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Video Games and Education
(Education in the Face of a "Parallel School")

MIGUEL DE AGUILERA AND ALFONSO MÉNDIZ
University of Malaga

Fully integrated into the everyday lives of millions of young people throughout the world, video games are a vital part of contemporary culture and society. But the reaction of many authorities and the majority of educators has been to discredit video games by assuming their negative effects. After more than two decades of research, however, many studies have been published that have gradually led to a more complex, nuanced, and useful understanding of video games. This article focuses on one of the most interesting alternative perspectives—that of their educational potential as teaching and learning tools. After justifying this point of view, we offer a critical review of previous research on the subject; and finally reach some conclusions on the advantages of using video games for educational purposes.
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1. INTRODUCTION: UNDERSTANDING THE EDUCATIONAL POTENTIAL

1.1 Apocalyptic or Integrated?

It is undeniably enlightening and interesting to talk with video game players, watch them play and listen to their comments, or read about their thoughts on the subject. It is useful, if not indispensable, to take advantage of all available means to get to know firsthand what millions of video game players throughout the world say about the meaning and experience of playing video games.

Opinions voiced by the players about the video games are extremely varied, ranging from curiosity through amused indifference to fascination; although the general opinion is one of acceptance. However, the players' attitudes, based on their experiences as end-users and on the way the games help to constitute their everyday lives, contrast with those of politicians, educational leaders, and many media professionals and critics. Although some accept video games, the majority express deep concern, and some reject them outright, blaming them for the growth of a culture of violence.

So when serious or harrowing incidents that involve young video game enthusiasts occur, public opinion leaders frequently pass judgment, depicting the players and their games in a way that causes general alarm. In terms similar to those used in criticizing television, they

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Authors' address: Department of Audiovisual Communication and Advertising Faculty of Communication, University of Malaga, Campus de Testinos, 29071 Málaga, Spain; email: deaguilera@uma.es amendiz@uma.es

disparage video games generally. They fault the people who play them, alluding to the games' violent, sexist, or addictive characteristics. In this atmosphere, it is not hard to understand the reasons for the steps taken by legislators to regulate the game industry or the debate in the United States Senate. Interestingly, during this debate several experts testified that there was a lack of scientific evidence proving any direct link between the use of video games and the negative effects imputed to them. Many experts have shown that it is impossible to attribute negative effects to video games, except in rare cases and under unusual circumstances.

Despite the enormous concern expressed by public authorities, sociological data reveals how popular video games have become. The data reflects a totally established reality, and one that is still growing. Video games constitute a powerful cultural industry that is constantly evolving technological applications; it is a symbolic universe frequented by millions of citizens, especially younger people (which includes everyone under 35, since, although the first generation of players has matured, they have not given up their hobby).

The great majority of officials and opinion leaders have never played video games. This lack of personal experience, together with the caution with which (of necessity) officials treat the products and marketing strategies of the entertainment industry, has in all likelihood contributed to the spread and development of a social discourse that denounces video games across the board. This hostile criticism embraces all the games, platforms, and players, since a new medium will always be defined along with its users, no matter how diverse they may be.

These attitudes are undoubtedly a product of a "moral panic" typical of our age. For both the *apocalyptic* standpoint (outright rejection) and the *integrated* point of view (acceptance and fascination with video games and other forms of -electronic communication) are based on ideas and beliefs about the representation of childhood, youth, technology, and the games themselves. These beliefs are incorporated in turn into the *stories* and *discourses* that characterize today's age of rapid and comprehensive change.

In the main, the apocalyptic discourse was adopted by the governments and institutions of a number of countries and disseminated through a variety of channels to consumers, who finally adapted it to their own domestic settings. But no matter how stereotyped this discourse may be, its implications, voiced in public and then elaborated at home, often make a significant distinction between video games played on a television screen and those that use a personal computer platform. Appraisals of the former, related solely to leisure and entertainment, are based directly on assumptions previously used to assess the effects of television. In contrast, the latter, immersed in the discourse on *new technologies*, acquired positive connotations in the productive, useful, and modernizing sense. And families, fearful of lagging behind technological advance, frequently accept this distinction, which then helps justify the expense of the new equipment.

