachers, recognizing the important role of digital media, have already started introducing them into their lectures. Computer and video games are recommended so that learning becomes more interesting and enjoyable. Furthermore, governments all over the world, in an attempt to make children familiar with the use of technology, spend money to bring computers into schools. After all, what all experts seem to agree on, is that children should at least acquire the skills required to efficiently use Internet and computers, since these seem to be a prerequisite for their future professional career.

Kids of today, seem to be enamored with technology, as this is a fundamental element of the context in which they develop. They have never lived without it and societies have to adapt to the fact that computers will have an increasingly strong influence on future generations' lives. As the Kaiser Family Foundation revealed, Americans –aged between 8 and 18- spend on average 7.5 hours a day with electronic devices, varying from smart phones to computers. Further studies prove that while kids text their friends on daily basis, face-to-face discussions with them are not that often, a fact that comes to confirm the shift in communication forms.

With the use of technology beginning in the very early years of children's life, concerns about whether computer based content can have an impact on children's learning process increase. According to a Kaiser Family Foundation survey, 31 percent of children age three and under are already using computers. Sixteen percent use them several times a week, 21 percent can point and click with a mouse by themselves, and 11 percent can turn on the computer without assistance. Furthermore, a third of children -- many as young as 11 years old -- use blogs and social networking sites at least two or three times a week, while two-thirds of parents don't even know what a blog is, according to a report by NCH Children's Charities and Tesco Telecoms.

Current technological trends include computer camps and playing communities, concepts relatively new to the scientific community. Offering kids the opportunity to combine summer holidays with collaborative knowledge acquisition as well as with recreational activities such as sports, computer camps are usually sponsored by large organizations or public institutions. They are operating in multiple locations, embracing kids between 8-18 years old which are taught computer and technology related topics such as hardware, programming, game design and authoring, creation of iPhone applications etc. Playing

communities, on the other hand, are established by kids who enjoy playing a certain game online, in order to share their interest and passion about it. Even without knowing each other face-to-face, members of a play community share responsibility for the safety of those they are having fun with. Even stranger, despite the fact that peers might not be familiar with one another, the fact that they all are familiar with the game connects them under the goal of maintaining and having fun through the play. They meet for the sake of the game and gradually they get to know each other better. If the play community continues to exist over time, members will most probably start trusting each other, and this trust will reside not on the rules of the game but on the community itself, while online relationships and friendships might transfer even to offline world.

As it comes from the above facts, the prevalence of technology to society is irreversible. Youngsters, trying to follow mainstream trends are getting involved to digital activities more than their parents do, increasing anxiety among the scientific community about the effects that this phenomenon will have. The solution though is quite simple. Instead of being cautious and stare at it as if it were a threat, standards of usage and guidelines should be provided to better protect this vulnerable group of computer savvy young children. If we cannot avoid technology evolution influencing our lives, we should at least try to control it.

Pros and corns of early introduction

As we continue, we will analyze the advantages and disadvantages that early introduction of technology to children's life has. Starting with an attempt to identify what 'early introduction' really means, we should mention that as experts claim, kids should not be introduced to technology before the age of three, as until then they should learn using their bodies, acquiring skills such as walking, talking or making friends. It is at a later stage of their lives –after the age of three- that software and technology become appropriate for them and contribute to the development of further skills. Thus, three-year-old children could engage with graphic programs- that help them learn to recognize shapes- or other mathematics applications that teach them to count or sort numbers. It should be pointed out that it is at that age that kids become able to explore computers, always under the guidance of an adult –parent or teacher- who undertakes the role of intervening for providing minimal help or asking questions that expand children's experiences with computer.

As research shows (Haugland, 1992), children using computers have gains in intelligence, verbal and non-verbal skills, long-term memorization as well as structural knowledge and problem solving. This is the reason why experts in the field of education assert that integration of technology to schools could largely benefit kids and have started considering computer-based education as a fundamental feature of schools. Current technological advances started creating applications that integrate opportunities for physical interaction aiming to engage children to activities appropriate for their development level. After all, developmental appropriateness is exactly what seems to concern the educational community, as often teachers use computers and other technological achievements in a way that makes them developmentally inappropriate for them.

But what makes software developmentally appropriate for a certain group? Developmental appropriateness, as Clement perceived is defined to mean *'challenging but attainable for most children of a given age range, flexible enough to respond to inevitable individual variation, and, most important, consistent with children's ways of thinking and learning'*. Developmental appropriate software and programs engage kids in collaborative play, learning and creation, and in the end, enhance children's social abilities.

As studies reveal, computer and Internet are widely used within organizations, and good knowledge of how to use them is a required qualification for all candidate employees. Early introduction of technology to kids' life will better prepare them for satisfying and adapting to future needs that will rise up in work environment. Experts assert that the earlier students get familiar with technology use, the deeper their comprehension will be. Of course the problem of continuously changing technologies emerges, though children are supposed to be equipped with skills that will enable them to adjust in any –potentially new-technological environment.

But even the quality of learning seems to be enhanced when digital media are introduced. More specifically, using computers in education enables students to form distinct groups based on their capabilities and wants, allowing for different learning levels to exist, something that alleviates the problem of large groups, within which students are either held back or proceed too fast without understanding the learning material. Learning becomes personal –taking place through the interaction of one student or a small group of students, with the computer- and learners can adjust the learning environment to their own needs, desires, goals and likes.

Furthermore, good teachers are not constrained to one classroom but can act in a wider environment through either virtual classrooms or special programs built to facilitate distance learning, while students confronted with the huge amount of information that Internet offers broaden their horizons acquiring more skills and capabilities. Computer programs that put learning material into real-life context –such as Tenth Planet- are increasing in popularity and are considered to make learning process much more enjoyable and at the same time effective- ensuring that the child will be able to apply learned capabilities to real-life situations. After all, computers, allowing creation, save and retrieval of information as well as feedback that asks for immediate interpretation, seem to offer students opportunities to develop higher-order thinking skills.

On the other hand though, it is a fact that introduction of technology to children's life, is associated with the marginalization of students not having access or skills to operate computer media, while experts are often concerned that it contributes to reluctancy of children to be engaged to physical activities. Adopting a sedentary life, kids are exposed to many health hazards, varying from obesity to eyestrains and body damages, while overexposing themselves to digital media, they are kept away from essential activities that contribute to social skills and creativity- resulting in phenomena like loss of reality, addiction and social isolation, which will be further analyzed in the following chapter. Laziness is fostered as children tend to believe that everything can be as simple as sitting on a chair in front of a screen and just clicking.

Concerns about the depth, quality and safety of content also emerge. It is a fact that teachers usually offer the chance for deeper meanings and interpretations of the learning material, while providing evidence with what is right and wrong. On the other hand, violence, harassing content and sex-related topics are some of the dangers that technology – especially Internet- entails. Appropriate measures should be taken to protect kids from such menaces rendering parental intervention, responsibility and guidance key aspects in this process. After all, according to Papert, computers must provide concrete experiences and give children the chance to control their learning in a collaborative framework. It is this kind of usage that will help kids to actively construct and acquire knowledge in different domains, while motivated to explore new kinds of environments and resources. Because of lack of researches concerning the effects that technology will have to children's life, one cannot decide on whether its early introduction will finally benefit or harm them. In any case though, guidelines for the computer use at each age level should be provided to parents and teachers and appropriateness of programs for each phase of children's life should also be explicitly stated. These are the minimum measures educational and scientific communities should take to ensure that in the end technology will benefit kids, contributing thus to the social common well.

3.1.2   CHARACTERISTICS OF GENERATION Z

As it can be seen in Table 9: classification of generations, Generation Z includes kids born after 1997, which is the age group we will focus on for the goal of our master thesis – children aged between 7 and 11 years old. It is easily understood, that distinct generations are expected to have different characteristics as a result of the different experiences they have and the different environments they have lived in. Of course, it would be wrong to ignore cultural and developmental differences among individuals of the same generation, which might influence the degree to which they are acting online as well as the kind of activities they are engaged in. Thus for example, it is expected that children that come from lower economical classes have less access to new technologies and as such, they are less computer-savvy. Below, we will try to analyze some of the basic traits that distinguish generation Z from previous ones.

Kids of generation Z have developed completely new ways of communication and accessing information, as a result of the advanced technological facilities with which they have grown up. Born in a digital environment and surrounded by associated digital media and web technology, they could not help being affected- to a greater degree compared to their previous generation who had experienced the transition to a digital society. Feeling comfortable when working in teams –often mixed-race or mixed-gender- they can be characterized as 'team-players'. Quite confident for their power and skills, accountable for best education and best behavior they are often forced to work hard -for the reconstruction of the community in the realm of community- so as to cope with the demands and challenges of modern societies. Receptive to previous generations' values and beliefs but at the same time special, they have grown up used to sharing music, photographs, opinions and thoughts over the web.

Inspired by Brown's four dimensions, which are used to describe Net generation's characteristics – literacy, learning, reasoning and action- we will try to create a similar multi-dimensional framework to identify the shifts, as these are considered to have taken place to generation Z. The dimensions we propose are the following:

Literacy: Like Millennials, generation Z kids, are developing a digital form of literacy that going beyond text, extends to image and screen. They are very familiar with digital environments in which they can concurrently perform multiple tasks. For example draw a painting using the Paint program and at the same time chat with a friend using MSN.

Learning: Having the opportunity to try things on their own, children of generation Z would rather base their learning on their own experiences than teaching or lectures. Thus, a transition to more experimental form of learning is observed with traditional learning approaches being replaced by more practical ones- such as learning through playing or communicating.

1. **Action:** Just like Millennials –or even more- children of generation Z are considered to be action-oriented, preferring to try things on their own. They tend to have very short response times, indicative of the high speeds to which they act, something that might decrease the accuracy of their response.
2. **Technology:** A change to the use of technology has occurred, since from supporting individuals, it has now shifted to support and maintain relationships between individuals. This is a result of the social nature of human beings which asks for expression in a digital environment. Thus, for example, terms such as 'friends' are often used online, referring to people a person might- or might not know personally- and that are included in his or her contact list or network.
3. **Privacy:** Generation Z children, have completely changed the way they perceive privacy. In fact, for them non-privacy is not an issue at all. Unlike previous generations, they are characterized by their willingness to share, construct and collaborate while dealing with online environments.

For establishing effective communication with children aged between 7 and 11 years old we should take into severe consideration their traits as these were analyzed in the above chapter.

There are several reasons why we selected to focus our study on this specific age group:

1. At this age, children have developed motor skills that will help them to easily operate devices such as mouse, keyboard, web camera etc.
2. Cognitive abilities have reached to a satisfactory level by that time. Children have the skills required to develop critical thinking, judge, evaluate as well as guide their own learning process. Having already 2 to 5 years of experience in school activities, they know their strong points as well as their weaknesses and can thus act as producers rather than simple consumers of knowledge.
3. At this age kids are getting prepared for the transition from elementary to junior high school. It is thus important for them to enhance their cognitive, emotional and social skills using appropriate applications and efficient products.

4. This stage of childhood, is according to Case [1992c] the dimensional stage – more specifically Case's dimensional stage refers to ages between 5 and 11 years old. At that time of their life, children learn to solve more complex problems that deal with more than one dimension. Thus, as he asserts, children aged between six and eight years old have developed conceptual structures that are organized in two dimensions, while after the age of nine, kids can elaborate on multi-dimensional problems.

Below, we identify general heuristics and guidelines on how to communicate with children and try to come up with some general principles about the design of a user interface that corresponds to their needs.

3.2   DESIGN PRINCIPLES FOR CHILDREN'S TECHNOLOGY

As discussed before in this master thesis, much attention is paid to the definition of the design principles for children's technology; the wide use of software and technology dictates a clear and accurate description on how to develop applications that children find appealing and fit best to their needs. Developing software for the specific user group is an extremely demanding task since children in modern digital society are engaged in using technology from their early years and during their whole lives. Unlike adults that in a high percentage use computers for merely production purposes, children whose abilities and skills range a lot, use it mostly for educational or entertaining purposes. Thus simply "compacting" the finalized design principles formulated adult software to satisfy children's needs is by no means the ideal approach.

The sharp distinction between adults and children applications' goals is the basis for the defining the principles of designing children's technology. Most of the research on technology focuses on systems intended for adults, who assumingly have at least the basic computer skills. On the other hand, children may or may not possess this kind of abilities and skills like typing or reading efficiently. In their report "Designing Digital Experiences for Youth", Cheskin provides the following general design heuristics for digital experiences targeted at the youth market:

- create a sense of fun and spontaneity
- provide personalization
- incorporate fashion elements into design
- promote connectivity—make it mobile
- include creative tools (i.e., create custom music/movies, clothing, etc.)
- establish personal relevance
- incorporate existing social practice
- connect to popular culture
- create affordances for fan activity
- allow for significant interaction
- provide for transgressive play
- avoid serious consequences

The general rule is that for a product to be successful there is the need to identify its target group and the relevant idiosyncratic characteristics and adapt to them in respect to modes of communication, input methods, tasks, and appearance. In order to achieve this goal there is the need for clearly defining the design principles. The problem lies in finding and organizing these principles in order to be applicable and not distractive or confusing for the designer.

Research into design for children is the product of the combination of several fields; human-computer interaction, education, and psychology researchers have all made significant contributions in the area. This ostensibly incoherent information need to be united in a set of principles. In the next section we will elaborate on the definition and classification of design principles for children based on the three human development areas: cognitive, physical and social/emotional by providing first a brief description of each one of these areas.

3.2.1 CHILDREN'S TECHNOLOGY DESIGN BASED ON HUMAN DEVELOPMENT AREAS

The three areas of human development are physical, cognitive and social-emotional. Although all these areas have their unique features there is a strong relationship between them. Physical, cognitive, and social-emotional development of humans are all dependent on each other as well.

Human development happens physically starting from conception. Physical development consists of the growth of the body and brain. Other forms of physical developments include the genetic basis for some human characteristic and abilities, neurological developments and the activation and further development of psychomotor activities. Physical development is also expressed in the distinction between healthy/ normal behaviors and unhealthy behaviors. Physical development happens rapidly in childhood and teenage years by starting with learning to crawl, walk, and use the hands and feet efficiently and by the normal transition from child to adult respectively.

Cognitive development is linked with the changes in a person's reasoning and logic, which is expressed by the ability to conceive theories and use them to rationalize and understand. This area of human development relates to thought processes and their complexity. Cognitive developments are also reflected by an increased vocabulary level and usage. Developments of the cognitive sort also refer to memory, and concepts. In childhood human development of the cognitive nature is evident through learning to speak and write, metacognitive growth that awareness of one's own thought and an increased ability to understand and use symbols. Cognitive learning is increased in teenagers and continues throughout a human's life.

Social-emotional developments relate to feelings, emotions, moral beliefs and ethics. Emotional developments pertain to self-concept, self-regulation and a deeper understanding of feelings and how to handle them or express them. These characteristics are also associated with a person's relationships and their overall social behavior. They are also

reflected on the effort to identify the difference between the "right" and the "wrong". Acquiring or losing self-confidence is a characteristic example of social/development, which occurs throughout age. The increase in reasoning and logic facilitates dealing with social-emotional developments in a better way since a human possesses the appropriate level of awareness for his Self and others.

As mentioned above the three areas of human development are closely related. Although they all have specific characteristics, they also all influence each other. Physical development influence both cognitive and social-emotional developments. The former is influenced in respect to development of thoughts patterns, which is expectedly enhanced by the physical development of the brains and the motor skills. Similarly healthy or unhealthy behavior does affect in an extended degree the thought processes and the formulations of the relevant blueprints. Physical development and the health of human and body affect the growth or not of self-confidence. The way that cognitive processes and logic influence a person's ability to conceive and handle feeling and emotions and to understand himself and those he interact socially with, reflects the influence of cognitive development on social-emotional development. Physical developments like neurological growth allow people to act more socially since they increase their ability to analyze and handle any kind of demanding situation.

The design principles that we will present below will consider and provide support for these development areas in order to meet children's needs and expectations. These principles in the form of guidelines, approach children's technology design on three levels. Our collection of principles is the product of the needed adjustment of the three levels of human developments that are widely used in educational context to the process of designing tools and applications for children:

Cognitive development: Perception, Problem solving, Language

Social/Emotional development: Motivation and Variety, Socialization, Collaboration

Physical development: Learning to Move , Moving to Learn

 So we will to provide the developmental characteristics of children for each one of the three areas, describe the way that they relate with the children's use of electronic and address the related key design issues. Some of the principles might be related to more than one area but they are referred to the one that fit to the best.

3.2.1.1   SOCIAL /EMOTIONAL DEVELOPMENT

Motivation & Variety

 Since children's technology often has aims such as education or practice, keeping the user engaged and interested is an important objective. Designers of children's technology are often more concerned about user motivation than are those who design systems for adults whose focus lies more on principles like usability or utilization. The primary goals of children's technology are in most cases educational and in order to achieve them there is the need for spending a significant amount of time with the application which in turn

requires keeping the user's interest high. One rather popular approach to motivate children is entertainments and fun. Providing "entertainment breaks" on the screen from an demanding e.g. math activity would challenge a child to complete his task in order to be able to click and enjoy a video, a joke e.t.c

But since entertainment cannot be applied in all kind of application another interesting way to keep children motivated is though media equation." The Media Equation is a hypothesis suggesting that people respond to computers and other forms of media in the same ways that they respond to real people. Several studies, primarily by Nass and Reeves, have shown that people apply to computers the social rules and conventions that are usually reserved for other humans – that is, when presented with even minimal social cues, people automatically respond in a social manner. One finding of this work is that when computer software exhibits certain qualities of human behavior (such as praising the user or acting like a teammate), the users of the software are significantly more positive about the computer system and about their own experience" (Chiasson and Gutwin, 2005).Thus by introducing animated characters or text boxes that do not only provide guidance , help notes or support but that also offer an recognition of their achievements and a proper reward , would be a useful method to keep children "in" the system.

In these environments children should be allowed to explore a wealth of learning materials and be engaged in a variety of activities. Children should be able to explore and manipulate a variety of alternatives. Most of these learning environments are based on software that allows children to make decisions and take initiative in their learning. This provision of many and different choices and the encouragement of exploration can act as a "lessons learnt" process but restricted in a safe environment. Through free decision-making children will be highly motivated and bold their self-esteem. Several studies have proved that applications usage may not only encourage children's initiative but also function as an important factor in developing and enhancing self concept (Haugland, 1996).

In combination with the provision of a variety of choices children should be given the power to act independently and free of restriction. They generally tend to enjoy being in control and define the nature of their interaction with the computers. The most popular applications, tools or environment are those that offer children an acceptable level of control, an intense sense of active engagement and a clear definition of multiple goals. Children should have a sense of direction and purpose in their activities that would increase their motivation and their spontaneous preference in the specific system.

Socialization

Contrary to adults who consider computer's use a solitary activity, since they basically use it in their workplace and it deprives from them any direct human interaction, children use it mostly for entertaining and educational purposes. In this context it is generally accepted that playing games and learning are best enjoyed with the company of friends. Facilitating online social interaction is expressed in most children's systems in terms of allowing players or learner from all over the world to support each other, compete or cooperate. Children even those are so shy to interact via traditional means, are allowed to play, share and experience new things. A successful design should also

consider the social characteristics and experiences of their target groups when for example deciding the graphics, the personality of the animated agent or even those features that aim at surprising and increase children's satisfaction. Everything should depend on how the users define their social experiences, and not how social experiences should be bounded within a game.

Social applications, tools or should be incorporated in children's lives and not the other way round. Providing the opportunity to plan when they are going to use the system in order to achieve timing with their online- fiends, is of high importance since it relieves them from the obligation to be in front of the computer a pre-arranged time. Usually multiuser-like ideas require synchronous use and it is a rather demanding for systems that are based on asynchronous mode of operation. In this case the designer should try to maintain the ideas of multiuser experience and devise a way to make it asynchronous.

We also above made a reference in the work of Chiasson and Gutwin on how children attribute psychological characteristics to machines. So children have certain expectations from the computers and seem to feel conformable with interacting with them as long as an important prerequisite that is their compliance with social conventions and current practices is fulfilled. An important aspect is also reciprocity that is the notion where if someone does a good deed for you, you feel some compulsion to do a good deed in return. Children should feel via using the system (either is an online learning network or a game) the need to be engaged in it exactly because the system itself is providing of them valuable information, support or fun in such was they fell completely satisfied.

Collaboration

Children have a natural tendency to form groups even if they are given their own computer. Active peer interactions between children include: observing and acknowledging each other, children commenting and being ignored, and children sharing the computer or helping each other. Even with little or no teacher guidance are able to interact in a variety of ways with peers while on the computer: providing assistance and instruction and managing in turns. Allowing and promoting a child to provide guidance and support to other members of the informal group as a "leader" could enhance his self-confidence, promoting comprehension from the other children. In order to avoid conflicts regarding which child will use the input devices that are the mouse and the keyboard, software that allows sharing the display but using different input devises is required. The majority of research in CSCW today focuses on supporting people that are working apart from each other. Although computers and networks allow remote collaboration they lack solution for those who were "shoulder to shoulder", that would allow children to successfully cooperate in the same location, providing in the same time the needed feedback on the rest users' actions. Children this way will be able to imitate or avoid successful or leading to failure behaviors respectively.

SOCIAL/EMOTIONAL DEVELOPMENT		
MOTIVATION & VARIETY	Entertainment "breaks"	
	Media equation : software exhibiting human qualities (praising user or acting as a teammate)	
	Recognition of achievements and rewards	
	Text boxes/ animated characters for support/ guidance/praise	
	Variety of choices	
	Clearly defined goals (direction and purpose in actions)	
	Power to act independently and free of restrictions	
SOCIALIZATION	Facilitating social interaction	
	Scheduling the interaction with the application (for groups learning/playing)	
	Multiuser-like ideas in asynchronous modes	
	Compliance with existing social practices	
	Enhancing reciprocity	
COLLABORATION	Promoting the role of a team leader (from the group)	
	Feedback on other members' actions.	
	Multiple-users software and devices	

TABLE 10: SOCIAL/EMOTIONAL DEVELOPMENT AND TECHNOLOGY

3.2.1.2 COGNITIVE DEVELOPMENT

Technology has undoubtedly impact in a significant degree the cognitive development of children. Some already identified influences are:

- Computers are motivating for young children, increasing their time in on-task behavior. For example, one study found kindergarten children were on-task 90% of the time when they were on the computer (Bergin, Ford, & Hess, 1993).
- Computers provide consistent and frequent reinforcement (Parette, Hourcade, & Heiple, 2000).
- Computers allow children to work independently at their own pace (Parette et al., 2000).

- Software programs often provide extensive scaffolding of learning. Scaffolding is very important in developing cognitive skills.
- The computer provides unique opportunities that may enhance learning. For example, computers can allow children to access the "largest information bank—with the broadest range of quality and utility—the world has ever known" (Parette et al., 2000, p. 245). With the computer, children can participate in simulations and manipulate variables that might not be possible in the real world (Scoter et al., 2001).

- We will try to identify design principles that aim at the cognitive development of children in respect to perception and cognition processes enhancement, memory and language development and problem solving.

Perception and Cognition

Perception and cognition heuristics refers to the way the software should be designed in order for children to be able to directly perceive and comprehend what they see on their display. Children are a demanding target group since may have undeveloped reading and writing skills and they get easily confused and distracted .Web designers like all artists should try to impose a proper structure to their environment. They should enforce order and balance on the formless void that is the blank of the computer screen. They are expected to start with an organized layout that means defining the basic content either text, design concept or an image/color palette that would trigger the children. The environment should thus be in compliance with the current cognitive processes of the children and be made age appropriate.

The sounds and graphics gain children's attention. Appropriate visual and verbal prompts designed in the software expand opportunities. Vast collections of images, sounds, and text should be placed at the child's disposal. But what is of high importance is that childhood software should be in accordance with the technical maturity of the children; it should grow in dimension with the child, enabling him to find new challenges as he becomes more proficient, bolding the existing perception and cognition processes.

An interesting approach in making design choices that would support children in establishing well-based perception and cognition mechanisms could be based on six principles as described by Gestalt. The central idea behind them is "Wherever you gain the attention of the users, it's often not just the particular element that attracts users; it's the totality of the element and its surroundings. The 6 principles are:

- Proximity
- Similarity
- Prägnanz (Figure-Ground)
- Symmetry
- "Common Fate"
- Closure

The concepts work with one another to achieve a totality of function, elegance, and aesthetic appeal. Some of the best designers are not really aware of gestalt principles.

