VIDEO GAMES: EDUCATIONAL RESOURCES FOR THE CLASSROOM?

Pere Cornellà Canals*
Meritxell Estebanell Minguell*
Josefina Ferrés Font*
Eulàlia Guiu Puget*
*Department of Pedagogy of the University of Girona
Girona (Spain)
pere.cornellacanals, meritxell.estebanell, josefina.ferres, eulalia.guiu@udg.edu

Abstract

This paper focuses on video games and their educational possibilities (content, skills and values) in ESO (Compulsory Secondary Education – students between 11 and 17).

Since the 1970s, and continuing on into the present, there have been changes in the way society functions, mainly due to the technological revolution. Among them have been many changes that have introduced ICT into the educational system. This has led to studies and investigations, like this one, about its use in Education.

This study took place along the lines of research of the Research Group on Information and Communication Technologies in Education (GReTICE) of the UdG and within one of the projects currently under development, the CONTIENE project (Intelligent Content for Virtual Reality Applications, point of view and global illumination techniques, TIN2007-68066-C04-01) financed by EMED – Ministry of Education and Science (MEC) in the TIN - PN of Information Technology programme.

The results of the study are based on the analysis of two questionnaires given to three different groups, young students from ESO, their teachers and their parents or guardians, and focused on obtaining information concerning:

- personal data of those surveyed
- opinions of the video games
- video game habits (frequency, moment of the day, place, etc)
- the preferred type of video game (genre, platform, point of view, etc)
- the assessment of common aspects of the video games (graphics, interactivity, sound, etc)
- the feeling of learning using video games
- the use of video games in educational environments
- the evaluation of two of the main subjects: sexism and violence
- what they would like to find in new video games

The coincidences and discrepancies of the answers from the three survey groups lead to rich conclusions. Among the coincidences, we can highlight the high marks given to the educational characteristics of the video games and their possible use in schools.

The need to administer a second questionnaire has arisen as a result of the success that the Nintendo Wii console has had among the general population and new possibilities for interaction with the interface of the game. The questionnaire content (given to the same three groups as the first questionnaire) is focused on two aspects:

- the most appreciated interactive elements of the Nintendo Wii console
- gathering proposals for new functions that could be added to a videogame console to increase interaction with an ideal, hypothetical video game

Combining the conclusions of the two questionnaires (the first one focused on video game contents and the second on ways of interacting with them), we obtain some clues to help us design and create

ISBN:978-84-612-7578-6

new products that are attractive enough to motivate young learners and that combine enough educational aspects to be used in formal education.

Keywords
Innovation, technology, research projects, video game, education, interactivity.

1. VIDEO GAMES: EDUCATIONAL RESOURCES FOR THE CLASSROOM ?

This paper is focused on video games and their educational potential. Our work is based on the study carried out by researchers from different disciplines (Gee, Prensky and Buckingham, among others) of the learning acquired by playing video or computer games.

Gee [6], from the field of semiotics, compares the learning and literacy in video games with that of the classroom. He describes the numerous ways of learning in a video game, citing 36 learning principles, among which we highlight principles 1 and 20 for our study. In principle 1, active and critical learning, he suggests that all aspects of the learning environment join together to stimulate active, critical, non-passive learning, including those in which the semiotic domain is designed and presented. In principle 20, the multimodal principle, he points out that meaning and knowledge are constructed by means of several modalities (images, texts, symbols, interactions, abstract design, sound, etc.), and not just by words.

Prensky, a programmer interested in Serious Games, describes today's children and young people as digital natives who use video games to develop the generic competencies they need for life in the 21st century. In his last book [15], he argues that children learn to understand, reflect upon and manipulate complex systems by playing; they carry out multi-tasking and process several types of information simultaneously and in different mediums. At the same time, he draws our attention to the ignorance of teachers (digital immigrants) and the absence of this learning in the school curriculum.