Along with the discourse on the implications imputed to these technologies, several other issues should also be addressed. On the one hand, the public sector generally does not pay sufficient attention to some very important changes affecting young people. As a result, it is left to the youth culture industries to identify many of the expectations and demands of youngsters, which are based on the appeal of mass culture.. On the other hand, these discourses, each with varying degrees of persuasiveness, are disseminated to society as a whole and are appropriated, in some measure, by its members, including its scientists and

educators, who, as Edgar Morin [1962] states, are also imbued with "the spirit of their times," and direct their work on the basis of particular axiological, theoretical, and methodological suppositions.

1.2 A Necessary Clarification

As with other expressions of mass culture, there appears to be an established historical trend that minimizes its scientific importance Hence, scientific research into video games is still relatively rare (even though the overall literature is fairly abundant). Although some work was published in the 1970s, research took off in the 1980s, the first stage of the video game boom. The research has matured and diversified with time, especially in the last few years, with the active involvement of several generations of players. This has led to findings of considerable interest.

One of the foremost objectives of much research was the study of the "effects" of video games (aggressive behavior, addiction, isolation, school performance and the like), based on previous assumptions and research on television. But after two decades, research results on video games are somewhat confusing. First, the disciplinary and methodological approaches on which these studies were based vary. Second, the effects of video games were measured using parameters (i.e., types of games, platforms, age groups, length of exposure) that are not always comparable. And last, the research is fragmented, inconclusive, and barely consistent with any multidisciplinary outlook that embraces the sciences of psychology, psychiatry, education, sociology, and communications. Despite attempts to demonstrate that video games have a pernicious influence on players, there is no scientific evidence to support this claim. To the contrary, some positive effects, particularly those of an instructive nature, have proven to be more empirically and theoretically evident.

Most scientific research on the educational potential of video games was done in the English-speaking world, especially the United States. This work was conducted primarily in the fields of psychology and psychiatry (although others, such as medicine, communications technology, sociology, education, and women's studies, have also shown interest). The research in these fields covers a wide range of subjects, which fall into the following categories:

- *Access and use* (difference according to sex, age, and socio-economic status, contextual studies, models of use, relations with other activities related to leisure).
- *Subject matter* (thematic genres, structure, origin and background, technical mediation).
- *Social perceptions* (discourses on technology, youth issues, education).
- *Positive and negative effects* (aggression, addiction, sexism, social and cognitive skills, educational achievement and potential, impact on socialization and family functioning, role exploration, building identity).
- *Other applications and consequences* (*medical*: oncology, burn rehabilitation, alcoholism, drug addiction; *didactic:* special education, research in artificial intelligence, technology and its adaptation to users, user impact on technology, introduction of new technologies into society).

Despite its shortcomings and contradictions, scientific research helps us to acquire some knowledge of the video game phenomenon. Unfortunately, however, dissemination of these

empirical findings has not been very effective, impeding the indispensable exchange of information within the scientific community, as well as wise counsel to the public, including implications for educational policy and reform.

1.3 Reforming Education Through Change

It is important to emphasize *how* video games influence the learning processes of children and adolescents, as well as their effects on the educational process in general. The first ideas on the subject were published in the United States as early as 1978, and established a line of research related to motivation for learning, including the games' cognitive potential. This research spread somewhat in the 1980s, but especially in the late 1990s. By then, scientific research had already established links between video games and different realms of the human psyche, and had begun to examine links between playing video games and the complex socializing processes that, in contemporary societies, young people engage in.

So video games, like any other technological device, are simply media through which young people engage in particular activities. Or, seen from another angle, they are no more than another feature with symbolic, economic, and technological dimensions in a complex social context that is constantly subjected to an intense and accelerated process of change that affects all spheres of everyday life.