Even if they are not familiar with the relevant terms, they use them intuitively as soon as it does looks and feels right.

Problem solving

The second issue is about how to use the under development system in order to develop children's problem solving skills. The aim of the system would be to not to teach specific intellectual routines but to provide children with loosely structured opportunities to engage their problem solving skills. Focus should be given more on learners' intellectual actions the actual product of these actions. Although most would consider problem solving as simply trying to find solution to an addition equation it is much more than. It describes techniques to bring a solution to an issue that is running interference a user and the machine. More specifically, through problem solving incorporated in an application or a tool children can learn and use the gained knowledge to find solutions to the daily problems they encounter while growing into responsible adults.

Becoming skillful at problem solving is based on the understanding and use of sequenced steps. These steps are:

- Identifying the problem
- Brainstorming a variety of solutions,
- Choosing one solution and trying it out
- Evaluating what has happened.

Thus the system should declare to the child that he has to solve a specific problem. Proving a variety of solutions would facilitate a child's cognitive processes. Then prompt him/her to choose the best solution and provide the relevant feedback to him/her –right or wrong answer. A reward in case of success or even for the effort would motivate children and trigger them to think more thorough about the right answer the next time. The problems should ideally be related to every-day life of children like for example state a rule of a game and then ask to identify the game that the rule is enforced or try to elicit an answer for a geometry problem corresponding to the math level of the child. The problem should be presented in a visualized form -with animation, graphics and colors rather than plain text. The system like a real teacher or parent should guide children through the process as they try reaching a decision. Consistent exposure to situations like this will help to teach the children the importance of problem-solving skills.

Language and Communication

There are a large number of children that are not proficient readers and/or have a restricted vocabulary as well. Younger children may have a difficulty to fully user the alphabet properly and older children may find it difficult to comprehend guidelines that make use of an extended vocabulary. Systems should include menus and help functions that are text -based, making them inappropriate for young users. Interfaces that require textual input can also be problematic. Children are really creative in respect to

spelling, making it difficult for an interface to recognize text input. Thus text input fields should be replaced by visual means as much as possible. Since literacy level range from low to medium and high, children's interfaces should be aimed at a narrow age-group to successfully meet the specific needs of its users.

Furthermore systems should be designed in a way that they promote children's ability to communicate effectively. They should provide children with innovative ways to describe their experiences and assist them in generating and exploring ideas, and most importantly to elucidate their ideas through discussion forums. Children will realize that by performing technology activities they will be more convenient with expressing themselves regarding their experiences. Recording and labeling these ideas will be a powerful means in developing their vocabulary. A variety of other sources should be also offered that in combination with reading their own text will contribute to their familiarity with input texts.

COGNITIVE DEVELOPMENT	
PERCEPTION AND COGNITION	Order and balance in the environment
	Organized layout : defining the basic content either text, design concept or an image/color palette that would trigger the children
	Compliance with the cognitive processes of this age range
	Visual and verbal prompts
	Vast collections of images, sounds, and text
	Growing in dimension with children's maturity
	Power to act independently and free of restrictions
PROBLEM SOLVING	Focus should on learners' intellectual actions rather than the actual product of these actions
	Solve a specific problem Proving a variety of solutions would facilitate a child's cognitive processes. Prompt to choose the best solution Provision of the relevant feedback
	Reward for finding a solution
	Problems related to children's every-day life

	Problems presented visually
	Guidance from the system during the process
LANGUAGE AND COMMUNICATION	Menus and help functions that are text -based(adjusted to children)
	Text input fields should be replaced by visual means
	Interfaces should be aimed at a narrow age-group
	Innovative ways to describe their experiences
	Elucidate their ideas through discussion forums
	Recording and labeling their ideas and experiences
	Variety of other sources

TABLE 11: COGNITIVE DEVELOPMENT AND TECHNOLOGY

3.2.1.3 PHYSICAL DEVELOPMENT

Sheridan suggests that physical development and kinesthetic literacy involves two basic learning aspects: learning to move and move to learning. We will base and classify the design principles for physical development according to these two learning objectives.

Learning to move

Learning to move asks participants to focus on an understanding of the body in order to acquire the skills and techniques that are required to participate in physical activities. Doing so allows participants to take control of their body and to know its range and capacity for movement. Learning in this context often focuses on "fine-tuning" motor control and fundamental aspects of movement such as hand-eye coordination, coping with space, speed and distance (How to facilitate physical skill development in Exertion Games, 2011)

The term motor development refers to physical growth or growth in the ability of children to use their bodies and physical skills. Motor development often has been defined as the process by which a child acquires movement patterns and skills. Genetics, size at birth, body build and composition, nutrition, rearing and birth order, social class, temperament, ethnicity and are influential factor for motor development. The basic input device is the mouse and thus the base guidelines when designing children's software refers to the proper design of "clicking". Young children lack physical literacy; they usually fail in clicking on a narrow area or a small button and this definitely frustrates them and makes them feel disappointed. So children's systems should have large and separated by appropriate distance buttons. Moreover mouse buttons should all produce the same result on the screen and should be designed as subtle as possible. Alternatively for children that do not prefer mouse and clicking, the system should be able to support touch screen functionality.

Taking into account that today's child spends a significant amount of time in front of the computer many argue that the combination of digital technology with physical activities can contribute the most in his/her motor development. So if the demanding digital learning activities were associated with computerized physical activities could be ideal for fining and grossing motor skills. Visual motor skills refer to the ability to coordinate vision with the movements of the body. Vision is involved in all our movements whether they are gross motor or fine motor. In today's fast-paced, technology-rich world, the ability to coordinate hands and visual tasks is vital for children. Using a computer mouse, navigating through digital media and tracing activities involve hand-eye coordination and promote visual – motor dexterity of children.

Moving to Learn

According to Sheridan, in moving to learn, the physical activity is the context for a means of learning. Sheridan also used tangible exertion interfaces to explore this concept. (How to facilitate physical skill development in Exertion Games, 2011)

Tangible objects are thought to provide children with different kinds of opportunities for reasoning about their environment. Tangible User Interfaces (TUIs) can be employed to improve existing learning tasks. But they can also be used for direct interaction: children will be able to manipulate the system and navigate through info by selecting and positioning physical objects not just representations. Finally TUIs could be used to promote collaboration between groups of children.

PHYSICAL DEVELOPMENT	
LEARNING TO MOVE	Large and separated by appropriate distance buttons
	Buttons should all produce the same result on the screen
	Subtle and clear button
	Touch screen functionality
	Digital learning activities associated with computerized physical activities
	Using a computer mouse, navigating through digital media and tracing activities for visual motor development
MOVING TO LEARN	Tangible User Interface

TABLE 12: PHYSICAL DEVELOPMENT AND TECHNOLOGY

3.2.2 GENERAL HEURISTICS

Studies in the field of Human Computer Interaction –especially in the subfield of children computer interaction- and children's cognitive psychology – referring to cognitive skills that can affect or be affected by use of technology- have provided us with enough information about the formulation of design and usability principles –also known as heuristics- for the communication with young children. Principles of children's perception, cognition, motor activity, developmental level, problem solving, language and communication can guide design of applications that are targeted to this specific age group. It is obvious that helping designers to understand the capabilities and limitations of the intended users will result in a product that combines the desired functionality with increased usability.

When designing kids' software, we should keep in mind that the ultimate goal of it, should be to have a balance between children's abilities and the challenges the software is bringing up. That is, children should not find the tasks, they are engaged to, too easy- because in this case they will get bored- nor should they find them too hard- as they will be disappointed and most probably give it υπ παρατάω.

Furthermore, having discussed in a previous chapter the benefits that students enjoy when working together, systems should be designed in a way to encourage-and not force- collaboration. Respecting the learning style that each student adopts –whether he or she prefers individual or collaborative learning- software should try to foster a team spirit. Characteristically, we refer to the example of KidPad, which was re-designed so as to include such aspects. More specifically, the re-designed KidPad provided a functionality according to which when two students were using colors that were close to each other, then there was created a new area with the color that was resulting from the mix of the two initial ones.

Many different theories have revolved around design principles of systems that are to be used by children. Some of them take into account gender differences, concluding that boys and girls have a different behavior and understanding of technology. Thus, for example both girls and boys believe that game consoles are for boys, while computers and mobile devices are for everybody. Furthermore, while boys tend to value winning or having achieved a high score, girls seem to value experience and exploration, needing quick feedback and the ability to 'do something' in a game in order to stay engaged. Experts also believe that differences in the relation with technology can be attributed to brain-based differences between girls and boys as well as different way of understanding play –forms of play are likely to be gendered. For example, it is considered that girls tend to perform less well than boys in activities that involve mental rotation under time pressure, while in same-sex groups, girls and boys tend to establish social status through completely different means - girls prefer affiliating while boys would rather compete with direct measures such as sports.

Aiming to improve the usability of the system to be designed, enhance scaffolding, identify the look of interface agents that support kids as well as the interface elements appropriate for our target group, we have come up with some heuristics. We should mention that we based our research on a variety of studies and bibliography of Malone [1982], Grammenos and Stephanidis [2002], Baumgarten [2003]and Fishel [2001], Gilutz and Nielsen [2002],

Wyeth and Purchase [2003], Druin et al [1999], Shade [1996], Buckleitner [1999], Dix et al. [2004], Preece et al. [2007], Shneiderman [1998], Nielsen [1994]. Below, we have listed the basic principles that according to our research are the most fundamental ones for any application targeting at kids between seven and eleven years old.

ID	Heuristic
1.	Kids should receive understandable and interactive feedback –audio, tactile or visual- about the actions they have performed as well as about effects of their actions so that they will be able to determine the results of their future actions. Thus, having a predictable system that exhibits consistency in its functions and the way it interacts with the user is very important.
2.	When interacting with new systems children should be able to make use of prior knowledge.
3.	Metaphors should be used to foster familiarity and linkage with real-life situations. Fantasy and popular culture can be used to provide useful metaphors that are linked with the action children have to perform. Language and concepts should also follow real-world conventions.
4.	A clear distinguish should be made between available and unavailable operations, through appropriate means. This will help understand what the next required action is.
5.	It must be possible for children to initiate any action as well as customize and adapt user interface to their preferences. It must be possible for frequent users to create and use shortcuts and skip instructions they already know.
6.	User interface elements should all be active or interactive.
7.	Multiple channels of communication must be supported by the system.
8.	Response time must be minimized and comparable for similar tasks. Often children get impatient and start clicking with the mouse or hitting keys, when they have to wait a lot for the system to respond.
9.	Errors must be avoided as much as possible. Children should be informed with appropriate text messages about potentially erroneous actions they are about to perform.
10.	Errors must be precisely described in a language understandable by children. Furthermore suggested solutions- that fit their level of understanding- should be provided so that kids are given the chance to diagnose and recover from errors on their owns.

11.	Effectiveness of the system is important. That is, any system must achieve the goals for which it was designed.
12.	Safety of children must be ensured. This includes both physical –body injuries- and psychological aspects – exposure of children to harassing material such as pornography images.
13.	The effects that interface elements have on the system should be clear.
14.	It should be known in beforehand whether the children who are going to use the system will be novices or they will have some experience with similar systems.
15.	Different levels of engagement should be provided, depending on users' expertise. Thus more experienced users should be given the chance to proceed faster while mechanisms should be established so that novices are prevented from making errors.
16.	Among the different levels of engagement, increasingly complex tasks should be involved so that interest and motivation are not lost.
17.	Actions and options must be visible so that users do not need to remember by heart instructions.
18.	Kids should be able to use the system without consulting any tutorial.
19.	The system should avoid stereotypes based on gender, race or culture.
20.	Interface should be transparent so that kids focus on what they want to do rather on how to do it.
21.	System should provide a reward when children successfully complete a task. This will give them the sense of success and help them develop their self-esteem. On the other hand, if playfulness is seen as the motivating factor that engages a person in a non-mandatory activity, systems and the activities they embrace should lack serious consequences.
22.	System designers should try to model relationships of and offer children chances for role play, fostering collaboration.
23.	Advertisements should be avoided as children cannot distinguish between website elements and advertising content.
24.	Systems should offer variant paths of interaction so that children's interest is not lost.
25.	Multi-sensory experiences should be provided as kids with video games, television and other digital media is increasing the expectations they have when

	it comes to technology.
26.	Classroom software should give teacher the opportunity to adapt it to his and his students' needs and preferences.
27.	In a classroom environment audio effects might be annoying, distracting students from focusing on their tasks. On the other hand, similar effects are more than desired in software designed for home use.
28.	Computer systems should aim to introduce children to new technologies and virtual environments that children would normally not have access to- such as using computers for gathering and managing information.
29.	Systems should integrate features that give children the chance to get involved into multiple social networks and communities – creating their 'buddy lists' or sending mails. Such activities can be centered around any aspect of life –e.g. sports, school, art etc.

TABLE 13: PRINCIPLES FOR KIDS' APPLICATIONS

User Interface

When it comes to user interface, we should first of all identify usability as a basic requirement that has to be satisfied. After all, creating a usable product should be the main objective of any designer. USABILITY DEFINITION???? In case of children, improving usability is translated to facilitating their interaction with the product so that they can perform their daily in and out of school activities easier.

As Preece et al. [2007] suggested, there can be identified fourteen types of interfaces. The relevant ones for kids' applications are listed below:

1. Advanced Graphical Interfaces
2. Web-based Interfaces
3. Speech Interfaces
4. Pen, Gesture and Touchscreen Interfaces
5. Multimodal Interfaces
6. Shareable Interfaces
7. Tangible Interfaces
8. Augmented and Mixed Reality Interfaces
9. Robotic Interfaces
10. Interface Design in the Software Development Process
11. Design Guidelines for Interactive Systems

 Speaking of children though, we should mention some of the features they usually like to see in any application they are engaged with. Thus, kids – of target age group- like to have an interactive and appealing way to communicate with systems. Feedback, audio and visual effects as well as active support and guidance are important aspects that must be taken into account when designing UI for children, as they foster better understanding of both

concepts and functionality of the system. As Norman (1990) put it, providing a transparent interface is also significant, since this will enable children focus on their activities and not on exploring the interface. Furthermore, geographic navigation metaphors, such as pictures of rooms or villages seem quite appealing to them, especially when accompanied by animation and audio effects. Another important trait of young children is that they rarely scroll down. Thus, an effective user interface, should avoid embracing such features. Finally, taking into consideration cultural and ethical differences and restrictions proves to be more than essential.

Based on the heuristics described in the above section and taking into account features that children like when coming to user interface we came up with the following guidelines:

ID	Guidelines for the Design of UI
1.	Metaphors that are intuitive not only in the functionality they provide but in the way they should be operated as well.
2.	Easy to remember instructions, presented in age-appropriate format
3.	On-screen icons representing familiar items
4.	Buttons having 3D appearance
5.	Visual/audio feedback when moving mouse over clickable areas
6.	Interface indicating current state of the system
7.	Tracking and displaying exploration of environment
8.	Avoid extensive menus and sub-menus
9.	Direct manipulation – actions mapping directly to changes on the screen
10.	Pen-based interfaces or touch screens
11.	Simple mouse interactions
12.	All mouse buttons having the same functionality
13.	Large and distanced items
14.	Avoid drag and drop functionality
15.	Tangible interfaces appear as a more natural form

16.	Direct manipulatives
17.	Physical props – large input devices
18.	Use of entertainment click-ons
19.	GroupWare interfaces
20.	Visual and audio means instead of text

TABLE 14: GUIDELINES FOR DESIGNING UI FOR KIDS

Till now, we have analyzed the relationship of children with technology from a theoretical perspective and provided some general guidelines for designing children's technology compliant with the needs and abilities of children of 7-11 years old that would contribute to their development. In the following chapter from the general term "children's technology" that encompasses many different systems, application and tools we will move to "digital games" that are fairly considered to be the most important, typical and popular form of children's technology. This is the reason that lies behind our interest in designing an online game-authoring community for children of 7-11. Towards this goal we will specify the relation of games with technology and education and illustrate interesting frameworks for integrating digital games in educational context.

4 GAMES AND LEARNING

For this chapter, please consult master thesis with number 151 IK.

5   CHILDREN AS GAME AUTHORS

The invasion of technology into modern societies, during the last decade, has unquestionably changed dramatically our lives, as well as the way we think and act. In a similar way, penetrating into children's everyday activities, technology can support and facilitate the tasks they have to perform, while altering the way they live and learn. As mentioned in previous chapter, learning is benefited from the usage of digital media and web technology while recreation has acquired a completely new meaning making it impossible for modern kids to think of ways to entertain themselves that do not involve computers or the web.

In this chapter, we will focus on the relation of technology with the field of entertainment, and more specifically with games, and try to analyze in what ways children could benefit from and contribute to the design and creation of games that better meet their needs. In this vein, we will firstly identify the difference in playing and making games –instructionist and constructionist approach correspondingly. Continuing we will mention existing models of children's role in the process of game design and try to adapt or even complement them so as to reflect the requirements of the platform that we propose in the end of our master thesis. Following, we will elaborate on programming languages for microworlds and simulations as well as graphical game creation tools andenvironments that are currently available and we will end up with an analysis of rule-based programming languages and conceptual specification languages.

5.1   PLAYING OR MAKING GAMES?

The cheap and ever-present nature of technology allows children worldwide to spend a significant amount of their free time in digital gaming. As we presented in the previous chapter the interest in incorporating an educational content in some categories of digital games is constantly increasing. The phenomenon of digital games possesses a notable place among modern entertainment activities and this is proven by the huge amount of time spent in front of the screens. However playing digital games is not simply a pass-the-time activity; it involves psychological and intellectual engagement and keeps the interest of the participants in high levels while offering novel experiences that increase their knowledge. As we have pinpointed several times before in this master thesis, digital games are an indispensable part of modern technological society and have the power to formulate behaviors. In this section we will go one step further and claim that not only playing but also making digital games can contribute the most in learning and education. Instead of incorporating educational content directly in games, we will elaborate on another approach that is based on provision to children with the opportunity to be involved in creating their own game, looming to knowledge from a new perspective.

 The focus of the majority of both designers and commercial companies is on making games for learning. They seize upon the fun nature of entertainment games in order to design highly-motivating educational games that would appeal to students and facilitate learning. Few educators and designer opt for reversing the relative positions; instead of playing why not making games for learning? Before proceeding with analyzing and proposing a framework of game authoring in educational content, we will briefly refer to the contructionist perspective–making games.

Constructionists do not deny the effectiveness and valuable support of educational games; they just follow a different approach on how to implement Digital Game-Based learning. Instead of intergrating d the desired content in the games they simply provide children with

the opportunity to create their own game. Although constructionist approaches are not as widely-used as instructional approaches, they are really promising in transforming boring and passive activities into fascinating and actively engaging experiences that are interesting in a way that makes children think of new ideas and that changes their attitude to educational processes.

Applications of constructionist patterns can be found in a variety of fields including math education, science, computational literacy, and engineering education. Several studies have been conducted, in which children were asked to design their own games, create their own character, stories, themes and interactions. These studies have shown game creation to be a powerful vehicle for both genders and all learning types to develop an effective mechanism of assimilation of the educational content and develop problem solving skills. Their prominent finding though is that children enjoy making games for learning ; and the most interesting remark is that designing/creating games is not that costly as most people think; the majority of the environments that allow children to create high quality games are unexpectedly affordable for educational institutes.

Although the domain of digital games design is thoroughly examined by the whole educational community, little consideration is given to constructionism. The few efforts focus on designing constructionist environments that give children the role of game designer. Programming environments facilitate the process of skillfully handling and controlling media so as to introduce children in programming. These environments generally motivate children to actively participate in Digital-Game design. The emerging hype in Digital game design is introducing constructionism not only in such environments that develop the programming and design skills of children but also in the gameplay of popular commercial games. Already many commercial games provide level and character editors –totally novel features in digital entertainment- to enhance their playability. Commercial designs could thus be used to incorporate constructionism prototypes for educational purposes. So the playing of video games could also benefit from a constructionist design. Popular commercial games via incorporating constructionism can be efficient and high-powered means for identity molding and problem-solving skills development.

This new approach suggests a redesign of these games based on constructionism. A new set of design strategies should be developed that would provide players with the opportunity of character construction, a mechanism for creating new artifacts to solve problems and a system for sharing games and artifacts. Each player should be given the opportunity to construct his own solutions, follow their own pattern through the different levels and adjust the game-environment according to his own wishes. Character construction would allow players to embed in their virtual personification their own idiosyncratic characteristics, leading to the formulation of a well-defined personal identity. Furthermore instead of providing well-rounded objects that decrease the challenge in gameplay, commercial games could give players the opportunity to proceed with a systematic design of their own artifacts based on a smart combination of various components that the game would provide. These new and self-constructed artifacts could then be used in order to successfully solve the problems that players encounter during the games; the construction process would allow them to look at a specific problem in a closer and more exhaustive way. A medium for sharing their constructed characters and objects as solutions to problems would formulate a new community of learners around the game. In this community players could exchange design/creation ideas and methods via conversation and sharing. In this master thesis though, we will not provide a specific model for transforming commercial games into effective constructionist environments.

Recent studies on the domain of digital games want children to have an active role in the process of designing and creating digital games. A shift is taking place, and emphasis is now given on players' needs and wants rather than on designers' likes and desires. The ever-growing competition within game industry has also contributed to this, as companies are now striving for creating games that are more than welcome by the young buyers. In this context, many studies are focusing on the ways that children could get involved in software –and more particular game software- design. Following, we will refer to different models that have emerged trying to categorize kids' role in application design and try to relate one of them with the platform that will be designed in the context of this master thesis.

5.2.1   USER INVOLVEMENT IN APPLICATION DESIGN

Many different views exist concerning the role ultimate users should have in the design process. Most of them agree that taking advantage of users' expertise can enhance product quality, while their involvement in application design gives them a sense of responsibility and empowerment. Other studies come to add that user involvement is linked to increased user satisfaction, since the people who are finally going to operate and use the application, involved in the early design phase, determine the requirements based on their needs and desires. Thus, the danger entailed in the process of retrieving requirements from stakeholders is minimized. Furthermore, as Kensing & Blomberg (1998) assert, user involvement in the design process is a prerequisite for the design of a good product.

Kujala's (2003) model, a graphical representation of which can be found in the figure below, suggests that user involvement aims to enhance system acceptance, something that comes as a consequence of the fact that user participating in the process will gain a better understanding of the system. To this we should add that participation can be a value in itself, as it gives user the sense that their opinion is important and that they have a say in the final product. But the most important factor that enhances system acceptance seems to be system quality- including aspects of usability, usefulness and performance.
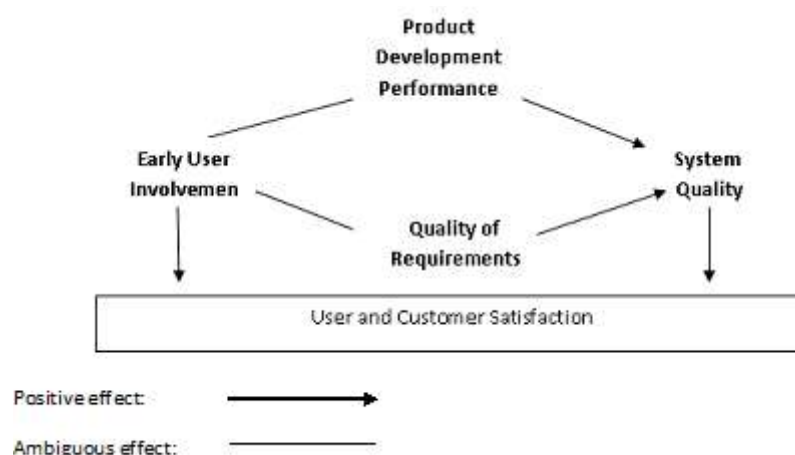

FIGURE 3: KUJALA'S MODEL

According to Good & Robertson (2006) as well as ISO 13407 (1999), user involvement in the process of software design can take place in any of the following phases:

- Gathering initial requirements: It can be achieved with ethnographical and observation-based methods, verbal narrative methods, documentation with photographs, hands-on or art-based methods, task modeling and game-like methods.
- Developing the design solution
- Evaluating the final outcome: Two options exist for the method to be adopted when evaluating the final product according to Gediga et al. (2002). These are 1)descriptive, taking place in the course of user-centered development and including behavioral, attitudinal evaluation as well as usability testing and 2) predictive, which involves experts rather than simple users, while aiming to create more general guidelines for future applications.

