Gaming for Multiliteracies: Video Games in a Case Study with Primary School Students to Enhance Information, Visual and Media Literacies

Eduardo Cruz-Palacios(✉)
and Miguel Ángel Marzal García-Quismondo

Department of Librarianship and Information Science,
Universidad Carlos III de Madrid, Getafe, Spain
eduardocruzpalacios@gmail.com, mmarzal@bib.uc3m.es

Abstract. Objectives: The aims of this study were to evaluate the effectiveness of video games when learning multiliteracies competences, study how to use video games on educational contexts, carry through a program with primary school students, and draw recommendations to design similar projects. Methodology: The 21st century competence-based education and pedagogical potential of video games are analyzed from a multiliteracies perspective. A program aimed at primary school students for the learning of information, media and visual literacies competences was designed. Video games were used as digital objects, context, environment and media. Learning outcomes were measured by analyzing the tests and activities undertaken. Outcomes: Video games are effective didactic materials in increasing student motivation to learn, understand complex ideas, and engage in projects. This program has helped students develop their information, media, and visual literacies. Recommendations to design and develop similar projects are given in terms of organizing pedagogical activities, suggesting the use of blogs and wikis, and managing digital repositories destined to learning objects in which video games are considered didactic materials.

Keywords: Multiliteracies · Competence education · Information literacy · Visual literacy · Media literacy · Gaming · Video games

1 Introduction

Sociocultural changes that have occurred last decades due to the use of digital technology in communication have caused many literacy models to have emerged. They differ in their approach, employing varying media, cognitive processes, methodology, pedagogical goals, and so forth. Multiliteracies focuses on multimodal and multilingual globalization [1].

To achieve multi-literate people in democratic systems, education must change. Learning must now be related with competences that group technical skills, knowledge, and methodologies to solve problems in the knowledge society.

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Video games are used more and more in education. Its ludic quality is effective in motivating learners. However, they can turn into a double-edged weapon if not used correctly. Therefore, it is necessary to know how to use them in ways that take advantage of their pedagogical potential.

In this case study conducted in the context of a doctoral thesis and the research project, VOREMETUR, video games were used to help twelve-year-old students improve their information, media and visual literacies competences.

2 Multiliteracies and Education

Multiliteracies involves: (a) making meaning of media where information is encoded and transmitted through information communication technologies (ICT); (b) evaluation of information, media, and contexts; (c) a vast, diverse amount of information sources; (d) social networks and collaboration; (e) digital identity; and (f) democratic systems characterized by participation and the values of justice, solidarity, freedom, equality and respect.

Information, communication, and image competences are especially important in the knowledge society [2], which requires that education focuses on citizenship. People must have skills to search and retrieve information with various, varied technologies (printed, audiovisual or digital); have cognitive capabilities to transform information into knowledge by critically analyzing, contrasting, reconstructing, and using it to solve problems; be able to express themselves and disseminate information in different communication contexts by using multiple media; and have criteria and values for the ethical and democratic use of information and knowledge [3].

Classrooms are immersed in a digital transformation led by ICT. Barriers of space and time are eliminated and knowledge is created collectively owing to educational networks: (a) those whose nodes are the schools that work collaboratively to develop projects, share knowledge, and manage resources; (b) virtual learning communities that promote diversity, interculturality, and social inclusion; (c) and those of personal learning environments that allow learners to share and manage knowledge as well as solving problems collaboratively.

The development of teaching materials has evolved through the use of ICT starting with the use of audiovisuals to illustrate lessons. PCs were used to learn how to use software and search for information related to subjects of interest. Printed material is being replaced by digital resources and learning objects. Copyright licenses facilitate access, reading, editing, and dissemination of digital content.

The teacher must guide the educational process, by designing learning, being a curator of knowledge, and accompanying the student cognitively and affectively. The student must play the key role and be in charge of his/her own learning [4].

Learning, according to Connectivism, involves: (a) diversity of opinions; (b) connection of nodes and information sources; (c) the ability to know is more important than the known; (d) interaction; (e) relations between disciplines, ideas and concepts; and (f) adequate and up-to-date knowledge as the intention of learning activities. Decision-making is itself a learning process [5].

3 Video Games and Learning

The relation between video games and learning must be explained by elucidating their pedagogical upsides and finding out how to use them in educational contexts.