Some of the signs and settings of this accelerated change are embodied in an intricate system of technically-assisted human communication where information is shared and knowledge is constituted. A network, whose principal interface is the screen, intervenes in most of the activities of our day-to-day lives. A global system, introduced over the last two decades (during which today's young generation was born and raised) intervenes in our knowledge and practice, mediates between technology and discourse, and constitutes the primary setting for a great cultural synthesis. It is a fundamental tool with which we participate daily in a unique cultural synthesis.

In adapting to the circumstances imposed by this new context society in general, as well as individuals, must make a serious attempt to acquire a comprehensive knowledge of the characteristics of *change*, in order to provide adequate solutions to today's social problems. One of the most pressing of which is the reform of education and training. Hence, it is not enough to simply educate the population in the new media, its languages and the cultural universes to which it is connected. It is equally necessary to rethink, and even redefine, the educational system as a whole, its media, settings, methods, and the concepts on which it is based.

Many scholars, as well as public administrations, who have launched a number of initiatives to develop the educational process, know how necessary this is all too well. Among other things, valid reform entails integrating electronic media, especially computers and the Internet, into school settings in order to correct the imbalance between students who have easy access to the Internet and those who don't, depending on the *economic and cultural capital* they possess.

Likewise, the idea is to develop the skills, abilities, and critical knowledge that will enable people to form alternate meanings, to compensate for the appropriation of areas of private life by the mass media. Although the success of these initiatives has been limited by a number of problems (finances, for instance) or by the skepticism of many teachers and administrators of educational institutions. Mainly orientated towards written culture, a significant number of "experts" in the educational system still do not acknowledge, or accept, the positive potential of electronic media. In addition to reading, writing, arithmetic,

and other traditional skills that schools have traditionally emphasized, authorities in the educational system must now recognize and utilize this complex *network*: the uninterrupted flow of miscellaneous signs and symbols transmitted via specific technical devices, conforming to different cultural keys, which after a fashion, constitute "parallel schools."

Sustained action has been taken at institutional and individual levels for carrying out the necessary reforms within the educational system, even though the changes still seem to a large extent rather vague, in many cases in the defining or experimental phases. The initiatives usually have quite limited objectives, either due to lack of available resources or the slim prospects for actual application, especially for video games. However, the culture industry is highly aware of the potential market for products designed for educational purposes. Certain specialized schools (business, military, and research centers), have also developed, and have available, applied software for their educational goals (e.g., *Games-to-Teach Project*, a partnership between MIT's Program in Comparative Studies and Microsoft Research). As a result, in the last few years several initiatives have been developed with the sole purpose of exploring and experimenting on the relationship between video games and the academic curriculum; but these are isolated instances in their incipient stages, and are not incorporated into the educational teaching system.

Nevertheless, the search for the most suitable strategies and actions to shape educational systems to the new era is an unavoidable task that is already being undertaken by public administrators, scholars, and educational leaders. Such an undertaking must be based on a sound understanding of social and cultural contexts, and of the new media that hold the key to potential educational reform. This was the specific aim of the study conducted by the Video Games Research Group at Malaga University for the National Centre of Educational Information and Communication of the Spanish Ministry of Education, Culture and Sports (Centro Nacional de Información y Comunicación Educativa del Ministerio de Educación, Cultura y Deporte). Above all, the group sought to conduct a thorough documentary search, taking into account specific ideas, research, and experiments originating from different sources regarding the educational potential of video games. To this end, we had recourse to a number of documentary centers and sources that allowed us access to reliable information, so we could preselect documents and subject the literature to a thorough critical review.

2. A CRITICAL REVIEW OF THE LITERATURE

2.1 Historical Trends

The first research on electronic games was conducted at the beginning of the 1970s, or thereabouts, at about the same time the first video games appeared in the United States. However, the first studies that went beyond their potential psychological effects to broach the educational potential for children and adolescents were not published in the scientific literature for another ten years. Work by G. H. Ball, entitled "Telegames Teach More Than You Think," published in 1978 set a solid precedent. In this study, Ball hints at two lines of research that would become commonplace in the subsequent literature.