It is important to note that user involvement is encompassing user-centered and participatory design, methods that have been largely used in the design of office applications and production tools to create solutions that aim to facilitate the way people are working. But when it comes to designing software for children –such as games or educational applications-user centered design can be renamed to learner-centered design. With the goal of achieving a higher level of entertainment – more effective and efficient learning will come as a result- communication and interaction of the team members as well as the roles and responsibilities they undertake come to the surface, highlighting the important role the functioning of the design team has. A more thorough analysis of kids' involvement in designing games and software for children is performed in the following subsection.

5.2.2   MODEL OF CHILDREN'S ROLE IN DESIGNING GAMES

As Papert argued, in his classical Mindstorms, computers, if used correctly, can provide children with a variety of new opportunities for learning, thinking and growing emotionally and cognitively. Despite the fact that the above phrase sounds more than logical, it must be admitted that in practice, embracing latest technological achievements into kids' –in and out-of classroom- daily activities becomes often of greater importance, while correct usage of these is hard to be achieved and often overlooked.

Apart from the important role that teachers and parents have in guiding children towards correct and beneficial utilization of technology, systems should also be designed and built in such a way that they do not leave much room for incorrect or harmful use. In this context, understanding kids' interests, likes, dislikes and the norms that master their communications and interactions with others as well as with applications could help a lot. Providing children with a system that successfully meets their requirements and brings satisfaction, reduces the possibilities for them to engage in its exploration, and be confronted with harmful, delinquent paths. The fact that designers often ignore such aspects, and see children like 'short adults' leads to inappropriate or insufficient applications that prohibit them from enjoying the benefits that technology can offer.

As Druin characteristically asserts, designers often consult parents and teachers about children's preferences rather than asking children themselves. Children though, have their own likes, dislikes and habits which might be very different from adults'. Their psychology and way of observing and interpreting reality are very special. Such aspects should be taken into consideration when designing and building systems for children. Being aware of this and attempting to create games that are contextually relevant to kids, scientific communities have started moving towards methods that try to actively engage children in game design,

so that they are able to offer their viewpoints and insights in all three dimensions of the triangle effectiveness-engagement-viability.

Importance of kids' input in the process of game design and development is increasing, as the competition in game industry grows. After all, the goal of any game is to entertain, challenge and engage children to meaningful activities that enhance their learning and kids seem to be the most appropriate group to give input on ways that the aforementioned goals can be achieved. Thus, children-centered approaches for looking at technology are becoming more and more popular within the fields of HCI – Human Computer Interaction-, while instead of just studying the impact that technology has on children and their learning, recent researches focus on the roles they can play in game design industry. The shift in the way we see kids – from passive target group to active participants of game design and creation- requires us to emphasize on aspects such as personality and individuality of children as well as social relationships and environment-driven activities. Focus is shifted on children's needs and desires, who, as active participants, can direct their own activities based on their own culture and experiences (Chung & Walsh 2000; Hujala 2002).

Espousing Downes' view that children are adults in preparation, listening to and even collaborating with them is essential. After all, it is through this process that children will feel empowered and develop their self-esteem and sense of responsibility. Furthermore, Clark (2005) claims that 'listening to children' is a fundamental stage in participation. Giving children a voice in the creation of applications that are developed for them sounds natural and logical -this is what will allow them to make decisions about issues that concern them.

When involved in the process of game design, children can offer their view and expertise concerning usability -navigation, ease of use, help functions-, functionality -important features as well as sound effects-, appearance -colorfulness and layout-, usage -ways of interaction with application and real use contexts- and learning effects –both by designing and playing games. What needs to be pointed out though, is the fact that collaboration in order to be effective must follow the establishment of, understandable ways to represent design solutions. As research indicates (Kensing and Munk-Madsen, 1993), communication in participatory involves three domains of discourse –user's present work, technological aspects and the new system- and takes place at two levels: abstract and concrete. After all, when children are involved into game industry, the main objective is to transform the abstract knowledge they master, into a concrete form understandable by adult participants.

Initial steps in the process of engaging children to the design of games, were trying to involve them in testing applications before their release. It was later, in the 70's, after the development of programming languages such as Logo and SmallTalk, that children's role became more active. Since then several models have been developed in order to identify the role children can have when participating in designing and/or creating applications, varying from idea generation to content creation and evaluation of the final outcome.

Below, we present Francis and Lorenzo's (2002) classification concerning children's involvement in city planning projects. This includes different views and approaches varying from seeing children as planners with no adult participation at all to having children being represented by adults -rather than actively participating themselves. In the table below, we represent the proposed dimensions of children's participation, together with their goals and a short description.

Dimension	Goal	Description
Romantic	Child-defined outcomes.	*Children are the planners.* *No adult involvement.*
Advocacy	Promoting children's interests via adults.	*Children are only advocated for the decision-making process.* *Adults act as planners for children.*
Needs	Defining and incorporating into decision-making process children's needs.	*Children's involvement in the process is not considered essential. Their needs can be identified based solely on research.*
Learning	Emphasizing learning as an important impact of participation.	*Children are seen as learners.* *Results of design process may be secondary to the goal of learning.*
Rights	Protecting children's rights to participate.	*Children must be empowered and act as citizens in a democratic environment.*
Institutionalization	Children's participation within institutional boundaries is essential.	*Children are seen as adults.*
Proactive	Planning together with children –in parallel with child-centered pedagogy.	*Children and adults have both an important role.* *Research and participation are combined for a better outcome.*

TABLE 15: DIMENSIONS OF CHILDREN'S PARTICIPATION

Further researches, held in order to identify the roles children adopt at participatory projects, after studying kids' participation in a children's parliament, came up with the following roles:

- Change-oriented: Children adopting this role, see participation as a chance to communicate with decision-makers.
- Critical: Children are tackling everyday issues.
- Activity-oriented: Children are dealing with concrete activities.

- Child-centered : Kids who are considered to be child-centered are inclined to coordinate with children, without being forced by adults.

This implies that children can get motivated either by the idea of changing things in general or in everyday life, while other kids can find a stimulus in the process of participation or in the chance for interacting with other children without adults' supervision. In any way though, it is adults' role to determine and establish the participatory framework that will enable certain degrees of participation and interaction among the children. Furthermore according to Kiili (2006) children need adults' support and assistance for practical issues as well as for recognizing their efforts and providing them with rewards.

For the purpose of our master thesis, we will propose the design and development of a platform that will be built upon the notion of having actual users as participants. More specifically, children themselves will be the designers and authors of the games that they are going to play. This will enable us to incorporate children's useful insights into the platform, something that will prove to be really helpful, since children – a quite special group- know better than anyone else their interests as well as the way they learn new things. It is true that it seems quite hard for an adult to get into kids' psychology and manage to understand their likes, dislikes and wants. Apart from that, as we already analyzed, user involvement in the design process is associated with many benefits in the final outcome, as well as in the process of designing and developing the final product.

The role of the children and the extent to which they will be involved in the game authoring process are very important issues that need special attention. For the purpose of our platform, children are encouraged to actively participate in all phases of game authoring-from requirements gathering to testing and evaluation of the final outcome. Guidance will be provided by some kind of administrator, who will undertake the tasks of supervising children as well as provide feedback in a sort of question list or forum. Of course children can also provide the same kind of feedback in case they have the knowledge, since they will be able to answer to question lists or participate in forums. Thus, a dual aspect of collaboration evolves, including coordination between children as well as between children and administrator.

We will base our analysis concerning the different roles that children can acquire in game authoring process, on Druin's model of Children's Roles in Technology Design. According to Druin the roles children can have in design process can be placed in a continuum from users to design partners. The categories as specified in his literature include:

- Users : Having children making use of existing products, we can study the impact these products have on their learning and generate new ideas for future technology.
- Testers: Having children involved in the testing process of new products can provide us with immediate feedback to guide design. Again the role of child is limited (initial ideas from adult).
- Informants: Children get involved to the design process and contribute either by giving their ideas in concept design or by using an existing application while being observed. Still, adults are the ones who take the final decision, raising fears that children will feel ignored. Children can get engaged in dialogues with adults.
- Design partners: Children as design partners can get regularly involved to different parts of the design process, introducing their expertise, with the rest members of the design team facing them as equal peers. Collaboration between children and adult members –both generating and working on new ideas- is a crucial factor for success.

It must be admitted that, in practice, the line between the different roles is often fuzzy, especially when it comes to identify the differences between informant and design partner. Furthermore, we mention that each of the aforementioned categories includes any the previous ones. The nested structure of the different roles is represented in the below:
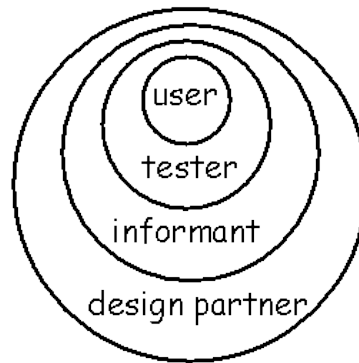
The Child as...

FIGURE 4: DRUIN'S MODEL

For the purposes of our master thesis, we extend Druin's model to include a fifth category, which corresponds to the role of a child as a designer and developer of a game, and will be named '*Game author*'. *Game authors*, will take decisions on their owns – or by collaborating with group members when working in groups- concerning the design and development of the game. They will have full responsibility of the design and development process while adults' role and participation will be minimized. A schematic representation of Druin's revised model can be found in the figure below:

The Child as...
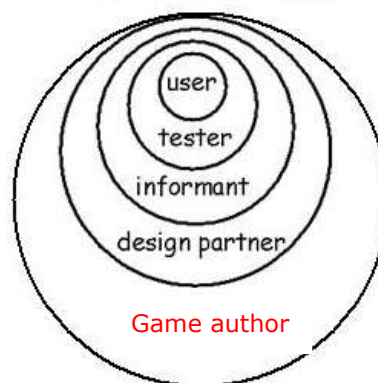
FIGURE 5: DRUIN'S ADAPTED MODEL

Motivation of children is a vital factor that affects their involvement in the project. Thus, children must find it appealing, challenging but at the same time doable to get involved in the project as *game authors*. The fact that children will participate in a real application that will consist mainly of children's products is a strong stimulus for them, as it will foster the sense of creativity and responsibility. In general, people- and especially children- like to know that their products will be published for use and view by other people.

We will try to foster a player-created content approach, in which children-as players- will determine the content of the games they will be engaged to, even though approaches that involve players in the whole process have not been adopted in game design yet. The reason why we suggested the new role of *game author,* is because we believe that players' participation in design and development/creation of games has the potential to elicit actual preferences and insights. Incorporating content creation perspective into our framework/platform, including player-created content and child-centered pedagogy aspects, will enable children to create and share concrete elements and patterns with other children/peers while thinking of their own learning-what they find more interesting and how they can get motivated.

This active participation of children in creating the games that they will play, will result to great benefits for them. According to Cherry and Macredie (1999), design process when conducted by groups of people –users and designers- who collaborate, can benefit both users and designers providing them with insights of each other's points of view. Despite the fact though that the advantages from involving children in the game industry have been recognized by both educational and design communities, steps for promoting their actual participation are taken quite slowly. In other words, children are often sidelined when it comes to evaluating their opinions. In the following subsection, we try to analyze the reasons why such an attitude that marginalizes children is adopted.

5.2.3   WHY CHILDREN'S ROLE IN DESIGN PROCESS IS MINIMIZED?

As it was introduced in the previous chapter, despite the fact that the benefits that stem from kids' participation in game design process extend not only to children's learning but to the quality of the final product as well, current trends in game industry, seem very reluctant in embracing this special group in the process of designing and creating games and applications. Generally, experts find it quite difficult to involve children in the design process and collaborate with them. The most important reasons that come to explain this stance are listed below:

• Children have school duties and activities that consume most of their time.
• Adults often degrade the role and capacity of children. Existing biases and traditional power structures want children to be less productive and efficient because they lack expertise and knowledge. Moreover they support the view of an 'all-knowing' adult and an 'all-learning' child.
• Young children find it difficult to express themselves and verbalize their thoughts. This implies that despite the fact that children usually are very concrete and specific when they express their opinion on a certain thing, often what they say needs further interpretation.
• Such aspects make it hard for children to have a say regarding the technologies they prefer as well as the features they would like to see.
• We all tend to think of children as dependent on parents and teachers for living, learning and acquiring experiences.

Despite the aforementioned reasons though, game industry should realize the significance of incorporating children into design groups. Attempts to empower children have started a long time ago with the introduction of programming languages that address to young developers and graphical game creation tools that allow children to come up with an entirely new game of their imagination. In the following subchapter we will delve into such

tools and try to analyze existing market trends as these are determined from current needs and requirements.

5.3   GAME DESIGN AND CREATION ENVIRONMENTS FOR KIDS

As mentioned in previous chapter, technological explosion is accompanied by many shifts to societies' organization and function as well as to the skills people need to acquire, so as to cope with the requirements of current work environments. In such a transitive framework, the need for computer literacy seems to be increasing, rendering the ability to communicate and act digitally, of the same importance with the ability to count, write or read. Children, as 'adults in preparation', need to strive for the training of skills that will enable them to successfully enter into adults' world. In this vein, learning how to constructively use the computer, so as to become active participants in the process of producing content –movie, music, web site etc- is of crucial importance.

According to the National Academies of Science, a set of FITness skills (National Research Council 1999) are defined, corresponding to capabilities students must acquire so as to use technology in near future. These include engagement in sustained reasoning, management of complexity, testing solutions, organization and evaluation of information, collaboration as well as communication with other audiences. In other words, students must be able to gather and apply data to solutions. They should be in a position to deal not only with present problems but with future, unpredicted challenges as well. School environment can play an important role on fostering students' creativity and imagination, providing learning methods and tools that allow them to elaborate and test their ideas.

In this context, we should note that computer programming is an efficient medium that can foster students' creativity and encourage them in developing, expressing and communicating their own ideas. Recent studies reveal the merits of learning through computer programming –many of which are not limited to practicing programming skills but have a more general applicability to other fields as well- and relate it with the constructionist approach in learning. For example, while involved with the creation of program algorithms students practice their reasoning skills as well, while several programming problems need good knowledge and understanding of mathematical concepts.

Having recognized the benefits associated with computer programming- and more specifically with game programming- educators are trying to incorporate it into classrooms. Papert's vision of programming as a vehicle to learning and fluency in information technology is now being realized. Firstly with the use of Logo, students are enabled to explore art and natural languages, while Kafai (1996) proposed paradigms for helping students learn about maths as well as social skills through game programming. More specifically, he suggested a model in which older elementary students, using Logo, develop mathematical games for younger ones. KidSim or Stagecast Creator, introduce children to the concepts of modeling and simulation and help them overcome the barriers that other programming environments impose. Other tools and game construction kits also exist that aim to introduce programming into the curriculum. In the following subchapter we will analyze the ones we found to be most popular among the educational community.

5.3.1   END USER PROGRAMMING LANGUAGES AND GRAPHICAL GAME CREATION TOOLS

Stagecast Creator: Rated as the top choice software, Stagecast Creator is an open-ended program that can be used by students, as young as eight years old, both in and out-of school environments –in computer labs, classrooms, technology camps and homes- to develop problem solving skills. It is related with benefits such as building of higher order thinking skills, and fostering deeper understanding of the subject matter, by deeply engaging students in the learning process. Furthermore, recent studies, want students who get involved in the creation and modification of simulations, to score higher on standardized tests at mathematics.

More specifically, based on the idea of learning by building things, Creator enables students, of any grade level, sex or culture, to create interactive simulations for math, writing, science, social studies and other subjects. Being easy to learn, it combines creativity and thinking skills development, fostering the imagination of young students. Children like it because they can create visual simulations, just using the mouse. There is no need to have knowledge of a specific programming language. They can create their own projects, consisting of characters that they import or draw, using available tools. Furthermore, options to add text, sounds or animations as well as variables that measure properties of the characters created -such as energy or score- are available. Pointing and clicking with the mouse instructs characters how to behave, determining rules of behavior. These rules can be specific for mouse or keyboard input. Directions on the creation of rules are available through a self-paced, interactive tutorial that children can consult any time. The figure below represents part of this tutorial consulted by a child in its effort to create a rule.

FIGURE 6: STAGECAST CREATOR TUTORIAL

When opening the Creator, users are asked to select one of the available actions –create a simulation, open a simulation, learn Creator or quit. The screenshot below depicts the initial screen:

FIGURE 7: STAGECAST CREATOR HOMEPAGE

Choosing to open a simulation, users can see the simulation on the screen, edit it –by double clicking any item- change it or play it. Creating a simulation means start from scratch with the development of a new simulation, while learn Creator opens the tutorial. After finishing with the game creation or editing, children can play the games they have created, while collaboration between students becomes also possible, as simulations can be shared –for play or modification- by publishing them on websites. Currently, many schools have already embraced Stagecast Creator into their curriculums, as it gives students the challenge to deal with both science and technology issues, while educators are sharing their lesson plans online, so that they can be used by other teachers in their classrooms. Furthermore, computer camps, in their effort to introduce young children –aged between seven and ten years old- to game design and creation, are also using the Creator, a tool that promises to equip students with skills necessary for thriving in today's and future world.

StarLogo TNG: Being the next generation of StarLogo simulation software, StarLogo TNG, is powerful tool to create agent-based simulations and video games. Bringing a lot of innovations -such as 3D graphics, keyboard input as well as a blocks-based programming interface- it introduces a graphical programming language together with a 3D reality, which increase ease of use and learnability.

More specifically, as a game making tool, StarLogo TNG offers StarLogoBlocks, a visual programming language, inspired by LogoBlocks, in which colored blocks represent on the screen language elements –pieces of code. These StarLogo blocks, fit together forming a program in the same way that pieces of puzzle fit together forming a picture. Once organized by children, the blocks are read to set the game in Spaceland – a 3D view of the world. This visualized programming environment is really helpful for young children-often novices in computer programming- since it enables them to overcome many of the programming obstacles that other environments impose.

Being an instruction-flow language, StarLogoBlocks represents each step in program's control flow with a block. The blocks can be added in the programming workspace by simple

dragging them from the palette in which they are organized. It is important to note that the workspace is organized into the following sections:

- Setup code

- Global operations

- Breeds of turtles.

This organization introduces children to concepts of real programming languages, in which they need to write on separate files the setup code, the executables and the libraries that include the global operations. Furthermore, we should mention that the size and shape of blocks are such that they can only fit with certain other blocks- and consequently commands – with which they make syntactic sense. A graphical representation of the program flow is also provided. The figure below depicts a snapshot of the LogoBlocks interface:
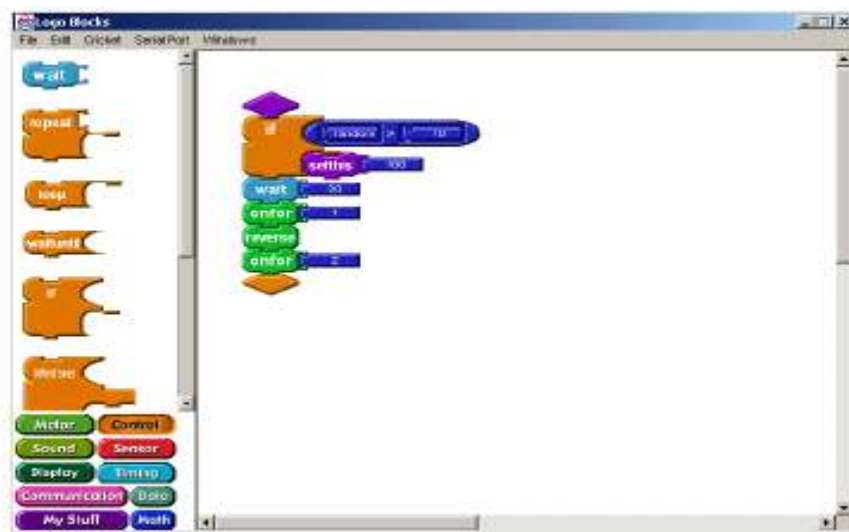
FIGURE 8: STARLOGO TNG LOGOBLOCKS INTERFACE

Below the zoomable interface feature is represented. Using zoom slider, users can easily zoom on the interface and have a closer and more detailed look at the procedure they are writing.
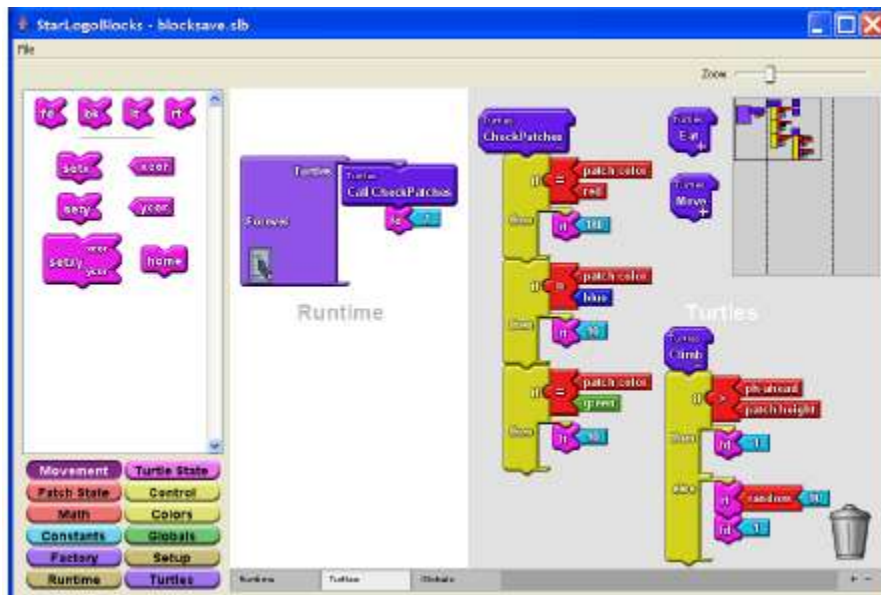
FIGURE 9: STARLOGO TNG ZOOMABLE INTERFACE

StarLogo, developed in MIT, as an extension of the Logo programming language, aimed to help students modeling the behavior of decentralized systems –systems and patterns that are not centrally controlled, but the result of individual interactions between different objects. While traditional versions of Logo allowed the creation of drawings and animation giving commands to graphical drawings on the computer screen, StarLogo allows users to control, in parallel, thousands f similar drawings. The next generation of Starlogo, moves a step further, enabling students to draw and import pictures from files or even import Google Earth models to be used as background. With improved camera tracking –for better gaming experience- and a parallel execution model for better performance and accuracy, it aims to attract more children into game programming. Furthermore, project sharing is now possible, via the new Community Site, encouraging students to collaborate and share their ideas and projects.

Using StarLogo, kids can model many real-life phenomena, varying from erosions to market economies, while they can develop new ways of thinking about decentralized systems, which would otherwise require a deep understanding of mathematic concepts. Thus, for example, modeling erosion , kids get familiarized with the view that large patterns of erosion are the result of many smaller interactions between water drops and soil – as small pieces of soil move, a drop of water flows down and so on.

Feedback from both students and teachers who have experimented with StarLogo TNG focuses on the fact that it is much easier to have a visual representation of the program flow, while they also highlight that they do not have to remember all of the syntax. Fostering the feeling of security among teachers and enabling students to decode programs written in StarLogoBlocks, creates the expectation that the evolution of this program will continue and that integration within learning environments will increase.

GameMaker: Designed to allow its users to engage in the development of computer games, without the requirement of prior knowing a complex programming language, while at the same time giving experienced users the chance to create more advanced applications with its built-in scripting language, GameMaker provides a great platform to take steps into game creation.