From the field of pedagogy, Pedró [13] speaks of New Millennium Learners (NML). These are the generations who were born after 1980 and have grown up and are currently growing in a context where the new technologies are part of day-to-day life. These generations find themselves so entrenched in a digital environment that their ways of communicating and relating are linked to the new technologies. They stand out for: mainly gaining access to information from digital rather than printed sources; giving greater priority to moving images and to music than to text; feeling at ease multitasking; and for acquiring knowledge by processing discontinuous, nonlinear information.

From the field of cultural and media studies, Buckingham [1] endorses the main theories of Gee and Prensky, although he questions or raises some of their contributions for discussion. Thus, in reference to Gee's [6] 36 learning principles, he raises doubts about the relationship between informal learning and situated learning (principle 17, the Situated Meaning Principle), and about the importance and limits of competency transfer (principle 29, the Transfer Principle). He also questions the role assigned by Gee [6] to pleasure in learning and places limits on the educational potential of games, depending on the type.

The multimodality of video games and user activity are also characteristics specified as positive in increasing the feeling of engagement and immersion in the virtual world and the development of learning.

Over the last two years, and since the launch of the Wii interface, the numerous possibilities it offers have given greater importance to the activity aspect. Different Wii commands, with several forms and uses, offer a new horizon: communication using body movement.

According to Egenfeldt-Nielsen [5], the third generation of computer games provides less content and, in contrast, enhances the importance of engagement.

In his recent book Gros [7] also quotes this author and points out that, although the narrative-story continues to be important for the success of the video game, and although the evolution of design has led to the sophistication of visual aspects, in the latest generation of video games "*meaning in the games is generated on the basis of a wider, more open interaction context*" [7, p.13].

The foundations of these approaches can be found in studies carried out over fifty years ago. In fact, with regard to studies on learning methods, Dale [4] developed a model that explained which methods were more or less effective for learning. His model, identified as “The Cone of Learning”, is based on an extensive, in-depth field study on the subject. This model (fig.1) is represented by a pyramid or cone of experiences, in which the levels correspond to different learning methods. The most effective and participative are at the base and the least effective and abstract at the top.