(a) On the one hand, Ball analyzed the capacity of video games for developing the spatial abilities of children, with special emphasis on the games' three-dimensional features and the simulation of real worlds. This aspect soon became a very widespread line of research. Authors who followed in Ball's footsteps include Lowery and Knirk [1982-83]; Gagnon [1985]; Greenfield [1985]; and Dorval and

Pépin [1986], all of whom arrived at the same conclusion: that the experience and skill shown by players have an accumulative effect during the game.

(b) On the other hand, he also studied basic aspects in the intellectual development of children and adolescents in learning language and mathematics and the role played by video games. Several of his conclusions can be regarded as daring, even now. For instance, he concluded that video games are beneficial to learning a number of intellectual skills, including assimilation of numerical concepts and reading comprehension, and they even promote reading.

At the beginning of the 1980s, with the spread of video games, research increased and became more diversified. An experiment by Griffith et al. in 1983 on a group of primary school students proved that the visual and motor coordination of players of video games was better than that of nonplayers in the same peer group.

Two years later, Greenfield published her famous book, *The Child and the Media* [1985], one chapter of which is devoted to proving that the sensor-motor activity of children who play video games regularly is much greater than average. In the same chapter, she gives a detailed account of her experiences with classic games like *Pac-Man* (a maze game) or *Tranquility Base* (the adventures of a spaceship on a distant planet).

Later on in the decade, the work of Dorval and Pépin (1986), Lowery and Knirk (1982-83), and Driskell and Qwyer (1984) built upon the important initial studies. All these authors converge in pointing out that adolescents with medium- or long-term experience playing video games show greater visual capacity, motor activity, and spatial abilities-reflexes and responses. Their work seems to prove a cumulative effect, as with other human abilities, in which practice and function are fundamental.

At the same time, the first work relating the use of video games to primary cognitive abilities was published: Long and Long [1984] analyzed the deductive processes that electronic games may involve, and examined the development of cognitive strategies through play. Following the same line of research, Silvern [1985; 1986] studied video games' potential in learning processes such as trial and error in formulating hypothesis, and generalizing conclusions. In relation to the work of his predecessors, Silvern also studied how a child's mind develops through play (the ability to organize the elements of a whole and arrange them with strategic purposes in mind). In general, the first researchers in the field concentrated on problem-solving strategies and on a series of markedly cognitive questions involving learning as the main focus of educational interest in the scientific study of video games.

Finally, initial research also indicates the importance of electronic games for those children who have difficulty learning basic subjects and skills [Greenfield 1985]. Several authors proved that video games helped pupils to perceive their deficiencies and try to correct them. According to these researchers, the adaptability and versatility of video games, as well as the players' control over them, motivate and stimulate learning, and make the games useful in cases of where children have difficulties concentrating. The immediate feedback provided by video games, and the need for a continuous response during play, challenge and a stimulate children and adolescents and arouse curiosity, which can be extremely useful in learning.

Since the end of the 1980s, research into video games developed at a vertiginous rate. To understand this explosion, it is important to take into account what happened in the video

game market at that time. For example, in 1989 Nintendo launched its pioneering console, GameBoy, and as a consequence, researchers began to concern themselves with the plausible effects of video games on children.

2.2 Common Ground for Research on Video Games

Broadly speaking, the pioneering work in this field has a common denominator regarding the educational implications of video games: i.e., the desire to analyze a phenomenon that had truly started to show signs of growing importance; but there was a negative factor too: the scientific community's open disbelief that video games were important. Video games were often judged as a merely meaningless form of entertainment.

Furthermore, the paradigm dominant at that time focused chiefly on the pernicious effects of the mass media on children, a perspective that was soon transferred to video games. For instance, until well into the 1990s, there was a widespread tendency to draw an almost compulsory parallel between consumption of video games and rising violence among children and adolescents. The authors of some of these studies pointed out that the percentage of adolescents who chose educational video games is very small compared to those who preferred war, strategy, or other genres.

During the 1980s, researchers commonly held the view that, for children and adolescents, video games are colossal time-wasters. The zeal with which researchers tried to calculate how many hours children devote to playing video games, as if this held the key to the quality of their education, is curious, to say the least. This kind of measurement only leads to an alarmist or apocalyptic perspective. Several authors have gone a step further, conducting studies that aim to reduce the addictions to which the indiscriminate consumption of video games may lead.