The drag-and-drop system, supported by the development interface, allows novice users to create games by visually organizing components in the workspace. These components represent standard actions or simple control structures but users, using the Library Maker, can develop custom 'action libraries'. Giving the chance to create adventure games with simple buttons or graphics and text, it is considered to be the best solution for beginners. A screenshot of the application, in which user has selected the object 'ball_normal' and is customizing its properties, is shown below:
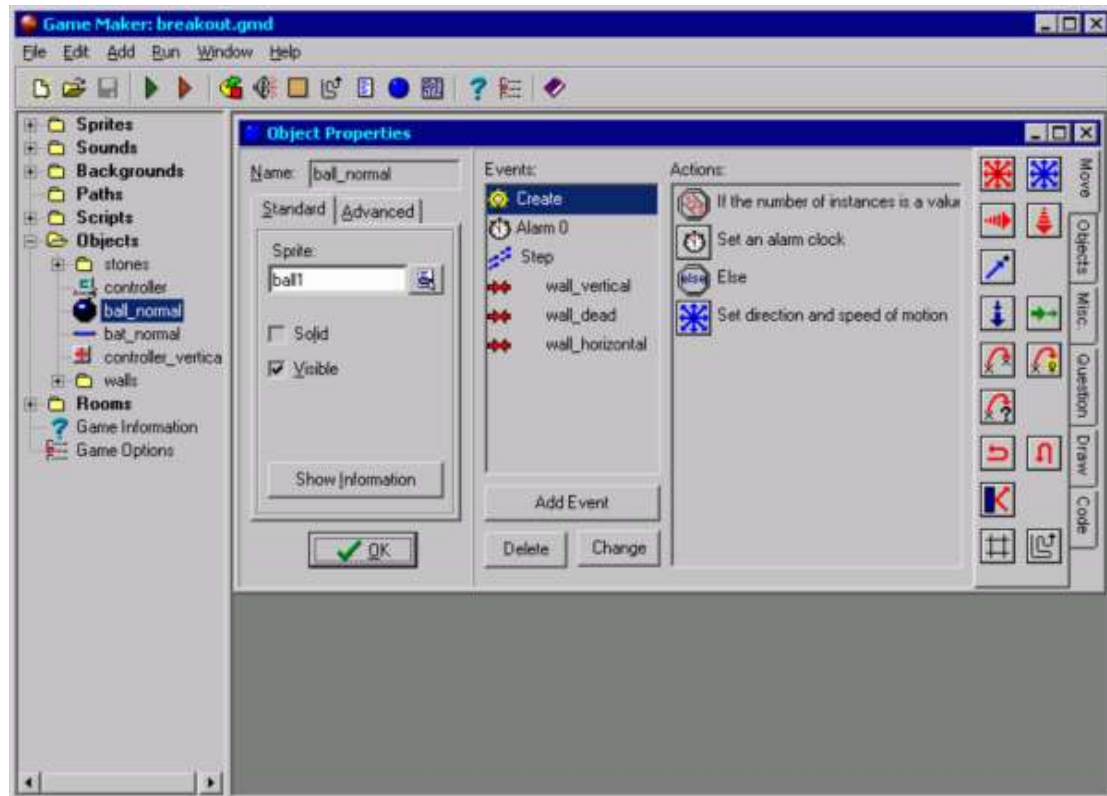
FIGURE 10:GAMEMAKER PROPERTIES' CUSTOMIZATION

As we can see, sprites, sounds, paths, objects and other components are available in the left sidebar. The only thing users have to do is just place the component they want on the workspace and adjust its properties to the functionality they want their game to have. The figure below represents another screenshot in which the user has selected multiple components –room , sound, sprite and object- and has opened their properties' windows for customization.
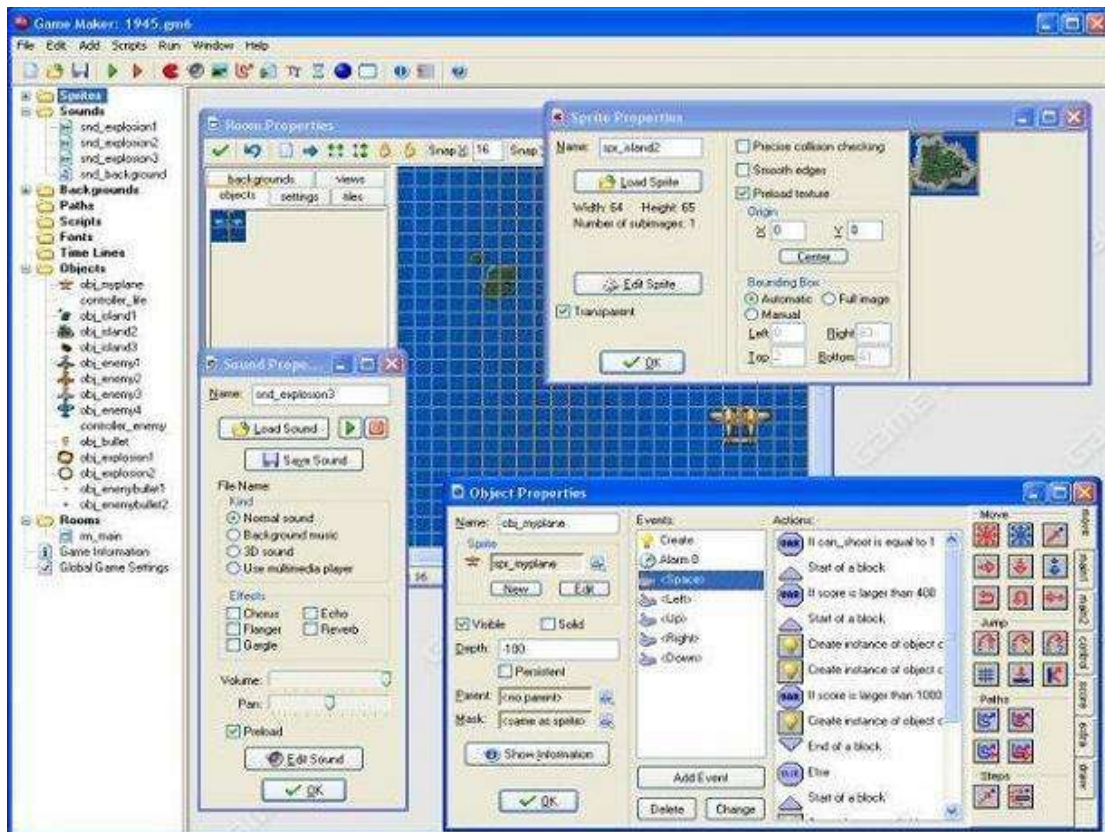
FIGURE 11: GAMEMAKER MULTIPLE COMPONENTS' CUSTOMIZATION

Using the built-in scripting language, GML –GameMaker Language- users can enhance the design of their application and create more complex and professional-looking games such as platform games, massively multiplayer online games or construction and management simulation games. Additional features –such as movies or actions based on player choices- can be added to make the game more appealing, while game creators can also upload their applications on YoYo Game's website and let others play. Furthermore, games can be saved as executable files and thus be used by any user on any computer.

GameMaker is an easy to use card based development system but this does not mean that users will be able to create their games within minutes. On the contrary, as any other application it takes time to get familiar with it. Furthermore, it has size constraints, limiting the applications to a certain size.

Game Maker is offered in two versions: Lite and Standard, with the former one containing most of the functionality that gives users the chance to create and share games –either by creating cross-platform executable files or by uploading them on YoYo Game's website, from where others can download them. Version 8, the latest release for Windows, is enhanced with 3D features –containing more than 500 3D objects- while existing functionality can be enhanced with extension packages such as OGRE.

The Game Maker Community, the thriving forum of users, provides instructions, manuals and opportunities for discussion on Game Maker and games. Users can find solutions to their problems using GMC and this is the reason why Game Maker is attributed as a community-driven tool.

Educators recognizing the benefits that introduction of Game Maker into curriculum could have, have started integrating it in both primary and secondary schools. Children of our

target age group can easily play with the drag-and-drop functionality and create their games based on the icons that are available. On the other hand, older kids can gradually introduce themselves to more complex programming issues, by experimenting with the GML scripting language, something that makes Game Maker, a very good solution for electronic learning environments.

Game Editor: Known as the cross-platform Game Creator, Game Editor is a game authoring tool, which enables its users to design and develop 2D games, using their imagination. Being open source, it encourages users to get, alter and enhance its source code.

Designed to develop games portable across the most popular platforms - iPhone, iPad, Windows, Linux, Mac OS X, Windows Mobile-based Smarthphones as well as Pocket PCs-, Game Editor gives users the chance to elaborate on concepts of game creation and programming, without requiring them to have prior programming experience. Without having to worry about compatibility issues, the only thing that users have to do is create the game end export to the desired platform.

Users who have experienced Game Editor find very comprehensive and flexible the way they are introduced in programming. The window-based interface as well as the available features contribute to this. With each action and event having each own window, users can change properties, while icons indicate the mode they are in. Objects –known as actors- can have either animations, text or sound effects and their parameters can be manipulated by the corresponding window, as it is also shown in the screenshot below:
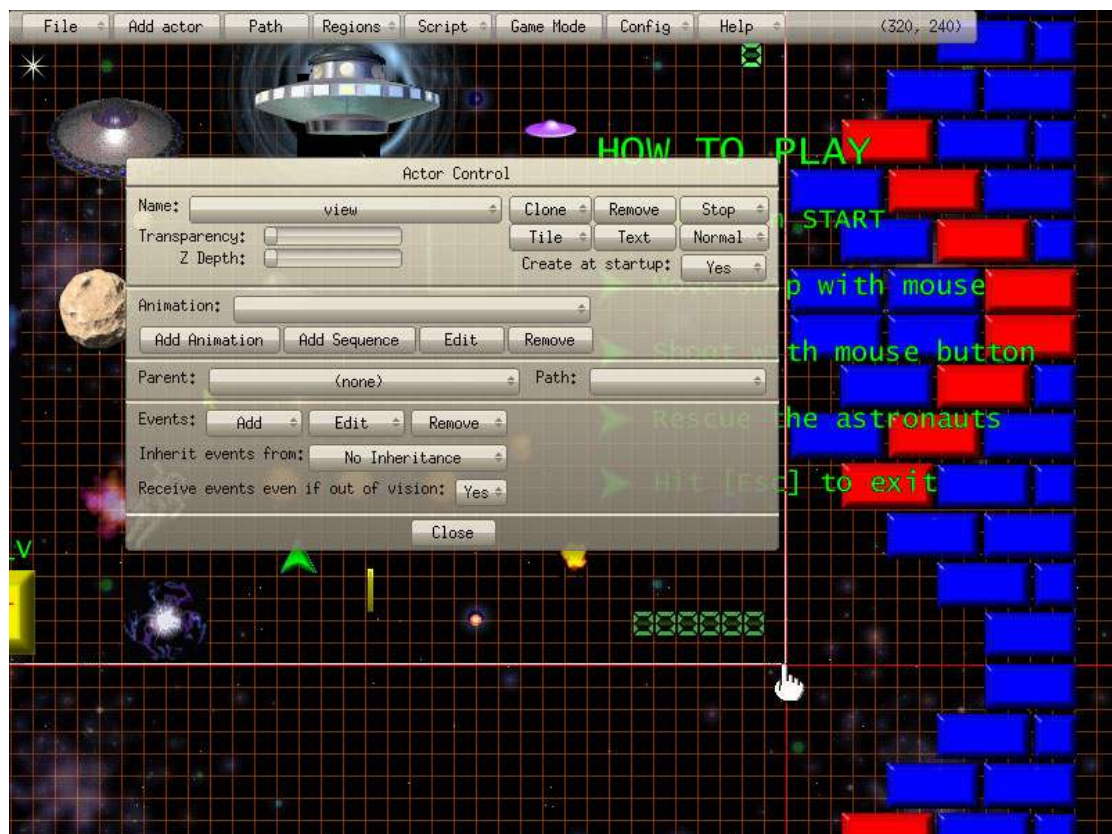

FIGURE 12: GAME EDITOR ACTORS' MANIPULATION

Being event driven, Game Editor, is using the interaction of actors to handle events – activation events, collisions, create, destroy or draw actor, key down, key up, timer etc. Actions that take place on an event can be customized too, while activation events are used

to send Events to Actors when a certain Event occurs. The following figure provides a screenshot illustrating this functionality.

FIGURE 13: GAME EDITOR SENDING EVENTS TO ACTORS

Furthermore, Game Editor is also providing a scripting language, with which users can create scripts through the script editor window as shown below:
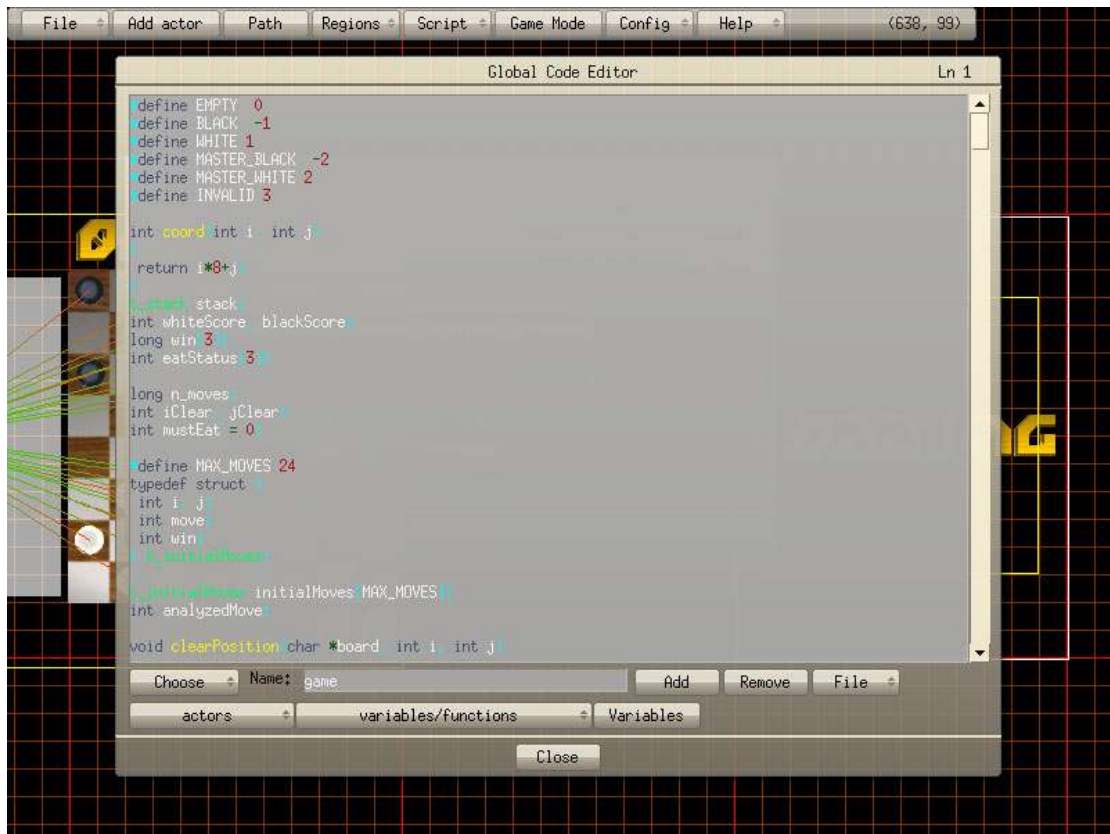
FIGURE 14: GAME EDITOR SCRIPTING LANGUAGE

Scripts are used to define actions that are triggered by events and can be easily written, since the script editor widow is providing access to the built-in names of actors and functions.

Being cross-platform, and flexible in the formats of image and audio it supports, Game Editor facilitates users and allows for quick and easy game prototyping. It is still considered to be a work in progress though, since it is known to have several bugs -such as problems when having many scripts or lacking autonomous multiple file update- a fact that does not seem to affect its popularity as a game development platform.

5.3.2   RULE-BASED PROGRAMMING

The most commonly found definition of rule-based programming describes it as the '*paradigm characterized by the repeated usually exhaustive, localized transformations of a shared data object (term, graph, proof, constraint store,…). The transformations are described by rules which separate the description of the (sub-) object to be replaced-the pattern- from the calculation of the replacement; optionally, conditional rules can have further conditions that restrict their applicability. The transformations are controlled by explicit or implicit strategies.*'

To put it simply, a rule-based program consists of a collection of rules. Each rule in turn, consists of a pattern –describing how the rule applies as well as the actions that come as a consequence of the rule application- and a condition – the constraints that limit rule applicability.

Rules are regarded as a useful programming tool and are used in many different fields of computer science- varying from theoretical to practical implementations. But the truth is that their use is not limited to computer area. On the contrary, rules are used in theorem provers to describe logical inference as well as in protocol access control policies' specifications and database interfaces. Furthermore, they can apply in expert systems, agent systems, software configuration (Linux kernel), software building, semantics, implementation of program transformation systems and other domains, increasing the level of abstraction and separating knowledge from implementation. In fact rules are regarded as partial functions identifying particular actions to be taken under particular conditions.

Using rules allows the advantages of declarative programming, which means that unlike procedural programming, a change in the knowledge base is not propagated throughout the implementation. This flexibility proves to be very beneficial, especially within business environments, which are characterized by the continuous change of rules. In such cases, rule based programming is almost dictated since, enabling to reconsider decisions without rebuilding the program, it helps avoid the costs of changing the source code. Especially, after the emergence of rewriting logics and rewriting calculus, the development of new systems and languages –such as Stratego, Claire, ASF+SDF- enable better understanding and usability of rule-based programming features.

Rule-based systems typically consist of rules also known as ruleset, patterns that make up the inference engine and facts or knowledge base, which is the information used to make decisions. A graphical representation of a rules engine is provided in the figure below:
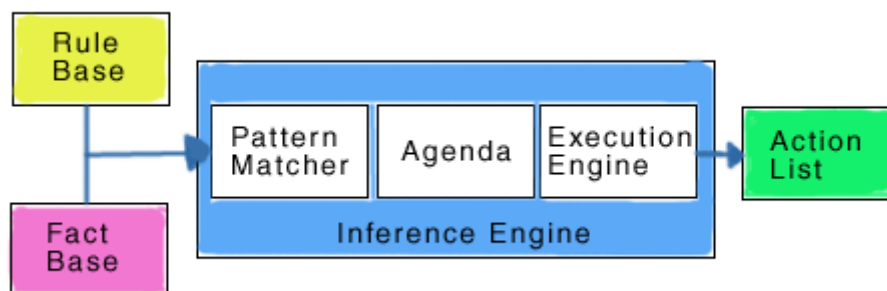

FIGURE 15: RULES ENGINE

Despite the fact that rule-based systems are considered to enhance and facilitate work in variant domains, it is often claimed that they are unreliable, due to insufficient testing. Furthermore, the fact that they are often associated with conflicts- issues of precedence of rules arise- puts further consideration when it comes to deciding whether to use rule-based or other more traditional low-level programming paradigms.

CONNECTIONS TO LOGICAL PROGRAMMING LANGUAGES (PROLOG)

Prolog-PROgramming in LOgic- is one of the first and most popular logic programming languages, having its roots in first-order logic. As such it is based on mathematical logic with the programmer having to specify relations among the data values and then test whether these relationships hold by posing queries to the execution environment. Developed around 1970, Prolog, as any other logic programming language, is quite useful for language parsing

and database applications. It is a descriptive programming language, used within the fields of artificial intelligence, computational linguistics, mathematical logic, relational database as well as design automation.

Prolog unification and semantics were standardized by the International Organization of Standards in 1987. Being declarative, Prolog is using relations –which are represented as facts and rules- to express the logic. Facts express relationships such as properties, while rules are used to infer facts from other facts. The set of rules that a program written in Prolog uses, consists the knowledge base, which is something different from database which contains facts.

 Thus, when a query is initiated, the engine is trying to refute it. If it succeeds, then it is concluded that the query is a logical consequence of the program and the user is presented with all generated variable bindings. The single data type it is offering –term- is used for the construction of the relations and the queries, while for the definition of relations, clauses are used. Terms can be numbers, variables, atoms or compound terms –compositions of atoms and other terms, called arguments. Clauses can be either of fact or rule type.

Treating executions as answering queries with backward chaining, Prolog provides a model of rule-based deduction process. In fact a Prolog program is a set of rules or answering questions that involves utilizing variables, recursions, conjunctions etc. Writing down those rules is the hardest part.

Prolog is widely used in research and education. We characteristically refer to Machine Learning, a field of Artificial Intelligence dealing with computer programs that expand their knowledge with experience. This knowledge improvement is easily achieved with Prolog, asserting new facts and rules to the knowledge base while the program executes.

It is important to note though, that Prolog has not affected the computer area as much as other languages have. The reason for this is that several drawbacks have been identified concerning compatibility issues between major Prolog compilers, limited portability across implementations and high performance penalties associated with programs written in Prolog.

GAME DESIGN AS RULE DESIGN

According to Wikipedia, game design is defined as '*the process of designing the content and rules of a game in the pre-production stage and design of game play, environment, storyline and characters during production stage. The term is also used to describe both the game design embodied in a game as well as documentation that describes such a design'*.

Game creators recognize the following three elements in games:

- Nouns, including elements of the game such as avatars, characters etc.
- Verbs, referring to the actions that players can do, such as jumping, climbing, running etc.
- Rules, creating constrains, relationships and interactions between the nouns as well as limitations concerning the context the verbs can act. This might be the most important element of game design, as the most frequently changing one.

Game design, as a field of computer programming, should deal with all three elements, encompassing artistic, technical and writing skills. Special attention, though, should be given on understanding and designing the rules and game structure that is described by them.

It is true, that introducing the concept of rules in game activities might sound quite oxymoron, as gaming is considered to be a relaxing activity created to offer pleasure and entertainment. Games though, most of the times are goal-oriented, as players are usually required to achieve a specific objective. This is exactly what makes the inclusion of rules indispensable part of game structures. As Juul, in his book '*Half Real*, says '*Rules specify limitations and affordances...rule give games structure*'. After all, rules are an integral part of games. '*Rules are what differentiate games from other kinds of play…. If you don't have rules you have free play, not a game* ', (Prensky, 2001). In fact, games are governed by rules. There exist rules about controlling football games, racing cars, characters' behavior etc. In the end, game players are rewarded when proving their mastery of the game rules.

Salen and Zimmerman, moved towards a classification of rules on three related levels:

- Operational rules: the written 'rules of play', the unambiguous instructions and guidelines that govern the actions of players, blueprinting their experience. In digital games, this is translated into internal and external events of the game.
- Constitutive rules: the structures that underlie the game, existing below the rules that users are presented with. Logical and mathematical by nature, they function as core logic and they are equated to the code that consists the game.
- Implicit rules: unwritten rules that deal with proper behavior and etiquette that players are expected to exhibit within the game activities and define what a 'fair play' is. Because they are not written, they can be often broken, and changed.

Thus, operational rules are built on constitutive rules, while any set of constitutive rules can be described in variant operational forms. It is the relationship between operational and constitutive rules that define the identity of a game. Furthermore, the border between operational and implicit rules is not very well defined, since implicit rules can become explicit, by simply including them in the written 'rules of play'. In any case, the true meaning of game, is considered to bridge the three aforementioned levels of rules.

Game design as a process, consists of world design, system design, content design, game writing and level design. From the aforementioned disciplines, the system design is the one that embraces the creation of game rules, and on which we should focus. More specifically, when designing games, rules have to be set up for defining how characters and template categories interact. Rules, thus, help to establish a framework that fosters discipline within the area of game design. After all as Brian Sutton-Smith in his work '*The Study of Games*' writes, ' *The focus of a game designer is designing game play, conceiving and designing rules and structures that result in an experience for players*'.

Many of the game authoring tools available are implementing the rule-based logic. Thus, for example, Game Editor, asks user to define the event –condition- that will trigger a specific action. The fact that the rule has to be constructed using a visual interface and specific windows that provide certain options to the users does not change their function. This rule-based design of games seems to facilitate designers –especially the ones with limited experience- and result in a clearly structured computer game.

As experts claim, because of the conditional knowledge it embraces, game design can be greatly enhanced when using rules. In this context, proposals for rule-based game engines have emerged. Such inspirations want the game designer to insert rules into the game

engine and immediately test those rules by applying them while playing the game. This will enable them to identify weaknesses and points of failure so that they are corrected. Furthermore, it reduces game programming to the creation of rules according to the game engine's specifications and, in a sense, merges the roles of game designer and game programmer, to that of game author.

At this point we should briefly refer to Inform 7**,** a design system that comes with a programming language and a development interface for creating computer games. Based on a system of rules and rulebooks, it gains attention about its natural language aspects. The development environment is like a book, in the one page of which users write their game while on the other page they play it. Though, I7 still has non-rule-based features such as variables, constants, classes and properties. Hence, as I7 rulebooks are heavyweight structures, game designers rarely define a single I7 constant with a rule.