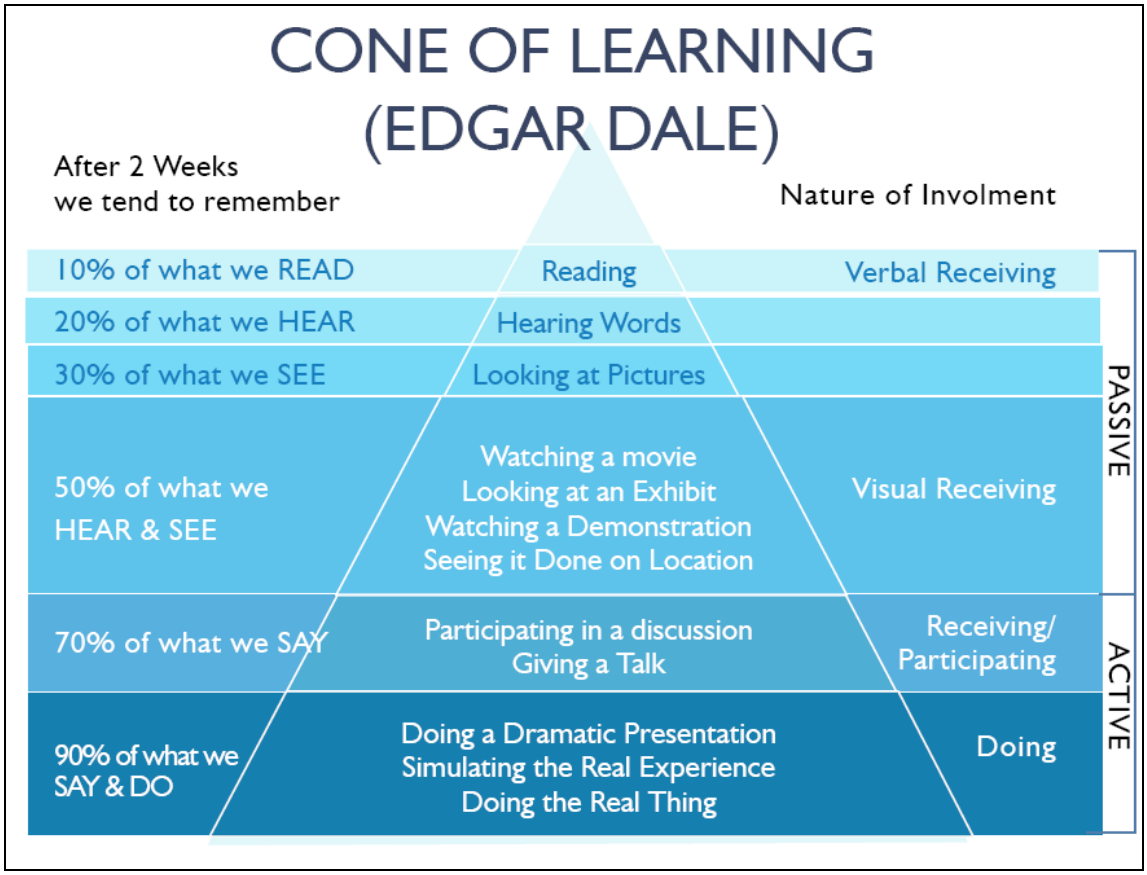

Fig.1. Edgar Dale’s Cone of Learning according to Percepsys [16].

Centres such as the MIT Media Laboratory, the Pervasive Interaction Lab and the Xerox Palo Alto Research Center, among others, have developed physical hardware interfaces that are very similar to real objects and can be manipulated in a very similar way to real life.

Marshall, Rogers and Hornecker [9] point out that these physical interfaces, called tangible technologies, provide playful learning, novelty of links, accessibility, collaboration and learning benefits of physicality as possible benefits for learning (fig.2).