The profound limitations of these kinds of studies make it clear why it is necessary to establish a calmer and more objective approach to the scientific research on video games, one that is not infused with such a negative bias.

It is also important to draw attention to the pervasive gender bias in many studies of video games. Many authors seem to do their utmost to measure and compare the consumption of video games according to sex, or to spell out how the games have an influence on gender relationships, social values, and stereotypes. Hence, the report called *The Video Generation* [Provenzo 1992], or the compendium, *From Barbie to Mortal Kombat: Gender and Computer Games* [1998, Casell and Jenkins, eds.], which illustrates the gender stereotypes in certain video games produced by Nintendo, are indeed enlightening.

In other work, references to video games appear in a more partial context or in open comparisons to other educational activities. In this respect, it is possible to distinguish between two lines of research of a more limited scientific interest:

(a) *Comparison of video games with other communication media*. This line includes the study carried out by Wellisch [2000] on violence on television and in video games; Roberts' book, *Kids & Media & New Millennium* [1999], which analyzes the audio-visual media as a whole; Provenzo's [1991] book on the educational potential of computers in the classroom; and the book by Flood et al. [1997] on cognitive development through the visual arts (theatre, dance, cinema, video games, and computers).

(b) *Comparison of video games with other leisure activities*. In studies of this type, the comparison most frequently made is to reading books; an activity that is quoted a great deal as the antithesis of electronic culture. These studies usually end by putting forward various proposals for introducing children to the pleasures of reading (for instance, work by Olen et al. [1999]). In other cases, a comparison is drawn between the different ways in which children employ their free time [Blaisdell et al. 1999]. And, finally, there are studies that analyze how children learn through play and gaming, which obliquely mention the potential of video games.

In other respects the aforementioned studies follow two main lines of research: one related to the motivation for learning; and another that takes matters a step further and examines the use of video games for clearly didactic purposes, combining elements from formal and informal learning contexts. One could say that the former has greater implications for psychology, while the latter has a direct bearing on the cognitive potential of these games.

Lastly, it is worth pointing out that scientific studies of video games and education vary greatly. In terms of kinds of publications, there are many more journal papers and academic reports than books and monographs (which are barely sufficient). As regards research, there is a preference for applied or empirical work, although there is now a significant number of a theoretical or reflective nature, too.

2.3 Main Lines of Research

The potential contributions of specific video games cover each of the three main fields of psychology: the affective (awakening feelings); the connate (aggressive or impulsive behavior); and cognitive (learning-related skills).

Regarding the connate aspect, attempts have been made to prove that arcade-type, action, role-play, and platform video games help to develop motor co-ordination, manual skills, and reflexes. As to the affective and motivational factors, there are studies that establish a connection between some kinds of games and stress relief. Finally, other studies indicate that more complex games, such as strategy or simulation games, are more directly related to the development of intellectual abilities.

There are many authors who herald the educational potential of video games like *Sims* (social simulation) or *Civilization* (historical simulation and strategy). Several prominent researchers who hold this view include the Le Diberdier brothers [1998] of France, who believe that these games will be accepted and used in the near future as important knowledge tools. Their compatriots, Esther-Gabriel [1994]; Perriault [1996]; and Lefrance [1995], agree.

Arguments in favor of the cognitive importance of video games are based on a number of studies indicating that many video games are conducive to the development of specific skills: attention, spatial concentration, problem-solving, decision-making, collaborative work, creativity, and, of course, ICT skills. The authors [Mandinacht 1987; White 1984; Okagaki and Frensch 1994] conclude that on the whole video games promote intellectual development, and suggest that players can benefit from developing knowledge strategies, practicing problem-solving, and developing spatial skills, and related aspects such as increased precision and reaction rates. Some even mention critical thinking as one of the positive traits [Séller1992].