Currently, new approaches to automation of rules development for computer games that include visual formal rules model creation, verification and model-based code generation, are developed and adopted. Characteristically we refer to a new approach towards automation that is being proposed in Pavlova's paper. In her work she considers the low level of automation as the main reason of the few successful projects in digital game industry and is thus proposing a rules development environment architecture in which rules definition and game graphics definition are clearly separated as it can also be seen in the figure below. Furthermore, rules verification –including aspects of consistency and balance check- is automated and performed at design time so as to prevent the implementation of erroneous design decisions.

Thus, designers are provided with a Graphical User Interface as the rule development environment, in which they can define the rules and alter properties of the model elements. Using a developed domain-specific language (DSL), entities are represented as objects, entity data as object properties and behaviors as methods. Furthermore, reactors can be attached to methods, causing the state of the game to change when executed. The Rules Translator module that is shown in the figure, undertakes the task of translating the created rules into C++ code.
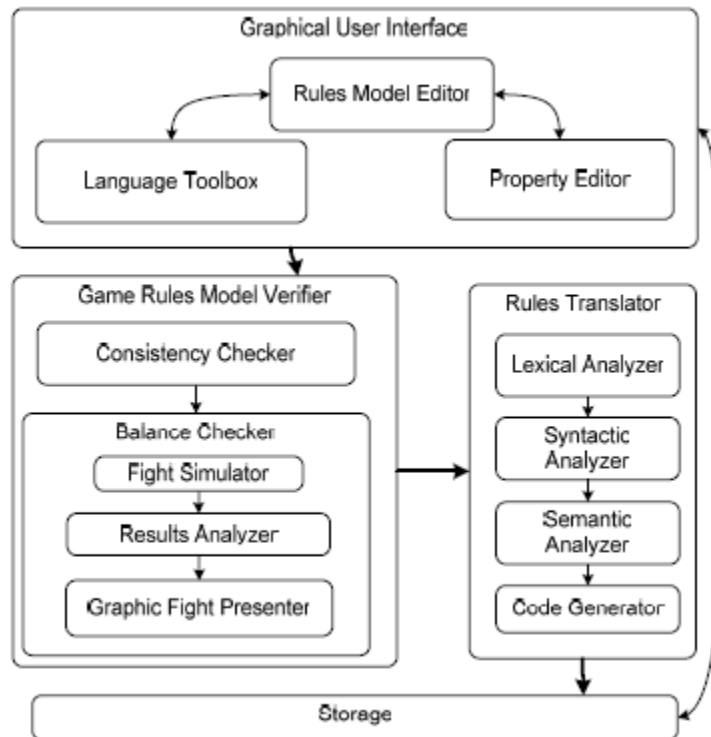
Rule-based approaches are already being used for constructing AI game systems as well. What is special about AI games, is that their implementation is based on behavioral rules, integrating knowledge of a particular domain. This often complicates the task of programming with procedural languages –such as C or C++- as the programmer has to take into consideration all the specific conditions and circumstances that will trigger specific actions, something that results in looping code with a large amount of if-else statements. In this context, RC++ has emerged as the solution that facilitates AI games development, applying rule-based programming to game AI.

RC++-abbreviation for Rules C++- is a rule-based language that extends C++. In particular, by coding collections of conditional knowledge, it succeeds in automating tasks enabling programmers and designers to focus on writing the rules. Furthermore, developers do not have to worry about storing variables or the game state, while adding individual rules is also possible. RC++ programs can consist of C++ and rule source file or solely of a rule source file, as it is possible for C++ and RC++ code to refer to each other. The figure below represents the RC++ compiler structure. We will not delve into a more thorough and technical analysis of RC++. We should mention though that, as all rule-based programs, RC++ games generally consumer more time and space resources.
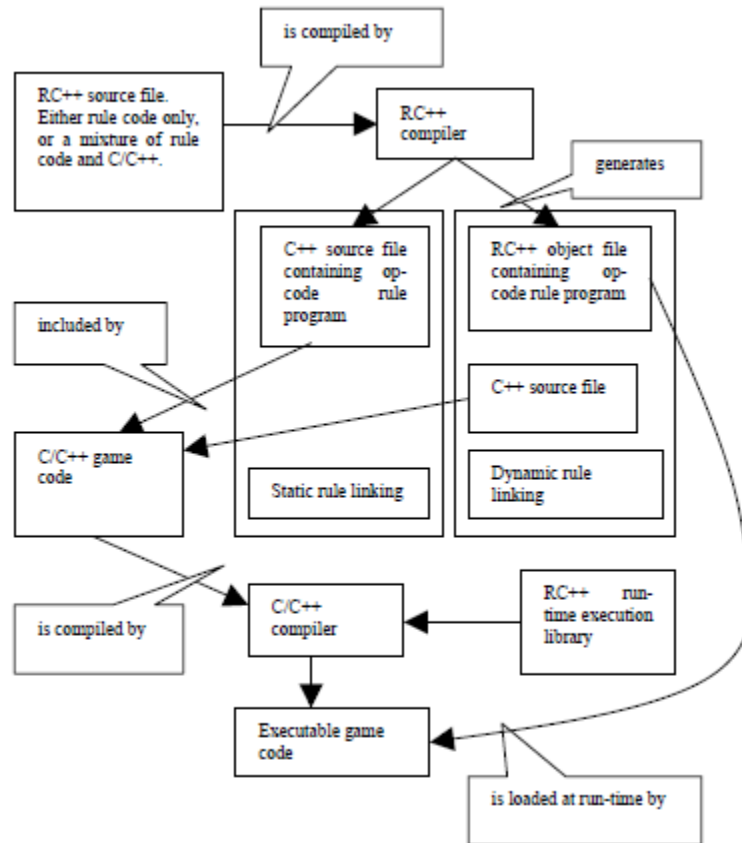
FIGURE 17: RULES TRANSLATOR MODEL

Summing up we should say that the association of games with rules is unquestionable. As Salen and Zimmerman put it '*game is a system in which players engage in artificial conflict defined by rules that results in a quantifiable outcome*'. After all, the emphasis on rules, that define the framework within which players can act, is something that all definitions of 'game' have in common. Rules are considered to constraint players and build the area of possible actions that may take place during the game. This is what Salen and Zimmerman called '*the space of possibility*' –what a player can and cannot do. Attempts for the automation of rules that govern the games are increasing control of the game and this might be one of the major reasons why effort is spent on this. Technical characteristics –such as the capabilities of the programming language that is being used or the platform on which the game will operate- play an important role in this effort. Concerning programming languages, despite the fact that they aim to handle design complexity, they often fail to do this as they lack of methods to express rules and verbs. This might be the reason why current trends in game industry, shift towards adopting rule-based programming approaches, which, unlike procedural ones, enhance discipline and game balance. In any case, we can conclude that even though a rule-based approach is not the sole way to understand games, it must be considered as an essential element of designer's conceptual framework, which will be further analyzed in the section below.

5.3.3 CONCEPTUAL FRAMEWORKS AND GDP APPROACH

Conceptual frameworks are tools used by researchers to identify the problem they are dealing with, frame their questions and generally guide their inquiry. They constitute a kind

of a map that apart from the research question includes the literature review and provides a guidance of the data collection and analysis. In other words, a conceptual framework is a structure that includes assumptions, principles and rules while bridging the ideas that make up a concept.

Several conceptual frameworks for analysis and evaluation of conceptual specification languages- declarative languages dealing with concepts- have been proposed. Characteristically we mention CMSL- Conceptual Model Specification Language- an executable language for conceptual models' specification, used to represent a specific domain –called object system- that has to be implemented in a database. The figure below represents the relationship between the conceptual model, the conceptual model specification and the domain of discourse.
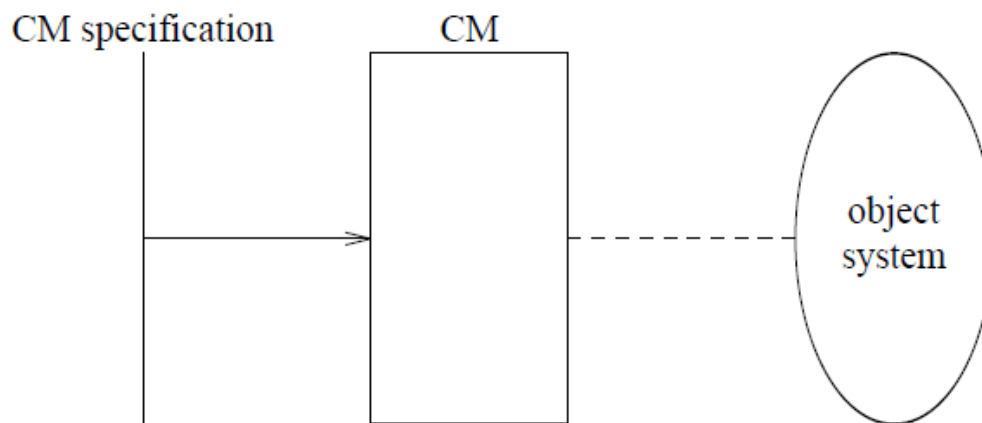

FIGURE 18: CM, CM SPECIFICATION AND DOMAIN OF DISCOURSE

Garris et al, proposed a conceptual framework for serious games- games that engage the user and contribute to the achievement of predefined objectives. An evolution of his model for effective learning through serious games can be found in the figure below.
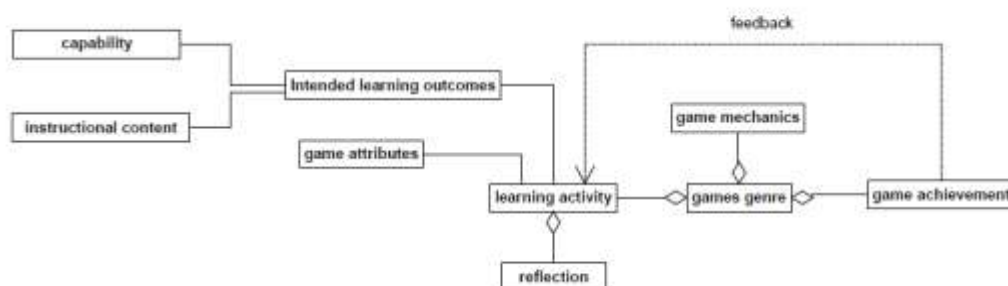

FIGURE 19: GARRIS CONCEPTUAL FRAMEWORK FOR SERIOUS GAMES

An explanation of the components found in the framework that are used follows:

- Capability: the skills that player will acquire when engaged to the game activity
- Instructional content: the subject matter that player will get to learn
- Intended learning outcomes: the goals to be achieved by playing the game
- Game attributes: the game aspects –such as scaffolding, linearity, interaction etc- that support learning

- Learning activity: the gaming activity/task in which player is involved
- Reflection: the part of the game that makes the player think about the purpose of the learning activities that he has performed as well as about the learning outcomes
- Games genre: the type of the game
- Game mechanics: the rules that define the structure of the game
- Game achievement: the level to which the player has managed to achieve the initially set game goals

At this point, it is important to mention an interesting approach, suggested by Barwood & Falstein, who introduced 400 Design Rules project, with the goal of collecting game design rules, known as instructions. These rules, having practical implications, consist of the following parts:

- Imperative Statement,
- Domain of Application
- Dominated Rules
- Dominating Rules
- Examples Aliases

Speaking of game design, we should mention that several attempts have been made, aiming to establish a conceptual model to be used by game designers, so that effective learning is favored. Most of them focus on the utilization of game design patterns that describe both the structural elements as well as the relationships between them. But the question of how can game design patterns support game design often arises.

The main idea behind the decision of adopting a GDP approach –game design patterns approach- while designing games revolves around the creation of a structural framework, in which game components as well as the patterns of their interactions describe how these components can be used by players. In this context, a view of the game as an entity, made up by components that need to be identified, could be the starting point for our model.

The game design patterns project was initiated by Staffan Björk and Jussi Holopainen, in 2002. The underlying assumption that inspired them to come up with such an approach, was that although games are numerous and varied, there exist certain traits that all games, regardless of the genre, have in commonality. These traits are regarded as the '*material for game design*'. Thus, Björk and Holopainen, published a first collection of patterns in 2005, which was later extended by other collections. At the moment, there exist patterns for mobile games (Kam et al., 2007), player motivation (Holopainen and Björk, 2008), NPCs (Lankoski and Björk, 2007), dialogue systems (Brusk and Björk, 2009), and pervasive games (Björk and Peitz, 2007).

Design patterns is an approach to codify design knowledge and provide a shared design vocabulary that is used to describe game elements interaction. They can be used as directions on how to separate and fragment program functions into smaller parts, while providing designers with a way to communicate with each other, document their insights as well as analyze their design. It is important to note that game rules can easily be transformed into design patterns, helping programmers in the starting phase of a game creation project. Not all rules though, can be used as design patterns. Other views regard design patterns as problem-solving tools rather than a tool to support effective design. Thus, according to Alexander (1977) '*Each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same*

way twice'. For the purpose of this master thesis, we regard patterns facilitating and supporting both game design development and problem-solving interaction elements.

In order to extract patterns from digital games, we suggest that a thorough analysis of a collection of digital games is executed, aiming to identify core game characteristics. This analysis can include game rules transformation, recognition and testing of specific patterns within games as well as interviewing game designers about the way game creation is utilizing game concepts. Having defined the design patterns, based on experience and internal knowledge we need to further identify the relations with each other.

A typical template of a game design pattern consists of the following sections:

- Name
- Description
- Consequences
- Using the pattern
- Relations

Work done by Björk and Holopainen, resulted in the creation of a structural framework, which describes the elements of a game, and game design patterns which describe interactions that take place while playing. It is important to note that as they argue '*Although the two parts are the results of an intertwined process they can be used independently; the structural framework can be used without the patterns to describe games and the use of design patterns can be based on other structural frameworks*'.

Regarding patterns as a tool that can be applied in many different cases, in different ways for different reasons, enables different user groups to make use of them. According to Björk and Holopainen, creating neutral design patterns based on interactions of the structural elements of the games facilitates communication and makes it possible for the design patterns to support game design process in any of the following phases:

- Idea generation: using the available patterns, game designers can come up with an idea of a new game or even more often, studying an already implemented game, they can imagine of a way to implement it in a novel manner.
- Development of game concepts: game concepts can be developed using patterns so that more specific and detailed design choices are made by trying to divide those patterns to subpatterns as well as by defining their interactions.
- Pre-production process: the use of design patterns facilitates game presentation to people, and makes it easier for them to make relations with other games that use similar design patterns.
- Identifying competition: studying the examples provided in the patterns, competition aspects -such as what the game will be compared to- can be identified.
- Problem-solving during development: combining designers' experience and knowledge, design patterns can provide solutions to common issues.
- Game analysis: analysis of a game can be achieved going through the collection of available patterns and try to identify which of those patterns exist to a certain game and to what degree.
- Games categorization: games can be categorized, taking into account the similarities and differences that come out after performing a pattern-based analysis.
- Exploration of new platforms and medium: using patterns new types of games –as well as requirements to play those games- can be explored.

After all, the patterns are described as an approach used not only to analyze existing games but to facilitate the design of new games as well. They both describe and analyze common game structures. It is this descriptive nature of game design patterns that enables them to be utilized not only in game analysis but in any of the aforementioned design phases as well.

Furthermore, in their work 'Game Design Patterns', Björk and Holopainen, are presenting a framework for the study of games that is based on game design patterns. Thus, they created a collection of patterns that functions as the basis for initial tests of the game design patterns. These tests came to prove that design patterns are useful for analysis and design of games. As they characteristically claim '*We do not believe that the use of game design patterns is the final solution to finding a common language for ludology. However, we believe that many of the characteristics of design patterns will be included in such a language, and that continued work with design patterns will help reveal truths about game and game play until such a language is found*'.

It should be mentioned that work on design patterns is still considered to be in very primitive stages. Having as a starting point the definition of game structural elements as well as the interactions between them gives us sufficient material to create a conceptual specification framework that can be used for supporting and facilitating the design process. One of the most often problems though when creating patterns, has to do with the decision of how much information a concept must involve so as to be a pattern and not a subpattern of a superior pattern.

Design patterns emerged because of the need for a formalized language to describe and deal with game elements and their interactions in a structured framework. Nowadays, more than ever the game design community agrees that there is a need for the development of formal or semi-formal game design methods and GDP approach is a promising step towards this direction. Alexander's pattern language is a sample of this movement towards pattern-based solutions, while HCI community has also started making use of patterns. It must be admitted though, that despite the fact that design patterns is a useful adaptable tool for analyzing and documenting game elements and design approaches, efforts for defining a canonical pattern language are not effective, as the great variety of existing games harden the task of defining a pattern collection that can be used from all these games. In any case though, the need for a conceptual game language that will enhance both game design and analysis is unquestionable. Game design industry is looking for methods to integrate more structure into the game design process and this can only be achieved by studying games independently of other domains.

Thus, more work is required so as to conclude on a well defined applicable conceptual game language. In the following chapter of this master thesis, we will proceed with the design of a game-design platform. However, the lack of a conceptual game language made us decide not to base our design on the GDP approach.

6   LETSGAMETOGETHER: AN ONLINE GAME AUTHORING COMMUNITY FOR CHILDREN

6.1   INTRODUCTION TO LETSGAMETOGETHER COMMUNITY

In this chapter we will design the community website project '*LetsGameTogether*', the aim of which is to create a social and collaborative environment based on the support of Information technology where children between 7 and 11 years old will be able to play and create games. The website aims to introduce children to the world of game authoring and allow them to feel comfortable with the use of new technologies as a tool for imagination, innovation and creative learning. The ultimate goal is for the website to constantly grow and eventually to contain a collection of innovative games.

As the members of our main target group –kids aged between seven and eleven years old- are characterized by limited programming skills, special attention should be given to the GUI layout and interaction design. In this vein and having in mind the suggested heuristics and guidelines for the design of User Interface mentioned in chapter 3 as well as features described in subchapter 2.5.1**Fout! Verwijzingsbron niet gevonden.**, we will try to provide our website with a familiar look and feel.

 The website is the product of the successful combination of an object and a user centric environment based on the triple game-creating-playing. Based on the Web 2.0 principles it provides a stable environment for game authoring with the active participation of the children. Obviously the game is the centre of the website, which encloses both entertaining and educational functionalities. '*LetsGameTogether*' utilizes game as an object in order to develop a social network. As every object-centric network '*LetsGameTogether*' similarly is based on trading objects. '*LetsGameTogether*' concentrates on game constructions that develop children's cognitive processes, problem solving and design or basic programming skills.

Aiming to facilitate learning, the website revolves around two learning theories: Kolb's learning theory and constructivism. Thus, students involved in game authoring tasks will experience all four stages suggested by Kolb's model ("DO", "OBSERVE", "THINK", "PLAN"). Furthermore, as constructivist theory argues, students will be able to accommodate new meanings by getting actively engaged with the website activities.

 '*LetsGameTogether*' also functions as a medium for sharing created objects as solutions to problems and this develops a new community of learners around the game. So users also interact on the website and develop deeper relationships through the system. The latter is achieved through the existence of user profiles, chat room and forum. Users check friends, co-authors or fans- other users that play their own created games- and share their thoughts or leave messages to strengthen friendships and share game ideas amongst their social circles. Based on the virtual and social network, it protects members' privacy and increases the trust of the interaction. The site includes:

Game: The central element in the website is the game. Games are highly dependent on the functionality of the authoring tool and range from simple games with uncomplicated game mechanics or a plain storyline to a more sophisticated game. We have to stress once again the high influence of the available technology (servers and authoring tool) and of course of the different skills and experience of children on the produced game elements including the story, the aesthetics and the mechanics. The metadata of the game include the name of the author, the version, the status (completed, pending, under evaluation etc), comments, the creation/ update date and the level (1-5) and its category.

Comments and Votes: These refer to the comments that users can add to the games. Users can also vote for a game –to which they are not authors- using the "good", "very good" or "awesome" buttons.

Tools: These include the authoring tool or any other application added to facilitate the creation and sharing of games. In cases that integration of tool to the '*LetsGameTogether*' website is not possible, link to the websites that hosts the particular application is provided.

People and Communities: Each user has his own profile, including any games that are linked to him/her as well as related people (co authors and fans) that are automatically associated to them. The chat section will be the area for meeting children, that could be their classmates or children from all over the world involved in game development and playing. Communication via chat can be done either through text messages or using the 'VideoCall' option that will embrace audiovisual aspects. Moreover children are able to interact with each other through a forum, add comments and/or create their own topics.

The four main sections of the LetsGameTogether community website are presented in the following table and graphically in the Community FlowChart.

	Some basic profile information of the user gender, birthday, email, cell-phone and address
Profile	A list with the game they have created the corresponding information about the item (the creation-date, game category). Users through this page are able to create new games using the authoring tool or manage – edit or delete- the existing ones
	A list with the favorite games of the user (when browsing games he/she has the opportunity to bookmark a game and this will then be presented in his favorites

	A "browsing friends" function. Users can find friends using a search engine and add them as their friend
	A list with their friends with whom they are can chat, make video calls and send messages. They are also to see their profile page
Chat	A list with the co-authors. The system automatically detects authors that work on the same game or on different versions of the and connects them via friendship; this s gives them access to each other's profile and provide them with the opportunity to chat.
	A list with the user's fans. These are automatically also detected from the system and are the users that play or vote for his/her games. The system suggests them as potential friends.
Browse Game	In this section the users can find games and create bookmarks. Using as simple search box they can search for a game and sort the results by relevance, name, date, status and author. They are also given the opportunity to "bookmark" a retrieved via search game that will then be presented as a favorite game in their profile page
Forum	The community includes also a forum, a conversation placed divided into several categories (e.g. casual, action, adventure). There users are provided with a list of the available topics where they can add their comments or add new topics.

TABLE 16: SECTIONS OF LETSGAMETOGETHER

While designing the community website we were concerned with the authoring tool functionality. As we wanted to give development group the freedom to choose and integrate any tool they find more appropriate we decided not to suggest any of the available ones. A list with the most popular authoring tools though, can also be found in Chapter 4. Our suggestion though, relies on using a web-based authoring tool as this will alleviate children from the trouble of having to download the tool locally on their machines, create the game

and then upload it to a server for view and use from other users, a process that encompasses difficulties and dangers for members of the target age group. Further reasons –listed in chapter '*Architectural Design*'- contributed to this decision.
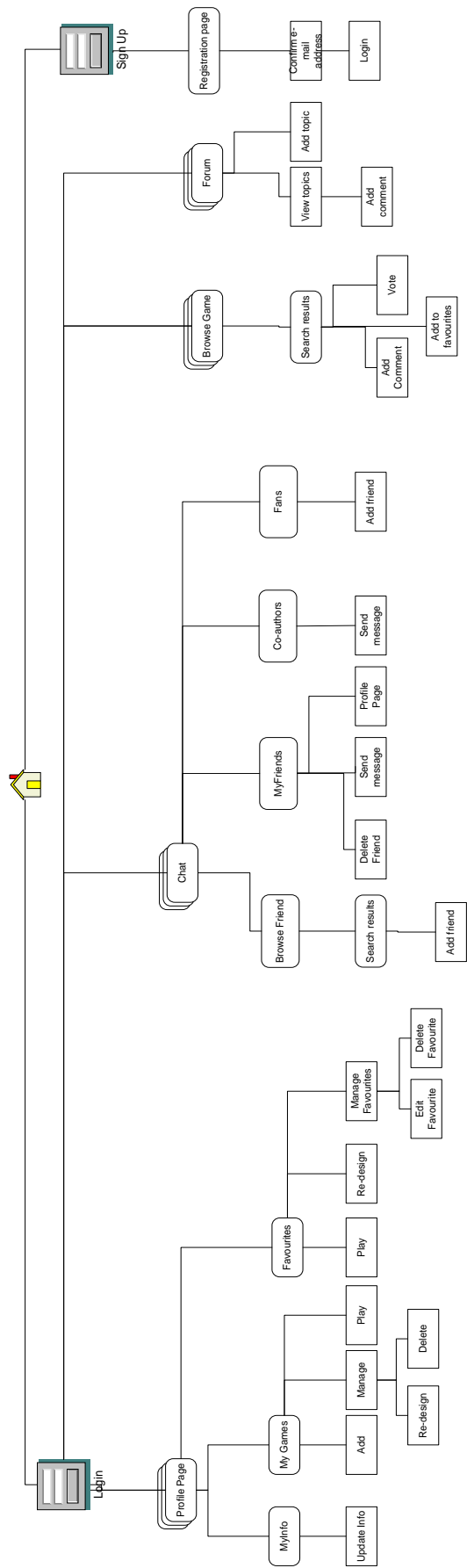
FIGURE 20: LETSGAMETOGETHER FLOWCHART

According to Wikipedia, software design is the 'process of problem solving and planning for a software solution. After the purpose and specifications of software are determined, software developers will design or employ designers to develop a plan for a solution. This should include low-level component and algorithm implementation issues as well as the architectural view'.