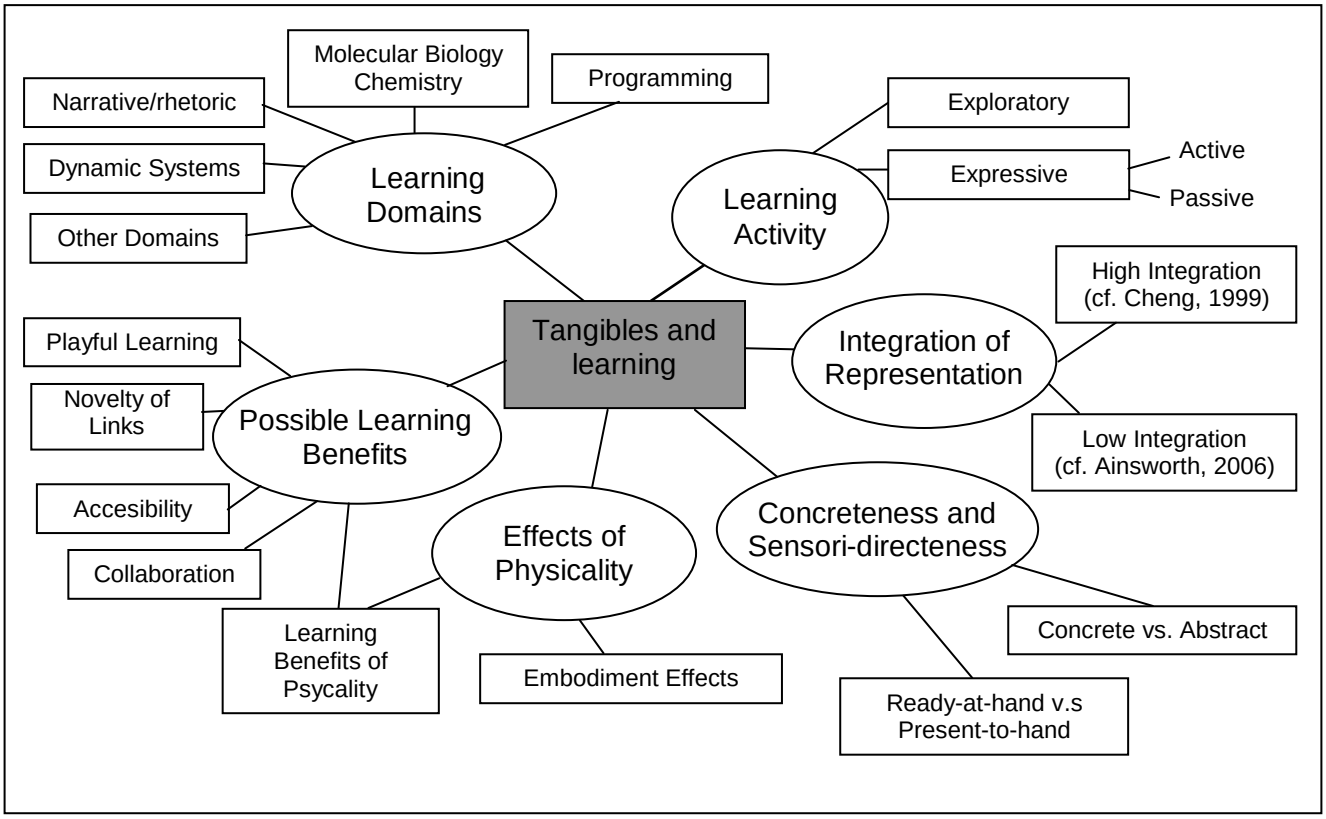

Fig.2. Tangible interfaces and learning according to Marshall, Rogers and Hornecker [9]

For Gros [7, p. 12] "*the use of the Wii has brought digital games closer to adults since they can be played without having to worry about the typical problems related to using the keyboard or other accessories. Interaction with the Wii Remote (Wiimote) is natural and reproduces movements made in 'real life'.*" In the same book, Moreno [12] uses the term "physical interfaces" to include intuitive "natural mimetic" hardware interfaces and interfaces for immersion in virtual reality.

Interested in the engagement and interaction that these new Wii-type interfaces offer, the GreTICE, group within the framework of the *CONTIENE* project (Intelligent content for virtual reality applications. Point-of-view techniques and global illumination. TIN2007-68066-C04-01, financed by EMED – Ministry of Education and Science -MEC-Spanish initials-, in the TIN - PN Information Technology programme), has been exploring the possibilities these resources offer. To do so, and as will now be explained, we have conducted an exploratory study aimed at detecting the preferences and perceptions that individuals have towards this type of technology. At the same time, its educational potential and possible integration in the school curriculum have been assessed.

2. VIDEO GAMES IN THE *CONTIENE* PROJECT

The emergence of multimedia contents on the Internet raises new issues, such as scale, usability and the democratization of the chain of tools needed to create these contents (Cencioni [2]). At the same time, there is a proliferation of data produced by these devices that must be integrated and interpreted and, in turn, generate new demands related to the representation of knowledge and reasoning. The project approaches this problem using two complementary strategies. The first consists of introducing intelligent tools able to create and present information for the user more intelligently (creating adaptable and adaptive multimodal interfaces for it) and also more attractively. The second consists of incorporating existing computer game technology and advanced hardware in order to have faster, more interactive tools.

The project team is made up of researchers from different fields (technological and pedagogical) that approach this subject from different perspectives. The technological innovations achieved in the project will have to be applied in the creation of a video game.

Before developing the application, the team of pedagogues thought it necessary to have an overview of user preferences (teenagers) and to adapt the new application to them. This paper presents some of the results obtained in this first study.

In addition, one of the project's lines of work consisted of incorporating the technological innovations developed for computer games, and one of the tasks entrusted to the research team was the introduction of new communication interfaces. Accordingly, the widespread use of the Nintendo Wii platform and the new interaction possibilities it offers led us to think that it would be interesting to know the opinions of users (on this occasion, expanding the population range). For this reason, a new survey was prepared to gather information related to the Wii console, some of which has also been presented in this paper.

3. EXPLORATORY STUDY

3.1. The questionnaires

The data analysed in this study has been obtained from two questionnaires: the first on video games in general, and the second focused on the Nintendo Wii console.