Spanish authors who defend the educational potential of video games form a group led by Estallo [1994; 1995], followed by Bartolomé [1998], Calvo]2000], Gros [1997; 2000], Etxebarría [1998], and Marqués [2000]. The work of Group F9, a research team at the Autonomous University of Barcelona who champion the unquestionable educational importance "edutainment" by practicing what they preach, deserves special mention. Garitaonandia et al. [1998; 1999], the authors responsible for drafting the Spanish contribution to the project *Children, Young People and the Changing Media Environment*, also take the positive view of the educational importance of the electronic media.

The work of Estallo [1994] deserves special mention because it was pioneering research into the effects of console and computer games. His conclusions are shared by a new group of scholars and educational leaders interested in electronic media. According to Estallo, video games can be instrumental in both the emotional and intellectual development of adolescents. Surprisingly, he goes so far as to assert that "video game players usually have a higher intellectual level than non-players belonging to the same peer group." In addition to other beneficial effects, he emphasizes their importance in relation to intellectual and sensor-motor development. Factors such as perception, deduction, and parallel and simultaneous processing, are also important, as are closely related aspects like spatiality and visual perspective, without forgetting the importance of selective attention to stimuli from the point of view of perception.

A number of authors cover other themes related to video games. Almaraz [1999[attaches importance to their lively and attractive subject matter and their auditory and visual stimuli. Etxebarría [1998] examines their educational potential, comparing them with school curricula from the viewpoint of social learning theory, and inquires into the reasons behind their attraction, which is a very difficult question to answer. He especially calls our attention to their potential in treating learning difficulties in psychomotor development and deductive reasoning by means of effective entertainment. Of all electronic games, those that involve simulation have monopolized the attention of researchers. Studies have been conducted on their use in improving skills at work and in other fields and settings, particularly in medicine and business. Calvo [2000] commends these games because they allow students to familiarize themselves with real situations in day-to-day life. For example, problem resolution and decision-making are continuous activities in the real world. So that what in the author's opinion could be defined as the procedural value of video games is irrefutable. To this effect, Bartolomé [1998] affirms that, for educational video games, simulators constitute an important leap forward, from the associationist theory to the contructivist one. The first theory is related to classic platform, action, or arcade games, owing to their importance in the development and practice of motor skills. But the more elaborate video games require players to use their intellectual resources to the full. This, combined with the open character of the games, their difficult challenges, possibilities, and use of information, means the establishment of a real pedagogical constructivism.

Along these lines, Keller [1992] asserts that children who play video games obtain better results than nonplayers in critical thinking, strategy development, and problem- solving tests. Based on this research, Bracey [1992] calls for the inclusion of video games in school curricula.

Research on the abilities and skills that children can develop through play is perhaps the most interesting subject in the field of video games and education. To a great extent, this line of research has been followed by the Department of Psychology at the University of

California, Los Angeles, which published four papers in the *Journal of Applied Developmental Psychology* [1994[, and six in *Interacting with Video: Advances in Applied Developmental Psychology* in 1996.

The majority of these studies share the view that use of video games can be instrumental in acquiring abilities and skills like:

- Spatial perception and recognition
- Development of visual discernment and separation of visual attention
- Development of inductive logic
- Cognitive development in scientific/technical aspects
- Development of complex skills
- Spatial representation
- Inductive discovery
- Iconic code construction
- Gender construction

Lastly, a certain number of authors refer to the need to include the video game phenomenon in the literature disseminated by the media. Many authors call for an analysis of the values that the media transmit to understand the educational and socializing processes of the media as a whole. The initiative in this cultural analysis has been taken by several Canadian and American researchers.

Authors including Flood, Heath, and Lapp [1997[stress the importance of video games from a purely artistic point of view, beyond any other considerations. The need to treat video games as a narrative art form is sufficient grounds for defining them as a visual art, one that ought to be included in school curricula. In his paper "The Video Curriculum" [1991], Ornestein, who belongs to the aforementioned school of thought, points out the necessity of giving pupils specific knowledge to help them view with a more critical eye the contemporary iconosphere, including video games, One of the dominant themes in current research is the need to forge ahead in the critical study of the values that the new media transmit and the cognitive aspects that they bring into play. The authors of quite a few studies voice their concern about the relentless role of the new technologies in all aspects of life. Hence, they point out how essential it is to act in school setting: either to counteract the effects of mass media, both cognitive and social; or to seriously affirm the inclusion of the critical study of these media and their procedures into school curricula.