Software design is focusing on data, architecture, interfaces and components, and together with software implementation and software modification, is considered to be one of the three fundamental aspects of software engineering that aim to the creation of maintainable and high-quality software. Aspects such as compatibility, usability, maintainability, security and usability –also analyzed in previous subchapter- should be taken into great consideration when designing a software system. Starting at a high level of abstraction, design aims to translate user requirements into features and representations that will be implemented by programmers.

As it can also be seen in the figure below, a good design of software product must be the overlap of three distinct disciplines: Design, Marketing and Engineering so that a 'Customer-driven product concept' arises. This means that the design outcome must be desirable and at the same time useful and usable, reflecting user goals, desires values and motives.

Design

- Brand image
- Lifestyle image
- Ease of use
- Cost of aesthetics

- Ergonomics
- Product interface
- Features integration
- Material selection
- Manufacturing
- Cost of integration

Desirable   Usable

Customer driven product concept

Marketing

Engineering

- Functional features
- Platform
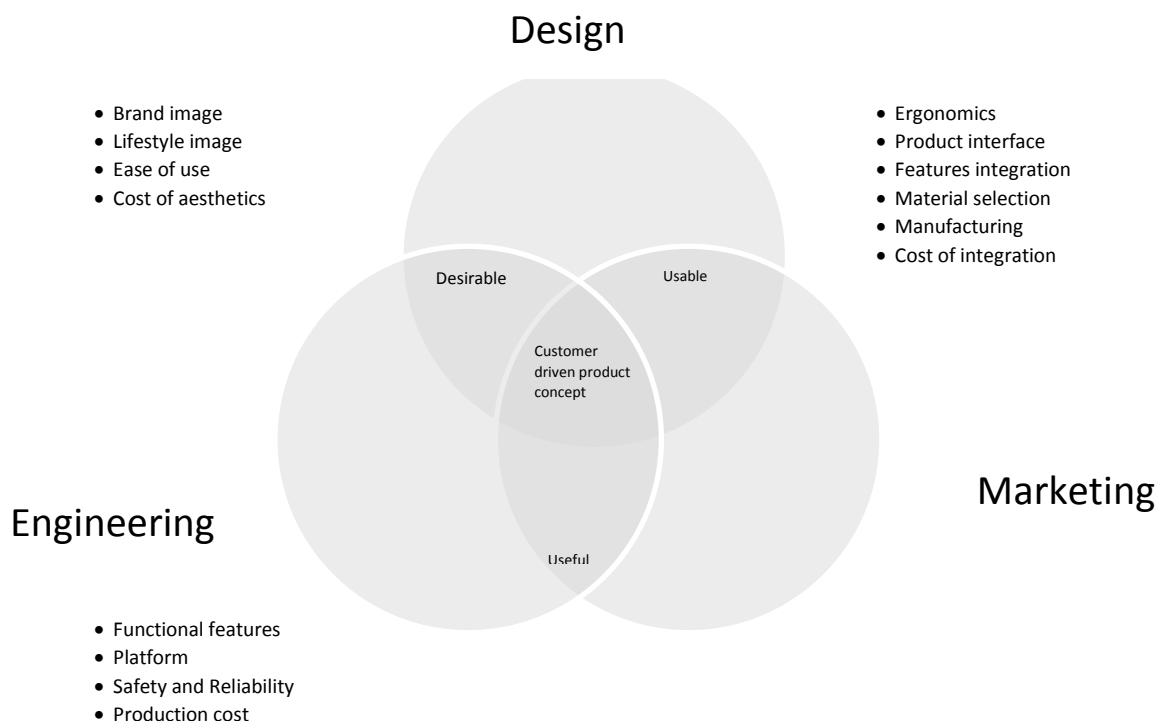- Safety and Reliability
- Production cost

Useful

FIGURE 21: SOFTWARE PRODUCT DESIGN

In the following sections, we will focus on the design of the website community we propose. Our goal will be to create a use-case view, an application model, an architecture model as well as mockups of the final product.

6.2.1   DESIGN PRINCIPLES

The principles described in this section underlie the implementation of the online game authoring community for children. These explicit principles will define the overall qualities and attributes of the resulting community, imposing restrictions on the final deliverable and on the development process and specifying external constraints that the product must meet. They will furthermore ensure that the final community will meet the needs of both the children and the educators.

Archival

Data created and uploaded from should be archived. The LetsGameTogether website should be able upon user demand to retrieve data from an archive. The community should thus provide a system which would allow users to upload your game to community's webhost for other members to download.

Authentication

The LetsGameTogether website functionality including playing or creating games, chatting with co-authors or fans of their own created games, communicating with other users through the forum and searching for games or friends should only be accessed by a user after being authenticated. Users through a form will be able to log-in to the Web Portal. Only after logging in, would a user gain access to all the functionalities provided by the community website.

Authorization

There should be a distinction between the simple users and the LetsGameTogether website administrator. This means that users and administrator(s) should have different privileges. Of particular significance is the account of the administrator since he/she has generally access to all resources and especially all data of the system. The database must support the recording of those privileges by entering the administrator's identity and registration information (user ID and password) of the users that interact with the community.

Compatibility

The LetsGameTogether website must be compatible with all widely used browsers, which are at least: IE7, IE8, FF and Google Chrome.. The new versions of the games should also be checked carefully for compatibility with earlier versions.

Portability

The authoring tool should also be chosen carefully and ensure that it is designed to develop games portable across all popular platforms, including Windows (95, 98, Me, NT, 2000, 2003, XP, Vista, 7), Linux, Mac OS X, iPhone, iPad, Pocket PC, Handheld PC, GP2X and Windows Mobile-based Smartphones.

Integratability

The '*LetsGameTogether*' website will be a stand-alone application. However the underlying applications like the game authoring tool will use data retrieved from an archive. This requires that the underlying applications, including the game authoring tool, should be able to communicate with multiple (external) databases.

Personalization

The community although object-centric will also include personal profile pages, which means that the Website should have a high degree of personalization. Both the user interface and the database should be designed in such a way to support personalization.

Usability

The ultimate goal of '*LetsGameTogether*' should be to attract children and help them learn through designing. To achieve this goal both the Website and the authoring tool should be easy to use. The user interface must be usable for children 7-11 as described thoroughly in the third chapter.

Reliability

The '*LetsGameTogether*' website should provide quick response time and clear feedback when the user performs an action. The server should be available for service when requested by end-users and should not be overtaxed by constant request to the database. The failure rate for the website should also be restricted to the minimum.

Extensibility

'*LetsGameTogether*' should be grown, not built. Online communities are strongest when grown by members into unique and supportive, environments. Amy Jo Kim, head of NAIMA, a well known design firm specializing in designing commercial online communities, has a set of guidelines for development.

- Communicate the purpose of the community
- Specify the ritual and requirements of membership
- Decide on the participation and personality of the leaders
- Provide clear guidance for new member
- Offer growth opportunities for established members.
- Create a policy for handling disputes and disruptions
- Cultivate cyclic rhythms for events and communications. (Campell 1997)

Community building

The give and take of good information is essential for providing value in any online community. '*LetsGameTogether*' should provide an environment that gives users value for participating and sharing their own games. The online forum, chatting and cooperation with friends are also indispensable parts of this robust online community. The online forum, chat room and group collaboration will use a Web browser interface. So the web design principles as explained thoroughly in the third chapter can be used to set the tone of a unique place where users can express their opinions and ideas or chat with other members. The email lists should also be carefully designed in respect to the name of the list, the email address, and the automatic messages generated when users subscribe and unsubscribe.

Robustness and Security

The '*LetsGameTogether*' community and the applications that supports should be able to operate under stress or tolerate unpredictable or invalid input. For example, it can be designed with resilience to low memory conditions. Moreover is should be secured wherever (e.g in input forms or check the executables it is needed from hostile attacks and influences from malicious users, hackers, crackers etc.

Modularity

'*LetsGameTogether*' community should comprise well defined, independent components as described in the architectural design. That leads to better maintainability. The components should be then implemented and tested in isolation before being integrated to form the online community.

Reusability

The different components of the '*LetsGameTogether*' community should be designed in such a way that they can be used in applications other than the ones for which they were initially developed.

6.2.2   APPLICATION MODEL

The Application Model of our community website will consist of the features that have to be integrated so as to provide young users with the functionality they require. The following table represents a list of the features that need to be incorporated, together with the development priority level each feature has –primary or secondary.

Feature	Priority
Authoring tool	Primary
Browsing	Primary
Games Results List	Primary
Friends Results List	Primary
Tab-pane	Primary
User Safety	Primary
Time and Date	Secondary
Hardware and Software	Primary
Performance	Primary
Metaphor	Secondary
Interaction	Primary
Different difficulty levels	Secondary
Rewards	Primary
Multi-sensory experiences	Primary
Email list	Primary
Forum	Primary
Chat	Primary
Rating	Primary
Personalization	Primary
Sharing	Primary
Find & Fix Bugs	Primary
Groups	Primary
Event Promotion	Secondary

TABLE 17: LETSGAMETOGETHER APPLICATION MODEL

Below we present the application features as these are derived from the requirements analysis:

Browsing

Browsing facility must be provided that will enable kids to search for a game when they know its name- or even a part of it. Browsing should also be provided to enable children find friends with the purpose of adding to them to their friends list or chatting with them.

Search Results list

The Games Search Results List will be presented as a list of search results, providing children with information about the exact title, author, available versions, category, status and difficulty level of the game.

Friends Results list

The Friends Search Results List will be presented as a list of search results, providing children with information about the exact name and last name as well as the age and a photo of the users whose names matched their query.

Tab-pane

The tab-pane enables kids to navigate between the various panels –profile page, chat, forum, game browsing. Each of the aforementioned panels allows for tab-pane navigation as well- e.g. the profile page contains 'My Info', 'My Games' and 'Favorites' sub-tabs.

User safety

Inappropriate content and advertisements need to be blocked by appropriate filters.

Time and Date

The website community will indicate current time and date.

Hardware and software

The website must run on Windows 2000 or higher and be compatible with the most popular browsers -Internet Explorer and Mozilla.

Performance

Taking into consideration that kids tend to become impatient while interacting with the system, the website must have short response time.

Metaphor

A metaphor can help children providing directions and useful tips in a more attractive and pleasant way (see also Table 13: principles for kids' applications).

Interaction

As discussed in chapter 3 (see Table 13: principles for kids' applications) children's interaction with the system must be immediate and consistent.

Different difficulty levels

The website must give children the chance to engage in activities –either game design or game play- of different difficulty levels. The difficulty level of the games should also be indicated when children are viewing the characteristics of a game.

Rewards

When children design games that prove to be successful they should be rewarded. This reward can be immaterial –such as watching their game receive a high rating among other games.

Multi-sensory experiences

The importance of multi-sensory experiences is pinpointed in table of chapter 3. Website must increase kids' attention, by incorporating audio effects to the metaphors.

Email lists

Children must be able to ask questions through email lists. Answers should be provided either by other children or by the website administrator. Furthermore newsletters about new developments and latest news should be sent on a weekly basis to keep children informed. In case of group working for game authoring, the group should have a dedicated email list to communicate and exchange information about the status of the project.

Forums

When logged in, children should be able to participate in a forum by creating a new topic and viewing or commenting on an existing one. Posting of videos and photos, as part of the replies, must be possible.

Chats

A hallmark of any social network is the fact that it gives its members the chance for direct communication, via instant messaging facilities. The website should give children the opportunity to chat with other website users or groups of other website users. Video calls must also be provided as part of the chat facilities.

Ratings

Children must be enabled to rate the games they are playing. The total rating a game receives can be an indicator of the resonance it has within the website community. Children cannot rate the games they have authored.

Personalization

Children should be able to insert personal information in their personal profile page. They should be able to easily find each other using multiple criteria.

Sharing

The website must provide children the opportunity to share their games –either for play or for the design a new game based on a shared pattern.

Find & Fix Bugs

Children must be able to re-design the games they are applying. This will give them the chance to immediately correct errors and bugs they have found.

Groups

Website administrator –usually a teacher or a more experienced child- must be able to easily assign kids to groups and give them subprojects to complete. Group members –called co-authors- should be able to communicate using the chatting facility.

Event Promotion

The website community should give children the possibility to organize and promote a public or private event. Children, who have been invited to a certain event, can mark their attendance. The website administrator must be able to moderate the events.

Authoring tool

The website must provide a visual, well tested, efficient authoring tool that will enable children to design and create their own games.

6.2.3   ANALYSIS MODEL

Use case view

The functionality provided by the 'LetsGameTogether' community is identified by means of a use-case view. This view is presented in a use-case diagram .Each ellipse represents a user action. The arrows indicate the direction of the dependencies between the actions.
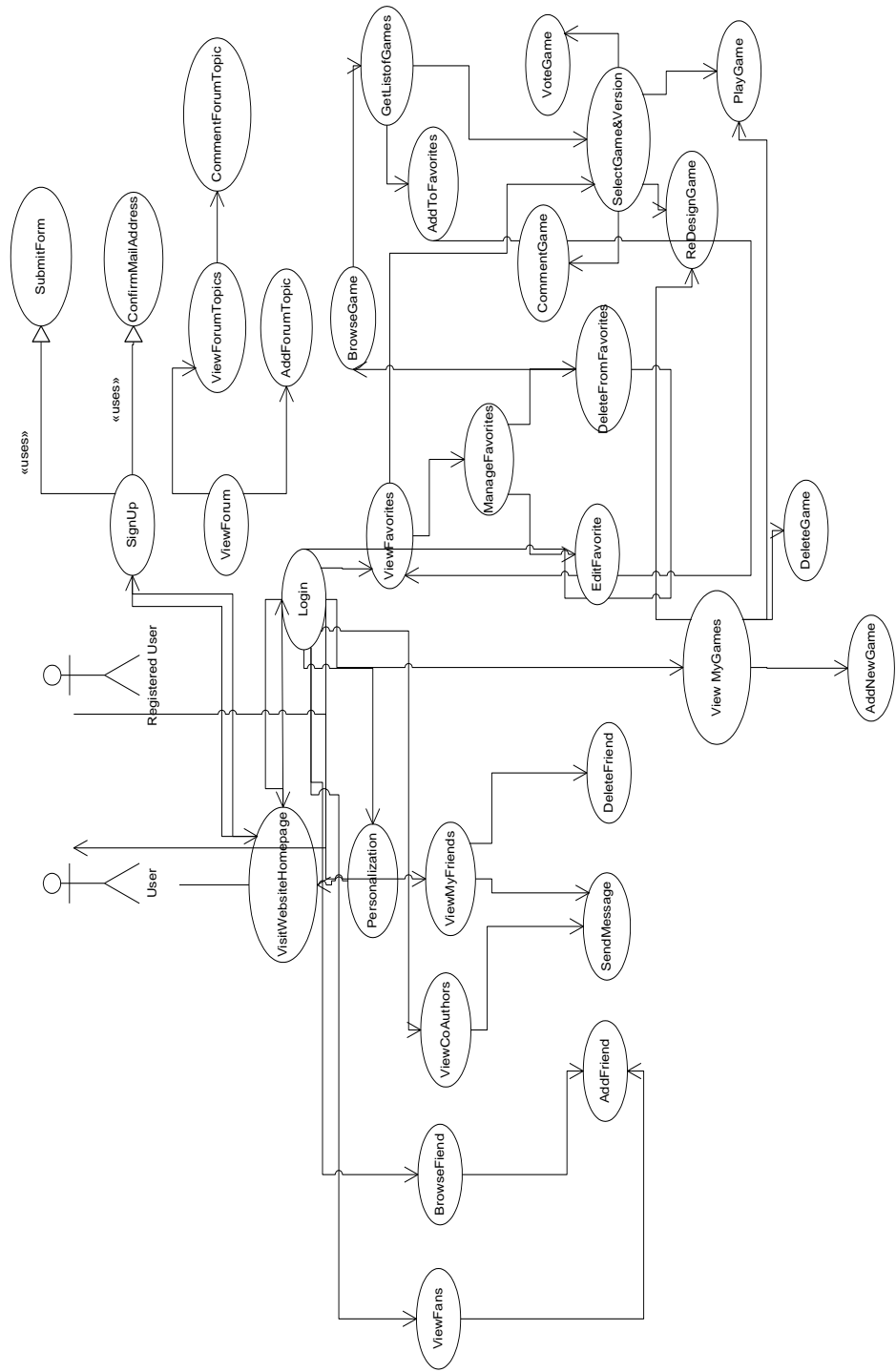
FIGURE 22: USE CASE DIAGRAM

6.2.4 ARCHITECTURAL DESIGN

The architectural design represents the collection of hardware and software components and their interfaces that are required to establish the framework for the development of GameBook. It provides a high-level view of the structure and properties of the different components of community. It also reflects the interconnections among all architectural components.
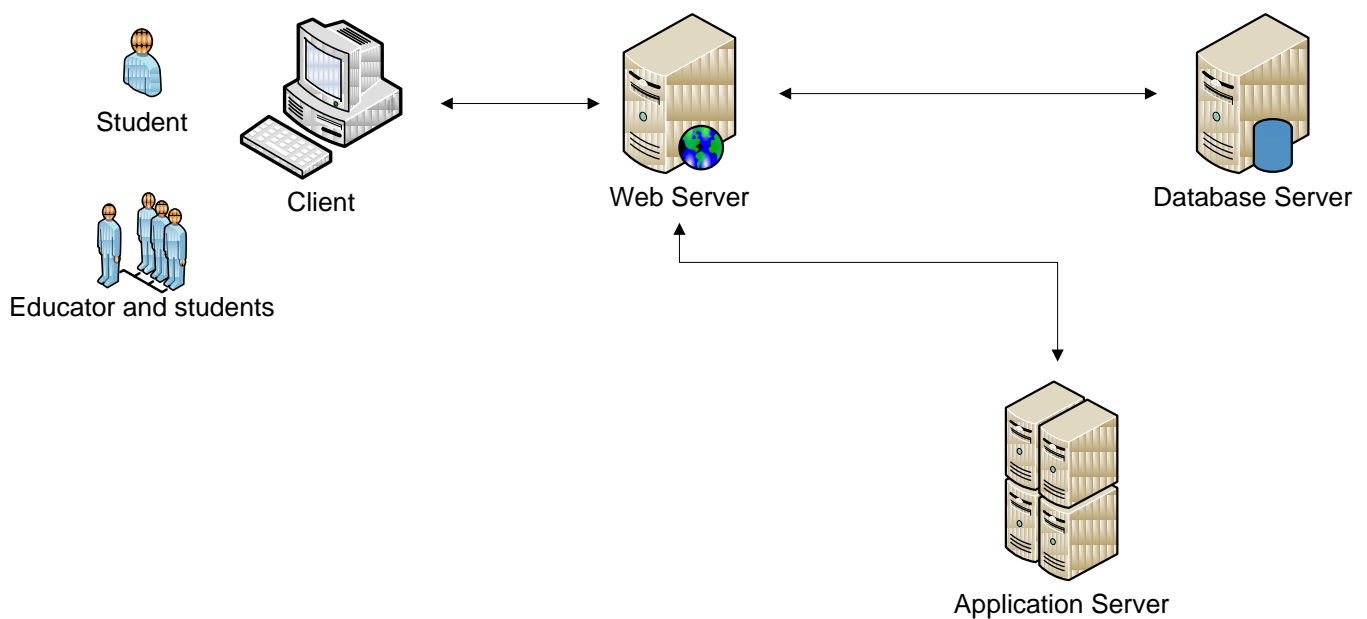
We will use a Web-based interactive game authoring tool. The reasons we chose a web-based system and not a traditional desktop-based system are listed below:

- No software installation required
- Fast loading and fast initialization.
- Fast interaction response. The performance of a Web-based system should be almost as good as a desktop application.
- A created game is saved on the server side, and can be accessed, and modified from anywhere.
- Easy publishing and sharing.
- Easy searching for useful games.

The different components as presented in the figure are:

Client: The user can access '*LetsGameTogether*' via the Internet with a browser. The user is provided with a web-browser based GUI for the authoring environment supporting authoring logic, a variety of dialogs assisting authoring, publishing, and communications with the server side.

Web Server: The '*LetsGameTogethe* 'website runs on the web server.

Database Server: The '*LetsGameTogether*' community should include a server that would allow users to store their games for their friends to download. It should include a file-type restriction on the uploads. It should also support files of any size and ensure that requests do not time out.

Application Server: The application server provides the environment where the game authoring engine resides, ensuring efficient execution procedures. In case a mindmap-creation tool is integrated to the '*LetsGameTogether*' website, this should run on the application server as well.

6.2.5   USER INTERFACE

The online game authoring community is designed especially for children. An important prerequisite that will motivate children in engaging in the activities of the community is to provide an appealing graphical user interface. In this section we will provide a graphical representation of our basic graphical user interface elements and ideas. Based on the GUI design principles as described in the third chapter we will define the basic "look and feel" of the GameBook community. The intuitive operation of the system generally provides users with immediate, visual feedback about the effect of each action something that facilitates using and consequently learning as well as influence importantly the success of 'LetsGameTogether'.