Video game questionnaire (VG questionnaire): Focused on obtaining information about video game use, habits and preferences of young students of ESO (compulsory secondary education). Aimed at three different groups: students from Catalonia (Spain) between 11 and 17, their teachers and their parents or advisors, due to the interest in finding out the educational potential (contents, skills and values) of video games. The responses were collected between the second semester of 2007 and the first semester of 2008 (the first results were presented in a conference in the 11th World Forum on Children's Television (FMTI-Spanish initials), held in Barcelona from 12 to 16 November, 2007, and published in the Forum's Book (2007) (11th World Forum on Children's Television (2007). *L'imaginari audiovisual: quins valors? Ciutadania Comunicativa*. Conference papers 2007. ISBN: B-47030-2008). The final sample was made up of 1281 students, 143 teachers and 147 fathers, mothers or legal guardians of the students.

Nintendo Wii console questionnaire (Wii questionnaire): With the dual objective of discovering the most highly evaluated interactive elements of the Nintendo Wii console, and of collecting proposals about new functions that could be added to a video game console to increase interaction with a hypothetically ideal video game. Aimed at the general population due to the huge success achieved by this console. The people surveyed are from Catalonia (Spain) and are aged 10 or over. We have been collecting responses since January 2009. This study is based on the results of a sample of the first 1100 responses.

Both questionnaires could be answered online. Compulsory fields were not used so as not to lose whole records of people who gave up completing the entire questionnaire. This means that some fields of some records have not been completed, and therefore the sum of percentages given is not always 100.

3.2. Data obtained

Profile of the respondents

In the VG questionnaire, the sample of young people is 50.4% male and 46.6% female. The majority response corresponded to 15-year-olds (25.4%), followed by 13-year-olds (20.8%).

Of the teachers, 52.4% were male and 42% were female. The most frequent age group was between 41 and 50 (28%).

In the parent sample, 53.7% were mothers, while 39.5% were fathers. 60.5% of the respondents were in the 41 to 50 age group.

In the Wii questionnaire, the sample population was 55.91% female and 42.64% male. The average age was slightly under 27.

Use of video games

In the VG questionnaire, when young people were asked to rate video games from 0 to 10 (0 = they do not like them; 10 = they like them a lot), the average mark obtained was 6.45, which is relatively low in relation to what might be expected. The reason might be that young people nowadays can choose from a wide range of technological alternatives that may be more motivating, among which activities entailing online social networks stand out (like Fotolog and Messenger).

Even so, it is worthwhile to note that the most frequent mark given was 10 (23.2%), followed by 8 (15.3%).

Analysing for gender, we can observe that video games have been awarded an average mark of 7.44 by the male group, whereas the female group have given them a 5.55.

Almost three quarters (73.4%) of the teachers declare they have played a video game at some point. The mark teachers give video games is 5.40. They perceive the students' assessment of video games to be 8.37, a considerably higher mark than that of the students themselves. This assessment clearly reflects that teachers are aware that video games occupy a great deal of students' leisure time.

Among the parents, 72.8% state that they have played video games. However, the mark they give video games (4.29) is the lowest. They assess the interest they believe their children have in video games with a 6.31 (a mark that is very similar to that of the students).

Regarding young people's interest in video games, 90.09% of respondents to the Wii questionnaire feel that the Nintendo Wii console is to young people's liking.

In the VG questionnaire, 24.6% of the young people claim to have used, at some time, a video game at school for didactic purposes. This high percentage leads us to think that affirmative answers do not only include the use of video games, but also other kinds of computer applications.

Almost three out of ten (29.3%) parents claim to be aware their children have used video games for educational purposes at their primary or secondary schools.

However, only 14.7% of teachers claim to have used video games as a didactic element, although it should be mentioned that 57.3% would be willing to. Only 5.6% would never use them.

In this same educational field, 54.45% of the respondents to the Wii questionnaire think they would like the Nintendo Wii console to be used in schools, while 32.64% think the opposite. Among the respondents' suggestions about what it could be used for, mathematics, language-related subjects, exercising memory and physical coordination stand out.