Some of the aforementioned authors, including Blaisdell et al. [1999], Carr et al. [1995], Haverty et al. [1996], Johnson and Reed [1996], and Krug and Fordonski [1995], address the issue and put a strong emphasis on teaching literature, above all through reading.

Similar measures, although aimed at counteracting behavioral aspects such as aggressiveness, were put forward by a number of authors: for example, Fortis-Daz [1997] sought to channel the aggression of children who play violent games through a process that reorientates and reconsiders values related to violence and aggression.

A third kind of study focuses on the need to incorporate the new media into the classroom. Knowing how the new media works and subjecting its values to a critical analysis is the best way of counteracting its influence. This is the objective of the studies conducted by Hepburn [2000; 2000], who suggests holding classroom discussions about the predominance of violence in the media and stresses how important it is to help pupils

develop a critical attitude towards programs and video games. He also proposes some criteria for doing so: discussion, critical analysis of violent scenes, the redesign of violent scenes so that they show as little aggression as possible, awareness of the existing market and its objectives, and involving families and communities. These views are shared by Johnson and Reed [1996], who affirm the need to introduce media, both old and new, into school curricula and to normalize the relations pupils establish with it.

2.4 Conclusions

From all the aforementioned references, it can be deduced that, for learning, video games are of unquestionable importance, and can be used, in fact have already begun to be used, at different academic levels. In addition to stimulating motivation, video games are considered very useful in acquiring practical skills, as well as increasing perception and stimulation and developing skills in problem-solving, strategy assessment, media and tools organization and obtaining intelligent answers. Of all the games available, simulators stand out for their enormous educational potential.

In addition, researchers advocate use of video games in the classroom to expose the values they (video games) disseminate; that is to say, to develop a critical attitude towards certain undesirable behaviors (e.g., violence) or values (e.g., sexism). Research has yet to prove that video games are intellectually harmful; on the contrary, many studies defend their great importance in the development of intellectual abilities. The study by Casey [1992], for instance, is paradigmatic in showing the enormous educational potential of video games. Gifford [1991] considers them to be a medium as attractive as it is effective: it provides knowledge of other worlds and cultures, develops fantasy and the ability to solve problems and encourages the growth of spatial and logical skills, such as visualizing objects and relating them in space, organizing several factors with an end in mind (thinking strategically), and so on.

By and large, each type of game is associated with skills and abilities related to learning and education (taking into account variables like gender, age, and academic level). Arcade and platform games can be instrumental in psychomotor development and spatial orientation; sports and dynamic games can facilitate better psychomotor co-ordination and relieve stress; strategy and role games can help to stimulate internal motivation and reflection on the values of the games themselves; puzzle and question games can help to develop the ability to reason and think logically; and simulator games can help in the development of all intellectual abilities and *a mind for machines*. Finally, and apart from the knowledge that can be acquired through play, it is possible to outline a series of procedural objectives that video games can help to fulfill. Among them, it is important to emphasize the following:

- *Reading*. It is essential to use video games to promote book reading related to the game in some way (e.g., *The Lord of the Rings*). Reading as a procedural value.
- *Logical thinking*. Video games help in thinking about how to solve problems by proposing strategies, organizing elements in anticipation of objectives, and so on.
- *Observation.* Due to the number of elements on screen, and hence the need for visual and spatial discrimination, this ability is used the most during play.
- *Spatiality, geography*. The development of cartography and spatial representations: maps, plans, and so on.

- *Basic knowledge*. Knowledge that allows children to acquire all the necessary skills and abilities for their own development and daily life.
- *Problem-solving and decision-making.* These aspects, particularly important in strategy games, are omnipresent in video games that involve difficult situations.
- *Strategic planning*. This aspect, related to problem-solving, is present in many games that involve a high level of mental activity, above all in the most complicated games.

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