Since we are in an early development stage we will create conceptual interactive prototypes of the website called mockups. Each mockup is a visual illustration of one Web page. It is meant to show all of the items that are included on a particular page, without defining the final look and feel (or graphic design). It's simply meant to illustrate the features, content and links that need to appear on a page .In a later stage a visual interface will be designed in order for the programmers to understand the page features and how they are supposed to work.
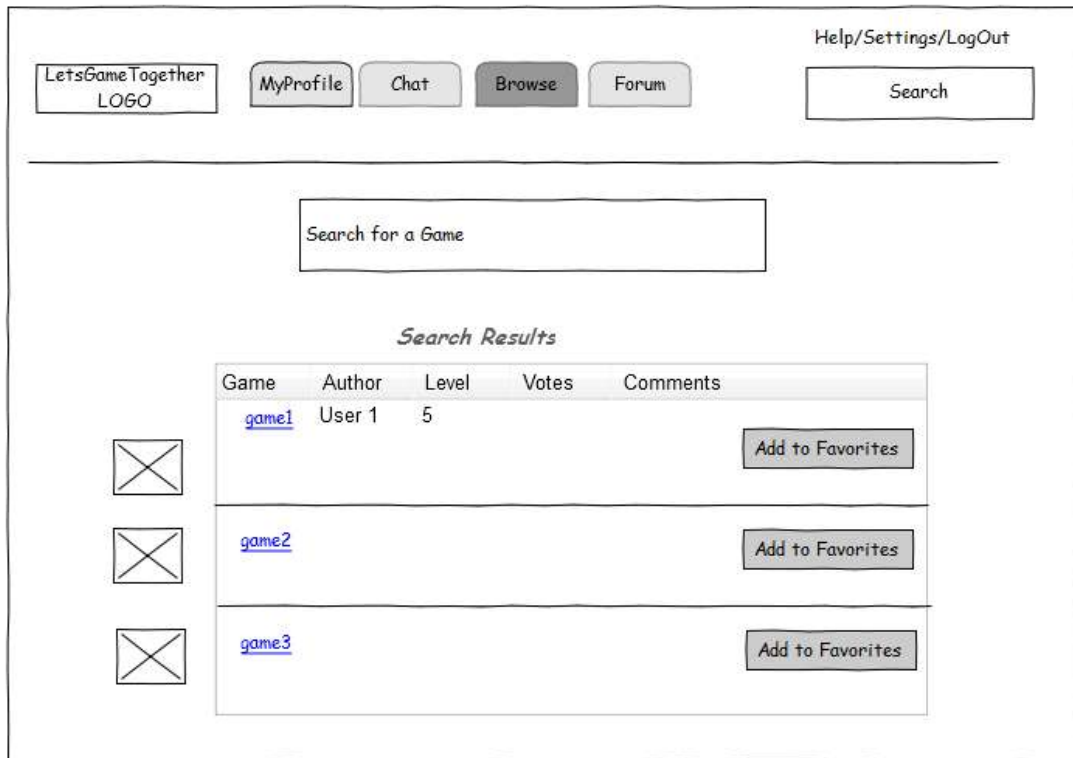

FIGURE 24: DESIGN OF BROWSE_FRIEND PAGE

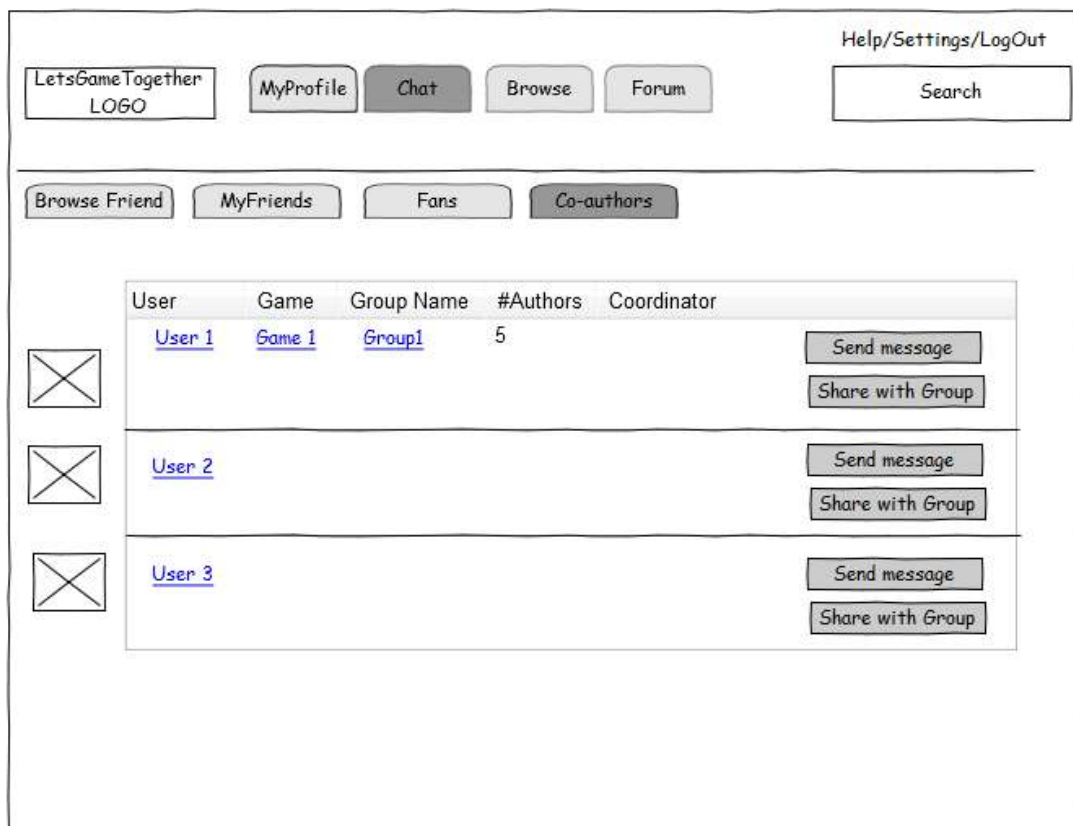FIGURE 25: DESIGN OF BROWSE_GAME PAGE

FIGURE 26: DESIGN OF USER'S_CO_AUTHORS PAGE

FIGURE 27: DESIGN OF ADD_NEW_GAME

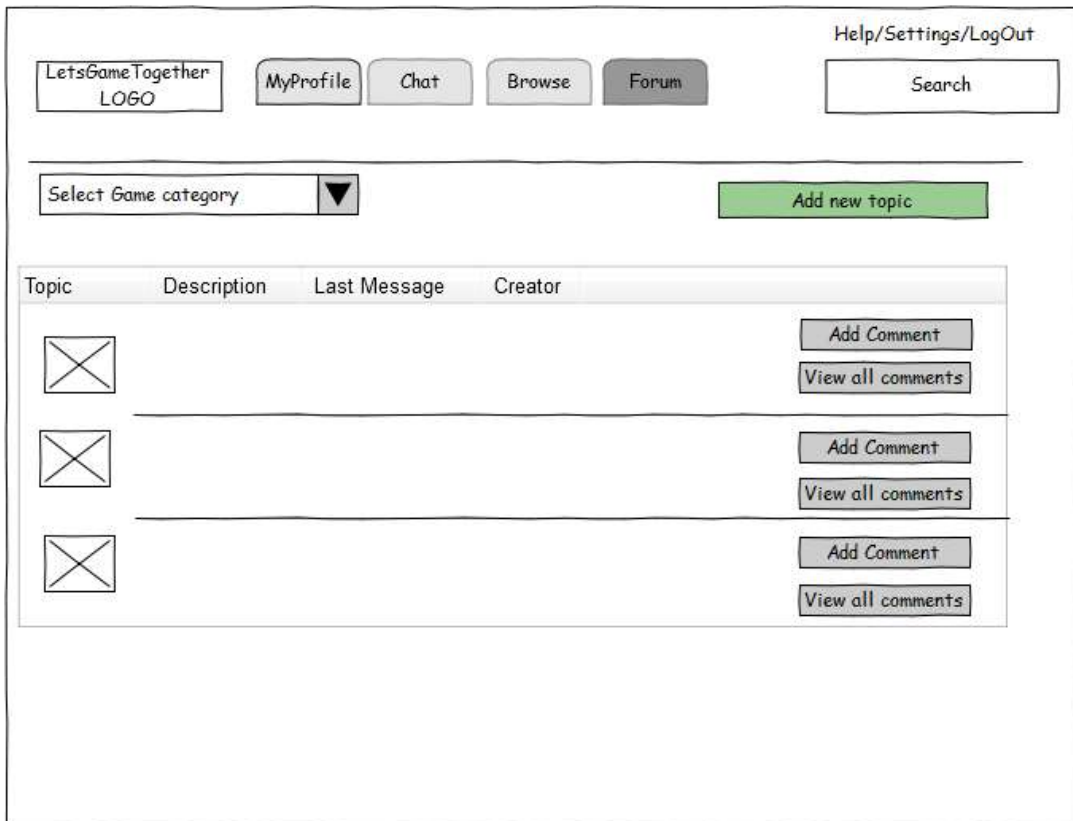FIGURE 28: DESIGN OF FANS
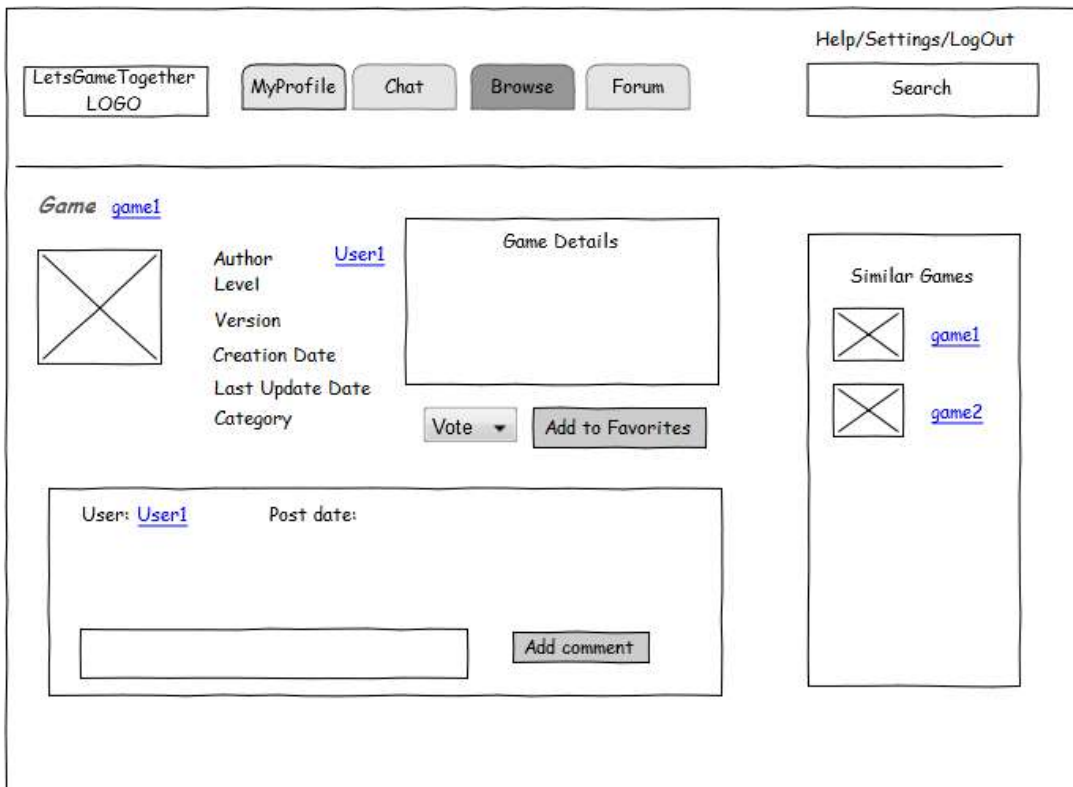
FIGURE 29: DESIGN OF FORUM PAGE
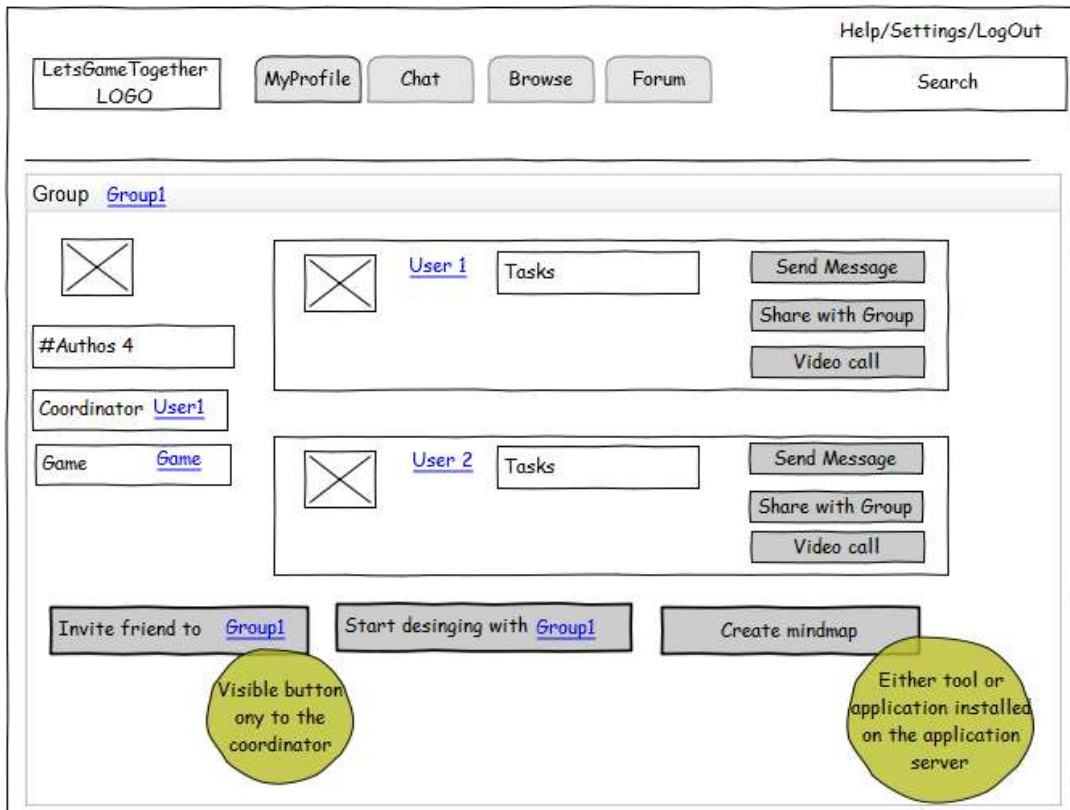

FIGURE 30: DESIGN OF GAME PAGE

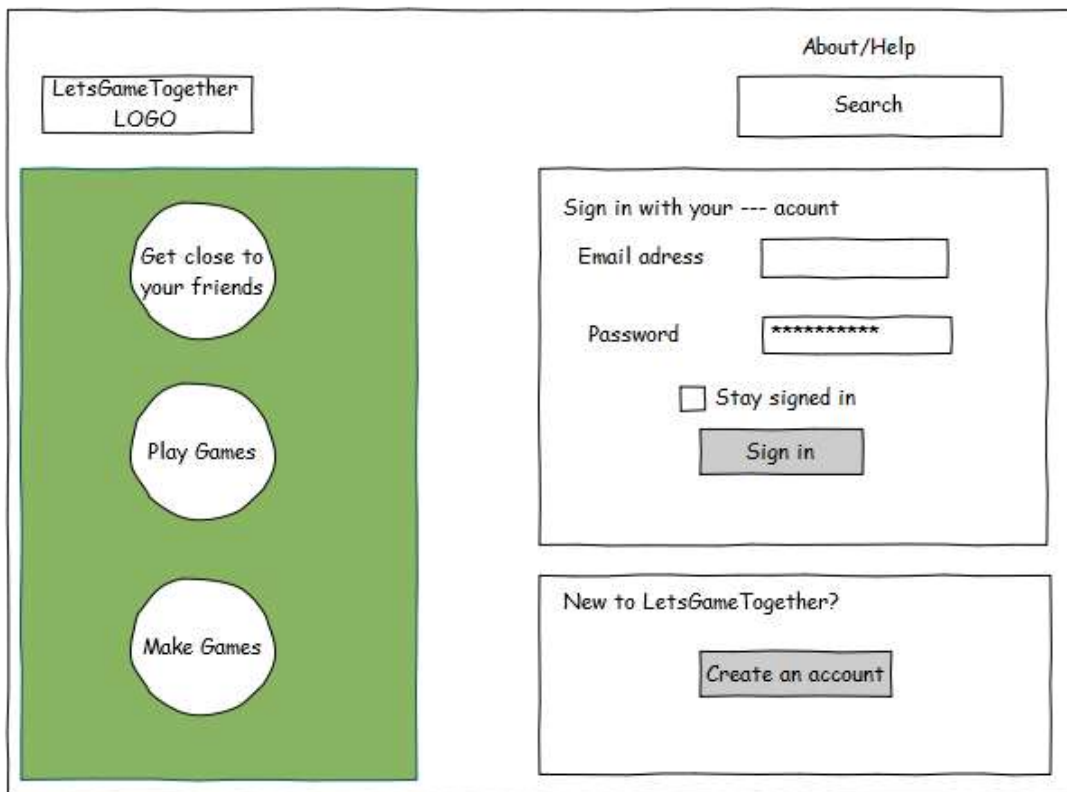FIGURE 31: DESIGN OF GROUP PAGE
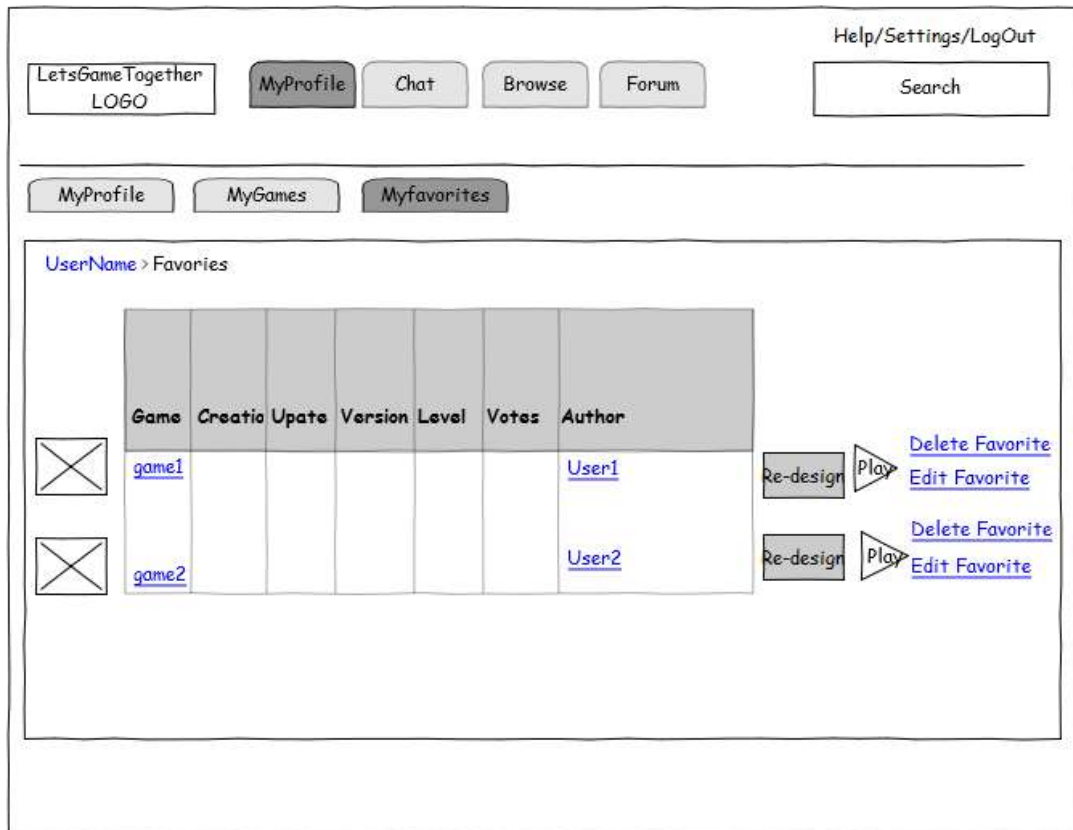

FIGURE 32: DESIGN OF SIGN_IN PAGE

FIGURE 33: DESIGN OF USER'S_FAVORITE_GAMES PAGE
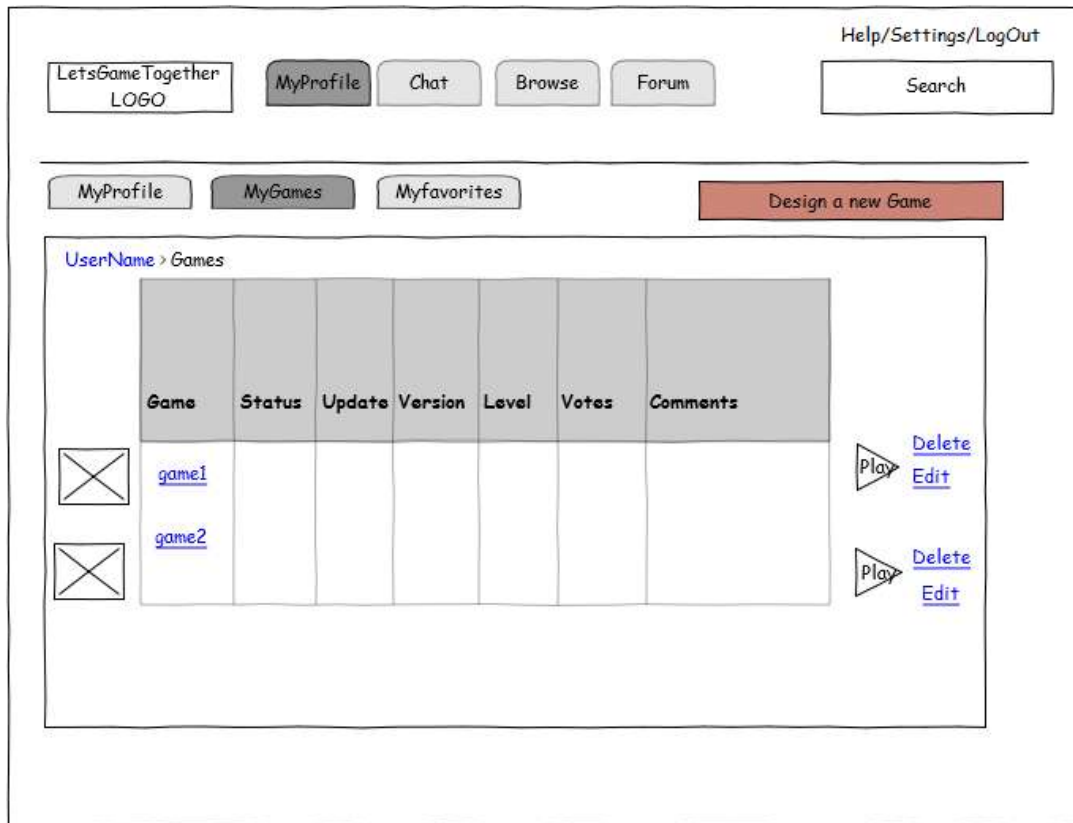

FIGURE 34: DESIGN OF CHAT_WITH_FRIENDS PAGE

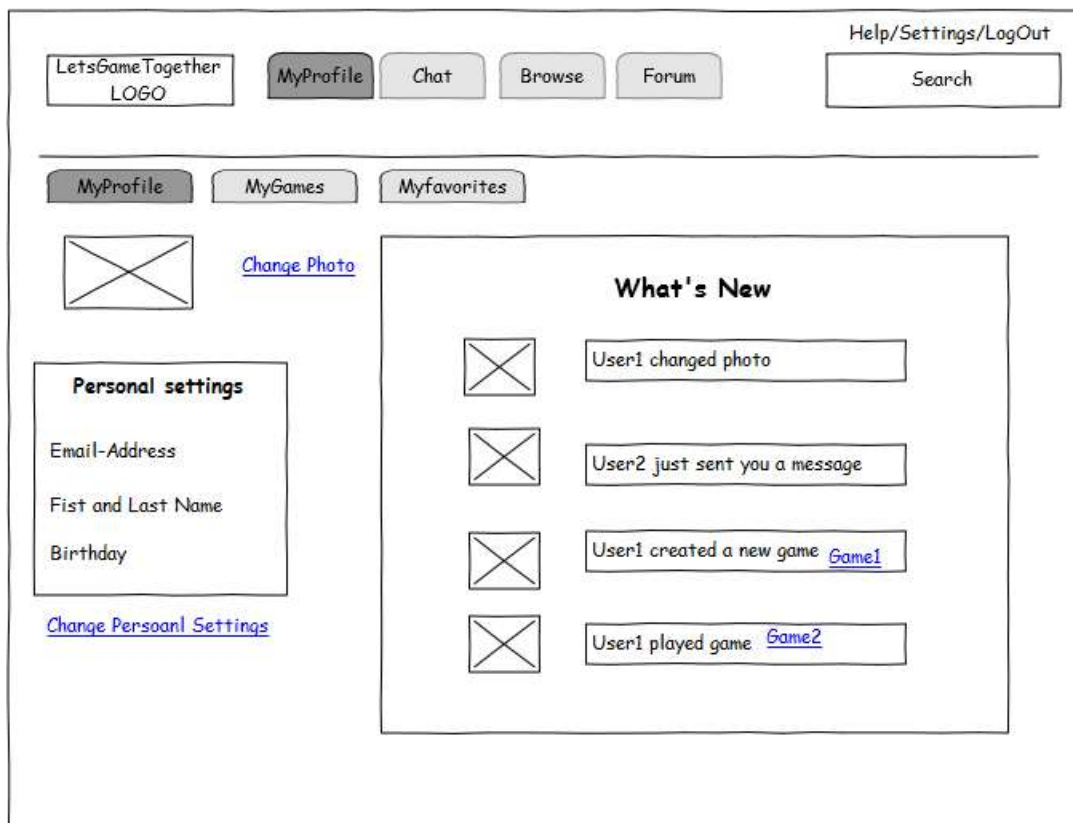FIGURE 35: DESIGN OF USER_CREATED_GAMES PAGE
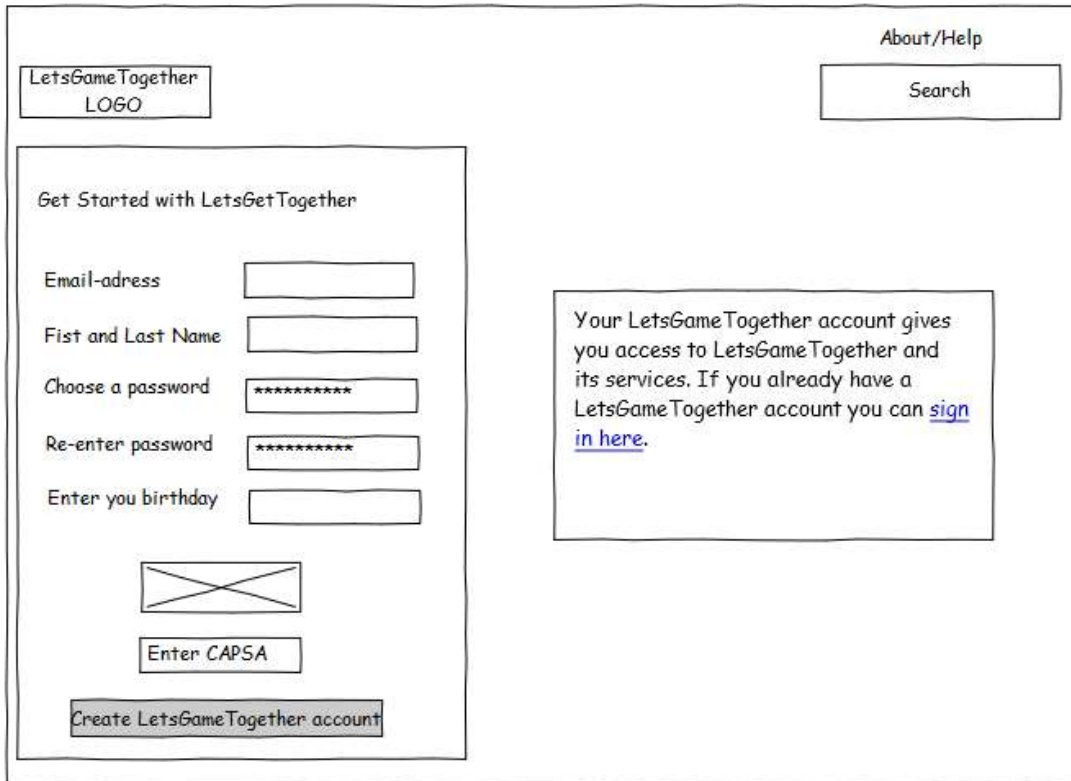