In the VG questionnaire, 73.5% of parents have bought video games for their children at some point. The main reason is that their children have asked them to. The criteria taken into account have mainly been the content and degree of violence of the video game.

Summing up student playing habits, based on the first questionnaire on video games, it has been possible to establish that:

- playing frequency is 1 or 2 times per week
- sessions last 1 hour
- they play in the afternoon/evening
- in a room at home
- they mainly play at weekends
- 64.9% have not reached an agreement with their parents
- the most used platforms are personal computers and the Sony PlayStation console
- 51.6% play on their own and 29.3% with friends

Based on the analysis of data from the Wii questionnaire, some relevant shifts in trends from the previous data can be observed:

- A slight majority (49.29%) of respondents has the Nintendo Wii console, which leads us to think that it has become one of the most popular game platforms. This information is reinforced by that from aDeSe (The Spanish Association of Distributors and Publishers of Entertainment Software (http://www.adese.es), according to which, in December 2008, four of the five highest selling video games in Spain were for the Nintendo Wii platform.
- Only 11.20% claim to play alone, while 42.21% say they play with friends and 39.38% with the family. Moreover, 72.62% of the players state that one of the things they like most about this console is being able to play in the company of others. These results contradict the popular belief that video games act against the socialization of the individual and create people who are isolated from each other. In contrast, they reinforce the theories of Mitchell [11], who asserted that families play together, interacting in a cooperative way, and those of Coldwell, Grady and Rhaiti [3], who concluded, on the basis of a study, that there was a positive relationship between the degree of sociability and the use of video games.

Preferences for video game characteristics

From the VG questionnaire we can deduce that the type of game students like best is the adventure game (51.4%), followed by sports games (47.5%). It must be pointed out that war video games have obtained a fairly low percentage (15.1%).

The favourite viewpoint is third person with 64.3% favourable responses. This means that video games showing the player at a distance are preferred.

48.9% of the students say there are video games meant for men and others for women. They think that games such as *Barbie*, *The Sims* and *SingStar* are for girls, while sports games and those containing violence and erotic scenes are for boys.

Along these lines, 44.2% of parents and 55.9% of teachers also believe that there are specific games for each player gender.

Of the students, 65.7% believe that certain video games can incite violence. This same opinion was shared by 76.2% of parents and 75.5% of teachers. These percentages are very high and demonstrate, on the one hand, the recognition of the use of this type of game among students and, on the other, the concern this triggers in adults. We must remember that 73.5% of parents buy video games for their children's request. These results lead us to think that a considerable percentage of parents has bought a video game with violent content at some point.

More young people (58.5%) say they have played violent video games than parents (53.7%) who are aware that their children have played this type of video game. One aspect of the marketing of the Nintendo Wii console that could be criticized is that it has been distributed with the Wii Sports game which, although basically dealing with sports, has been classified by PEGI (Pan European Game Information. Video game classification system used in most of Europe) as a video game containing violence. This is because boxing is included among the sports in the game.

Among students, 17.3% admit to having experienced aggressive or violent feelings after playing violent video games. Among their parents, 14.3% claim to have observed aggressive or violent behaviour in their children who play this kind of video game. And 44.1% of teachers state that they have thought at some time that certain aggressive or violent behaviour from their students has been due to violent content in video games. This data is alarming and although violent content cannot be directly related to subsequent violent behaviour patterns, the respondents' perception should be taken into account. In some cases, the production and distribution of certain video games should be reviewed, given that there seems to be little control over contents, the interests of certain enterprises and biased propaganda, and recommendations about minimum age requirements are not met. A protocol is needed to regulate this situation and make sure that certain video games are never marketed.

Almost four out of ten (39.2%) students think they learn something by using video games. Curiously enough, higher percentages of adults give this response: 67.3% of parents and 70.6% of teachers believe that something can be learnt using video games. According to respondents from the three

sectors, some of the things that can be learnt are English, history, mental calculations, exercising one's memory, organization, facing situations similar to real life, reacting in the face of certain problems, increasing the capacity to react, concentration, skill, dexterity, creativity, originality, the value of friendship and the art of having fun.