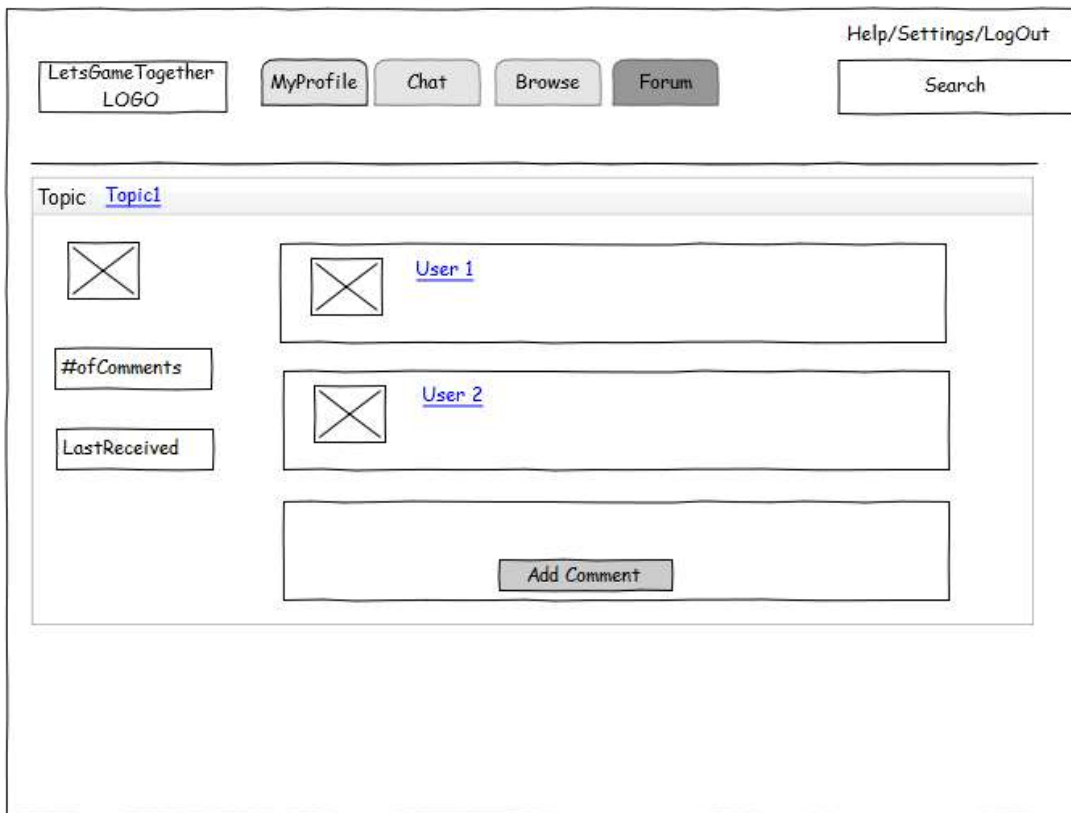FIGURE 36: DESIGN OF USER'_PROFILE PAGE

FIGURE 37: DESIGN OF SIGN_UP PAGE

FIGURE 38: DESIGN OF FORUM'S_TOPIC PAGE

In this subchapter we will try to associate Bloom's digital taxonomy, as this was presented in Chapter 1 of this master thesis with the community website '*LetsGameTogether*'. Our ultimate goal will be to identify which level of Bloom's taxonomy kids can reach when they are engaged with game authoring and '*LetsGameTogether*' website. Furthermore, we will investigate and analyze the digital activities, which are supported by our community website, and which foster the development of the mental and cognitive skills required for each category of Bloom's classification.

Remembering: As part of their engagement with the '*LetsGameTogether*' website, kids are encouraged to search for the game they want to play or re-author. Browsing and bookmarking games or even retrieving games that can be found in their Favorites list helps kids develop observational and remembering skills. Social networking is also regarded as fostering remembering mental capabilities, since kids have to name and recall their friends' usernames as these are defined in the chat or forum.

Understanding: The existence of metadata such as *category* and *comments* which need to be specified by the authors of the games requires them to demonstrate their comprehension and understanding skills. Furthermore, encouraging kids to comment on existing topics of the forum can also be encompassed in the group of activities that require skills of this taxonomy level.

Applying: Using the website facilities –authoring tool, chat, forum, mailing lists, browsing-, playing or editing existing games, sharing patterns of games and uploading videos, images and other files when commenting on forum topics are tasks that require students to use prior knowledge in new situations. This is even more obvious when kids undertake the task to re-author a developed game, something that will most probably result in continuing and extending an existing story according to their preferences and experiences.

Analyzing: Inherent to the concept of designing and creating a game, is that of firstly analyzing the game to be developed. In order to be able to create a game, children need to structure their ideas and compare the different approaches they might come up with. Furthermore, '*LetsGameTogether*' is offering the chance for children to continue and enhance existing games. A prerequisite for the success of this process is that kids have deconstructed the game they wish to extend and have well analyzed the possibilities it is offering. After all, organizational and analytical skills are more than required when dealing with design of any software application.

Evaluating: Testing, judging and evaluating games are also activities that children are getting involved within the '*LetsGameTogether*' environment. More specifically, being able to vote for games they play and comment on discussion forums requires from students to develop their evaluation skills and reach this cognitive level of Bloom's taxonomy.

Creating: Participation of children to the community website is done either in order to play games or to get involved in the design and authoring process of plays. The latter one is considered to be closely related to the highest level of Bloom's taxonomy –Creating. Thus,

no matter whether children choose to create from scratch a game application or base their design on an existing game, they develop and demonstrate the highest level of cognition. After all, Churches in his 'Bloom's Digital Taxonomy' asserts that program application or game development consist more complicated forms of creation.

6.4.1   INTEGRATING LETSGAMETOGETHER IN CLASSROOM

As analyzed in chapter 2, social aspects of learning as well as the role that group working and collaboration plays in learning process has already been proved by many studies. Taking such aspects into consideration, educators have started developing knowledge-building communities within their classrooms that enable children to create new ideas and knowledge as well as facilitate their own and their peers' learning. Furthermore, recognizing the value of constructionist approaches to learning (see subchapter 5.1) teachers are trying more and more to engage their students in activities that will help them construct their own interpretations of the learning material rather than just applying techniques that require them to memorize and reproduce information.

In this vein, and taking into consideration the benefits that, as analyzed in chapter 6, children enjoy when technology is introduced in their learning activities, we suggest that '*LetsGameTogether*' is used by educators within the classroom activities they organize for their students. In this subchapter we will propose a framework for the integration of '*LetsGameTogether*' in classroom, that establishing appropriate practices during lectures, best satisfies the needs of the target age group –children between seven and eleven years old. The proposed development structure though, should function as a general framework and further factors –including cultural and ethical characteristics of children as well as cognitive and developmental skills- should be seriously considered by educators when trying to implement it in their classrooms.

In order for the framework to be applicable and realize quality education in classroom stakeholders need to be identified and convinced about the efficacy of the proposed practices. Furthermore, their desires, interests and requirements need to be analyzed and taken into consideration.

Starting thus with the stakeholders, these involve both children and teachers, but as we will see they expand to further organizations and institutions as well. Apart from reflecting their needs, when introducing ICT in classroom several other issues need to be considered and thoroughly examined so that in the end learning is enhanced. Thus, especially as far as '*LetsGameTogether*' is concerned, such issues include the creation of a classroom curriculum that incorporates the new website ensuring the best utilization of the newly introduced features. The new cognitive challenges and opportunities as well as the obstacles that teachers have to overcome within the new environment need also to be addressed. In this vein, educators need to be appropriately trained to cope with the new demands that the introduction of technology encompasses. Adequately trained educators, with good knowledge of the strong points and opportunities '*LetsGameTogether*' is offering, is essential, since they should be able to support children whenever they need assistance. After all, educators are the means for children to get acquainted with technology, and as such they can influence their attitude and performance. That is, if teachers tend to degrade

and discredit the integration of technological tools in their curriculum, students will most probably adopt a similar view as well.

Traditional pedagogical methods that raise a barrier to the implementation of the outlined framework need to be identified and the pedagogical system -as this is defined both by school management authorities and government authorities- must provide means to take them away and/or replace them with other more flexible ones.

Additionally, the learning goals should also be adapted, reflecting the needs, desires and capabilities of the new classroom environment. This though should be done ensuring the maintenance of the standards and values of the community within which learning is taking place. In this context, parents' role should be pointed out as they can significantly influence their children's desire and interest in new technological means, fostering a view of technology as an intertwined component of modern society. After all, if parents disagree with the incorporation of '*LetsGameTogether*' within classroom activities, the application of the proposed practices will not be successful.

Finally, current legislation as well as the approach and policy that government adopts to introduce technology in schools should also be considered, as for incorporating '*LetsGameTogether*' in curriculum, students should be provided with the appropriate equipment – laptop or desktop machines with access to Internet. In the following table we list the stakeholders as these were identified by our analysis.

Student
Educator
School management authorities
Government authorities
Training center
Parents

TABLE 18: LETSGAMETOGETHER STAKEHOLDERS

Having identified the stakeholders, we should mention that for the purpose of designing a framework for the integration of '*LetsGameTogether*' within classroom activities, we will deal with only two of them: Students and Educators, who prove to be the most important ones. As it can be figured out, educators, are the ones who have to initiate and support the implementation of the suggested practices and this is the reason why, most of the proposed activities address to this specific group. In the following, we continue our analysis based on the assumption that educators have taken sufficient training and that governmental policies have foreseen the provision of one machine –desktop or laptop- per student.

Starting with the introduction of '*LetsGameTogether*' in the classroom, teacher should organize a lecture in which he will present the website together with the facilities and functionalities it comes with, to students. For this step, all classroom members- students and teacher as well- need to be provided with computer machines so that they practice and get acquainted with the applications. A whiteboard or a similar visual medium, connected to teacher's machine, is required, so that students can watch teachers' interaction with the system and reproduce his actions in their own machines.

We consider that students' introduction to LetsGameTogether should start with the presentation of both sign-up and log-in processes that need to be completed for them to have access to the application facilities. Thus, after providing students with the website's url, the teacher should encourage them to create their own accounts and log-in to LetsGameTogether.

Teacher should continue with the demonstration of one or two basic games developed with the authoring tool, supported by our community website. For this reason, teacher must have prepared in advance the games he thinks will trigger classroom's interest. Thus, for example, if students perform well to a specific sport, it would be nice for them to be confronted with a relevant simulation game, so that they can better explain the game structure while applying their knowledge to understand or even extend the game rules and possibilities. Furthermore, such a technique comes in accordance with Smith's view –presented in chapter 2 of this master thesis- that learning is enhanced when students are engaged in activities they like. Association with Bandura's social learning theory can also be found, since at this point the four fundamental conditions for effectively modeling a behavior –attention, retention, reproduction and motivation- are aspects that teacher needs to consider.

The 'sample games' should be analyzed in both applying and authoring dimensions. Thus, firstly, students should get to know how the exemplary game can be applied as well as its structure, rules and goals, by having the chance to play the game at least once. After they have understood these, and recalling the fact that students require a pause to restore energy after 12 to 15 minutes of attending a lecture, a short break should be provided. During this break though, the teacher should try and involve them in a conversation to discuss objections and/or questions. At this part, active participation of students should be fostered and especially shy students should be encouraged to express their questions openly.

In the next phase, students should be guided step-by-step, through the authoring of the game they have just played. This includes all steps from opening the authoring application to saving it and making it available to others. Thus, pupils create the game, they previously applied, from the scratch, in their own machines, following the directions of the educator and imitating his actions. Hence, they get to know how to add the characters and plots required, specify behaviors or rules as well as how to update and/or remove a character. Once finished with the game creation activity, the teacher should allow students to take their time to practice on their own or even consult each other so that misunderstandings and dark points are clarified.

After completing this kind of short break, it is time for students to come together and undertake the completion of specific group projects. For this reason, teacher should ask students to form formal learning groups of four persons (see 2.4.1.1). As mentioned in chapter 2, allowing students to select who they want to collaborate with, gives them the sense that they are leading their own learning and this is the reason we suggest that teacher does not get involved in the process of group formation. In any case though, if the teacher considers that this will result in non-effective groups, he can somehow influence and/or adjust their composition. Once the groups are formed, the teacher, as the game coordinator, can proceed with creating the groups online. The option 'Invite Friend to Group' can be used to send invitations to group members.

Continuing, the teacher should present students with a range of available projects- that is games to be developed. After providing a description and explanation of each game, groups should leave the classroom with the task of selecting the one they prefer to get involved to, as well as an alternative one. Again, letting children select the project they want to undertake, makes them feel responsible and fosters the development of self-regulatory mechanisms. In case two or more groups come up with the same choice, then teacher should ask all members of the two groups to negotiate and agree on which team will come up with the second choice. At this point we should mention the significance of face-to-face interaction in communicating and describing to the students the tasks they have to complete, in conformity with what is being described in subchapter 2.4.2.

Concerning the project structure, this should allow kids to use their imagination and storytelling skills rather than just providing explicit instructions on the activities that have to be performed. Thus, students should be given the chance to intervene on the game story for example, by adding new characters. For this to be possible, teachers should be as laconic as possible in the description of the games to be developed, leaving it to children the task of defining the game-specific rules and details.

During the next phase, the teacher can introduce students to the community aspects of LetsGameTogether – including chatting, forum and Email lists. It is true that more computer savvy students, as more familiarized with such communication forms, might find this part of the lecture dull. Though, we believe that introduction to the community aspects of the website cannot be omitted since this is the means on which children will base their communication and collaboration. Thus, at this phase, students will be encouraged to initiate informal friendly conversations with their fellows using the chat –the simplest of the communication means provided. They learn how to add friends to their chat list, create groups of conversations, initiate video calls etc.

Similarly, students will be introduced to forum and emailing lists, but this will require a more active form of participation from the teacher- for example he will have to initiate a topic in the forum and challenge students to comment on it or maybe to give an example of how mailing lists work. Students should be encouraged to create new topics and experiment with the different options that the forums and mailing lists offer. It is important to note that students should be left to explore all the aforementioned means on their owns and be encouraged to ask their peers when they face difficulties. The teacher should intervene only

in case children cannot find solution to the problem they encounter in any of the two ways. In any other case, he should be limited to observing each group as well as the frequency with which each student participates in it -in conformity with what is being described as Individual and Group Accountability in 2.4.2.

When habituation with the electronic communication media is achieved, students can start working on their games. Thus, after meeting, each group should come down with a story and detailed description of the game to be developed as well as with a list of the tasks that make up the project together with the responsible student for each task. Tasks consist of individual or more complex scenes that have to be implemented within the authoring environment and result from the process of partitioning and analyzing the overall game story. The game definition, the tasks and responsibilities should be sent electronically to the teacher using the mailing list, so that all groups are aware of the tasks and responsibilities.

After receiving the aforementioned input from all groups, teacher should schedule a separate meeting with each 'game team'. During this meeting –which can take place either online using the video calling facilities or offline in the classroom- the teacher should ensure that students have developed the mental and cognitive skills that correspond to the 'Analysis' level of Bloom's taxonomy. A good practice to achieve this is by involving kids in the process of organizing the tasks they have come up with. More specifically, teacher should ask students to draw a graph in which the relations between the constituent tasks are identified. This can be done either online – using the appropriate digital tool- or offline – kids gathering together and draw on paper their graphs. In any case, the website will provide link to a mindmap-creation tool so if teacher selects this path, he must have foreseen the creation of an account for each student.

Students should work individually on the tasks they are fully responsible for and collaborate for the ones that involve more than one responsibility. In any case though, discussions and exchange of ideas and opinions can be done using either chat or forums and mailing lists. In order to encourage utilization of community tools, the teacher should regularly initiate conversations or/and announce news –events, deadlines, presentations etc- through these media rather than doing so within classroom environment.

When the game is completed, evaluation phase should begin. Evaluation should rely not only on teacher's grade but should take into account other students' opinions as well. More specifically, once a game is developed, it should be available for playing in the LetsGameTogether website. Each completed game, is considered to be 'under evaluation' for a period of one week, within which students who play the game have the opportunity to rate it. During the 'evaluation phase', students will be able to access the game, either using the browsing functionality or via the 'News' section of their individual profile page. As it can be understood authors of the game cannot participate in this process of rating their own game. A week later, the game evaluation phase is considered to be finished and the game's final grade is calculated as a result of teacher's grade and overall score that game earned by students who tried it. Notifications about the grades each group obtained are sent via the group's mailing list.

Once the evaluation is completed, group members should have a kind of retrospective meeting- a discussion on how well they achieved their goals. During their conversation, they should also identify which actions were more helpful and which ones were less helpful, or not helpful at all, so that they make decisions about what behaviors they should repeat or avoid in the future –in conformity with the guidelines for implementing Group Processing that are implied in subchapter 2.4.2.

It is important to note that in the above-described activities that engaged children in game authoring tasks with the aid of LetsGameTogether, technical skills should not be regarded as the ultimate learning goals that have to be achieved but as capabilities that need to be developed for facilitating kids in their effort to learn. Thus, children and teachers should not regard IT as catalyst for curriculum change but rather as a tool for it, concentrating on the end goal, that is game creation. LetsGameTogether is designed in such a way that students do not need to concern about how they will complete their tasks. The tools and functionalities it is offering are the result of a deep analysis and suit the needs and capabilities of children aged between seven and eleven years old. After all, this is the main reason we chose to restrict our target group to such a small range. Teachers' role, in fostering a climate in which technical skills' acquisition does not constitute a problem for kids, is also very important. They should make it clear to the children that they can support them and provide them with directions and guidance whenever required.

We should note that the above described activities and practices can act as a general framework for any educator who wants to associate children's technology with peer collaboration and mechanisms integrated to the system in use. Benefits of both technology and collaboration in learning process have already been analyzed in chapters 2 and 3. It is important to note though, that the exact structure of the activities described depends on students' skills and ability to absorb new information as well as on their prior familiarization with the digital media of communication. This is the reason why we did not proceed with the definition of exact timeframes within which the proposed activities should be completed.

Finally, as it has already been mentioned in chapter 2, effectiveness of collaborative learning seems to be intertwined with the excitement with which students face the tasks they are engaged to. In this vein we could not dispute the fact that introducing LetsGameTogether in class will at least trigger students' interest and motivation and thus we expect that this will result to better collaborations that have the potential to significantly enhance learning.

6.4.2   ONLINE COLLABORATION WITH LETSGAMETOGETHER COMMUNITY

As every modern web-based community, LetsGameTogether provides users with many different opportunities to collaborate. The sense of active engagement is amplified by allowing the communication through the chat room, the forum and the in-group communication (messages and video call).LetsGameTogether aims to develop a community around it; and this community does not have to be the online counterpart of a real-life community like the classroom. LetsGameTogether allows users with similar interests around games to gather together .The forum has thus the potential to function as a source of

original and funky ideas. Through brainstorming in topics that they find appealing, children of this age get really enthusiastic and stimulated to initiate the construction of a new game and collaborate with other users that are also excited about this specific topic. In this case one of the participants in the discussion, probably the one that initiated the discussion or the one that is the most experienced /familiarized with the community, starts-up the authoring of the new game and takes charge of the whole project as a coordinator. His/her responsibilities include choosing the members of the newly formed group – probably those that had the most enthusiastic attitude in the forum- by sending them an invitation to join the group. Furthermore he/she is also responsible for coordinating the team work and ensuring a productive collaboration.

Similarly through browsing feature, the community helps learner to find games that they find interesting, vote and comment on them. These actions automatically make them fans of the corresponding author; and in turn these fans are suggested by the system as potential friends to the author. If he/she accepts the friend request then a valuable friendship is established; a friendship which potentially could lead to a successful collaboration since the above described process ensures that friends, have similar interests and tastes and are connected via mutual admiration and approval. The same applies when children search for friends. Formulating groups with people they like and seek after, undoubtedly promotes working together towards a shared goal, gain community knowledge and evolve their communication skills.

Apart from the aforementioned conventional collaborative activities, LetsGameTogether allows the establishment of an intercultural framework of collaboration, within which students from different countries and cultures form 'LetsGameTogether Groups' for the development of a game. Such an intercultural development structure will enhance learning, since children will transmit their own and learn about others' perspectives, viewpoints, cultures, learning experiences and living circumstances, and thus get better prepared for the world outside the school. The establishment of bonds with peers of different countries during education will foster critical thinking and allow for the construction of personal meanings that reflect ideas and beliefs of different communities. After all, living under the effects of globalization, having a personal experience of working with people from different cultures, kids can better adapt and perform in their future works as well.

CONCLUSION

The goal of this thesis was to define the requirements that are needed to successfully develop a game authoring community for children between 7 and 11 years old. In this section we conclude this thesis presenting the results of our work.

To achieve the objective, the thesis was partitioned in two sections. On the first part, the theoretical one, extensive scientific research was performed, aiming to fill in knowledge gaps of the authors, in the following domains of interest:

- Children's learning process
- Social aspects of learning process
- Children's technology
- Game and learning
- Children and game authoring

More specifically, learning models and frameworks were discussed and analyzed in a theoretical basis. Among all the theoretical models that have been studied, decision was made to organize the website in a way that engaged children are able to develop and demonstrate skills in each level of Bloom's taxonomy. To be able to give the game authoring website community aspects, social learning theories were analyzed. Recognizing the contribution of collaborative techniques to learning, incorporation of group working activities was encouraged. Based on social object theory, the whole website was designed to revolve around one central object: game.

To be able to design a product appealing and beneficial to children, their relation and habituation with current technological achievements was studied. The research in available literature suggests the need for controlled and guided engagement of children. This was also taken into consideration at the second part of the master thesis, which was dealing with the design of the community website.

As the end product would involve game authoring and game playing activities, research extended to the domain of games as well. In particular, studies underlying the close relation between learning and games proved to be very helpful. The fact that creating new games allows for constructionist learning was the ground on which the website community was developed. Finally, models analyzing the different roles of children in game development were studied. For the needs of the designed community, Druin's model was extended to include a fifth category, that of child as a 'game author'.

The second part of this thesis aimed to successfully define the design of a game authoring community website, which engages children in activities that enhance their learning. The first step towards this objective was to gather the requirements as these came up from the theoretical research. Requirements should reflect all stakeholders' interests and wishes – for example a parent does not want that his child views advertising content. After the requirements analysis, their translation into specific features that the website should incorporate followed. In order to assure that the website community does not lack of basic functionality the features were prioritized, so as to ensure a qualitative product.

The specification that resulted from the requirements analysis was used as input for the design model. Architectural specification was also performed, in which several decisions

were made, following design guidelines, best practices and authors' experience. Furthermore, a prototype user interface was proposed, reflecting the needs and likes of the target age group.

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