In technical aspects, the three sectors coincide in placing high value on graphic aspects. In contrast, being able to use peripherals, video game soundtracks and playing with other players connected to the Internet are, generally speaking, less appreciated.

In the Wii questionnaire a change of tendency can be seen yet again. Only 8.48% of players identify the graphics as what they most like about the Nintendo Wii console. Similarly, sounds are only appreciated by 8.09%. In contrast, using movement to communicate with the console is assessed positively by 84.44% of respondents. Moreover, if we take into account that 72.62% highlight the possibility to play with others as very important, it could be interpreted that technical aspects remain in the background, while interaction with the console and with other players gains great relevance, as Egenfeldt-Nielsen [5] and Gros [7] have pointed out.

In the VG questionnaire, both adult groups evaluate positively aspects such as having to reach conclusions based on clues, having to establish plans of action, solving problems, learning something and having to take decisions. The young people have always appreciated these aspects less than adults.

The only aspect the student's value more than adults do is the length of the game. For young people it is important for the game to last a long time. They are probably motivated, at least in part, by having to overcome certain obstacles and they lose interest in the game when the objectives have been met.

The basic characteristics of the ideal video game

In this section, we will list a set of data to enable the design of new products that include all the incentives (both technical and in content) that a recreational video game may have, and that implicitly favour the acquisition of certain kinds of learning.

In the VG questionnaire, we recorded opinions on the type of setting, type of space and characters that respondents would use if they set out to design a new video game.

In the case of the ideal setting, despite the great variety of responses, they coincide in preferring settings that faithfully reproduce the present time: 21.9% of students, 26.5% of parents and 25.2% of teachers.

The results for the ideal space are clearer. Open spaces that allow the player to move freely are preferred by 55% of students, 54.4% of parents and 47.6% of teachers.

A similar situation occurs with the ideal character. Real characters are preferred by 44.1% of students, 42.4% of parents and 46.2% of teachers.

The Wii questionnaire revealed several aspects mostly about the relationship between the player and the video game.

We started by asking for an opinion on whether the Nintendo Wii console is better, the same as, or worse than other consoles. Most (54.18%) thought it was better, more than a quarter (28.70%) thought it was the same, and only 6.82% said it was worse. It is worth analysing, therefore, the reasons why this console stands out from the others.

Among the main reasons why people like the Nintendo Wii console, the most frequent ones are:

- high level of interactivity, real interactivity
- it represents a different way of playing
- participation is greater, you have to move, you do exercise, it represents a dynamic activity, you use your entire body
- it enables involvement in the game

- the remote controls are very original
- it can be played with family and friends
- easy to use
- high degree of entertainment
- for all ages
- most games permit the multiplayer version (up to 8 players)

Among its main drawbacks and aspects to be improved, the following stand out:

- the price of the console and the games
- not all the games exploit all the possibilities of interaction with the console
- graphic aspects
- games offered are too childish
- some myths: isolation, addiction, playing time
- none

Finally, we asked the respondents what they would like to be able to do with the Nintendo Wii console, and what they think still cannot be done. Among the most imaginative answers, the following stand out:

- represent holograms that would expand active parts of the game, virtual reality, 3D settings
- online chatting
- use of lightweight gloves to communicate with the console
- use of sensors distributed all over the body to capture body movement
- develop a didactic unit with all the course content, didactic applications, learning programmes, applications to promote social competence, didactic use for schools
- games adapted for the handicapped and for people with physical limitations
- voice communication with the console

4. CONCLUSIONS

Video games represent one of the many profound ways our society is changing: technological advances, the importance of image and multimedia, information management and processing, interactivity, speed and access to digital resources. They have become one of the main sources of fun and entertainment for children, young people and adults.

The analysis of the results of the VG questionnaire confirms that it is possible to use recreational video games for educational purposes within a formal educational setting. The respondents themselves (young people and adults – parents and teachers) state that the use of video games brings new learning outcomes (examples are given of concepts as well as skills, procedures and values) and demand greater educational potential from new products. At the same time, they provide information about their preferences with regard to certain design and content aspects of video games.

The data analysed in the Wii Questionnaire shows that attention must be paid to new trends in the field of video games due, above all, to the emergence of the Nintendo Wii console and its revolutionary level of player-gadget interaction. It is worth highlighting characteristics such as:

- **being able to play in groups**: the profile of the new player is not a person alone in front of the screen, but instead a group of family members or friends who get together to have fun
- **the possibility to use body movement to communicate with the console**: which makes the activity being carried out total, simulating real experiences with, as Edgar Dale has already formulated in his Cone of Learning, greater and longer-lasting learning outcomes
- **not giving such importance to technical aspects**: such as graphic and sound effects

Observing this shift in video game interaction trends has encouraged us to continue seeking new uses for this console in particular and new breakthroughs in the field of video games in general.

The results obtained in this study may lead to the design and creation of new products that are attractive enough to motivate young people, and satisfy enough educational aspects to be used in formal education.

5. REFERENCES

[1] Buckingham, D. (2007) *Beyond Technology. Children's Learning in the age of digital culture*. Cambridge: Polity Press.
[2]Roberto Cencioni & Stefano Bertolo, From Intelligent Content to Actionable Knowledge:Research Directions and Opportunities under Framework Programme 7.
[3] Coldwell, J.; Grady, G. i Rhairi, S. (1995). *"*Computer games, self-esteem and gratification of needs in adolescents"*. Journal of community amd applied social psychology,* n. 5*.*
[4] Dale, E. (1946) Audio-visual methods in teaching. New York: The Dryden Press.
[5] Egenfeldt-Nielsen, S. (2005) *Beyond Edutainment*. Copenhagen: University of Copenhagen.
[6] Gee, J.P. (2004) *Lo que nos enseñan los videojuegos sobre el aprendizaje y el alfabetismo*. Málaga: Aljibe.
[7] Gros, G. (Coord) (2008) *Videojuegos y aprendizaje*. Barcelona: Graó.
[8] Jones, G. & Dondlinger, M. (2007). "Measuring Habits and Attitudes towards Computer and Video Games". In C. Crawford et al. (Eds.), Proceedings of Society for Information Technology and Teacher Education International Conference 2007 (pp. 1221-1223). Chesapeake, VA: AACE.
[9] Marshall, P., Rogers, Y. and Hornecker, E. (2007) "Are Tangible Interfaces Really Any Better Than Other Kinds of Interfaces?" In Workshop Proceedings on Tangible Interfaces in Context and Theory, CHI'07, San Jose, April 27th. (5/12/2008).
http://www.cl.cam.ac.uk/conference/tangibleinterfaces/TUIworkshop-Marshall.pdf
[10] McDougall, J.; O'Brien, W. (2008) *Studying Videogames*. Leighton Buzzard (England): Auteur
[11] Mitchell, E. (1985). "The dynamics of family interaction around home video games. Special Issue: Personal computers and the family". *Marriage and Family Review 8(1-2),* 121-135
[12] Moreno, I. (2008) "Videojuegos constructivos y aprendizaje participativo". En: Gros, G. (Coord) *Videojuegos y aprendizaje*. Barcelona: Graó, pp 73-91.
[13] Pedró, F. (2006). "Aprender en el nuevo milenio: Un desafío a nuestra visión de las tecnologías y la enseñanza". OECD-CERI . (8/1/2009).
http://www.enlaces.cl/tp_enlaces/portales/tpe76eb4809f44/uploadImg/File/seccion_actualidad/aprendiz.pdf.
[14] Percepsys. *Simstudio Secon Generation 3D Simulation*. (21/1/ 2009).
http://www.percepsys.com/images/Percepsys_SIMSTUDIO.pdf
[15] Prensky, M. (2006). *Don't Bother me, Mom, I'm Learning! – How computer and video games are preparing your kids for 21st century success and how you can help!* St. Paul – Minnesota: Paragon House.