The former involve interaction, motivation, cognitive and spatial skills training, immediate feedback, problem solving [6], and the improvement of the ability to manage resources, autonomy, and multidisciplinary learning [7]. Video games are related to the psychology of social learning [8] and their uses depend on their genres [9]. They can be used according to different theories of learning such as, behaviorism, cognitivism, constructivism, and sociocultural perspective [10]. Their pedagogical potential stems from the game experience, which is active, experimental, situational, and based on solving problems and providing immediate feedback [11]. In fact, there are many principles of learning in video games [12].

In using video games in education, the educator must first define the learning objectives, followed by the pedagogical activities with video games. Use of video games must be guided by the teacher. Although their use is recommended in certain subject areas, it is not necessary that video games content correspond to the specific curricular area of study, since they can be used to develop skills instead of acquiring knowledge. In fact, video games allow working in a multidisciplinary and cooperative way, fostering research, decision making, teamwork, and assumption of responsibilities. However, all video games are not suitable for any learning objective or sociocultural context. In addition, owing to its playfulness, students may find it difficult to relate fun with learning, so it is of the utmost importance to explain to them why they must play [13]. Some ways of how video games can be used in education are: (a) as context; (b) to develop competences; (c) to increase motivation and commitment; (d) to teach content; (e) to evaluate learning; and f) to make students serve as game designers and developers [14].

Good practices can be found in the "Gamepaddle" project [15], where students modeled a digital city, taught adults the relationship between video games and 21st century culture, designed a card game about video games, and reflected on urban environment and citizenship. Another excellent example is the report carried out by the Interactive Software Federation of Europe and European Schoolnet regarding educational projects. There, video games were used for media literacy, the improvement of behavior and attitude, designing real projects based on game experience, socialization and bullying, the promotion of teamwork and collaboration, and the learning of both knowledge and competences [16].

4 Design and Development of the Program

4.1 Context

This case study describes was carried out at Miguel Hernández public school in Fuenlabrada (Madrid, Spain) [17] with a group of 24 twelve-years-old students. All sessions took place in the computer room that housed 25 PCs for students, another one for teachers, a projector and a screen.

4.2 Competences Frameworks

Competences frameworks have been used to determine learning objectives and design adequate pedagogical activities for twelve-years-old children.

I based the competences for our program on the The European Union Digital Competence Framework for Citizens. These competences included [18]: 1.1. Browsing, searching and filtering data, information, and digital content; 1.2. Evaluating data, information, and digital content; 2.5. Netiquette; 2.6. Managing digital identity; 3.1. Developing digital content; 3.2. Integrating and re-elaborating digital content; 3.3. Copyright and licenses; 4.2. Protecting personal data and privacy; and 5.3. Creatively using digital technologies.

I assessed the adequacy of the pedagogical activities I designed with the help of the Wales education reform that has integrated digital competences into its curricula [19].

I used the ACRL visual literacy framework to determine what aspects of images are relevant: (a) nature and extent; (b) search; (c) meaning analysis; (d) sources evaluation; (e) use; (f) design; and (g) ethical, legal, social and economic issues [20].

4.3 Structure, Planning and Learning Aims

The program consisted of five modules that group seven didactic units. All units had one session, except the last one which had two. Each session lasted one hour and a half. Sessions took place in 2018 on February 19 and 26; March 5, 12, and 19; April 9, 16, and 23. The Modules and their Didactic Units are shown in Table 1.

Table 1. Modules and didactic units of the case study

Modules	Didactic units
1. Video games and culture	1. Video games and culture
2. Information literacy	2. Information search and retrieval
	3. Information sources
3. Web communication	4. Digital identity
	5. Creating knowledge collaboratively
4. Visual literacy	6. Image as information
5. Presentation with digital technology	7. Presentation with digital technology

The first didactic unit objective was to become aware of the cultural value of video games in the 21st century.

The second didactic unit objective was learning why and how to use the following information search and retrieval systems: advanced Google search; a Spanish digital reference service [21]; and the OPAC of Fuenlabrada libraries [22].

The third didactic unit objective was learning relevant criteria to determine whether information sources are reliable and useful to meet information needs.

The fourth didactic unit objective was learning aspects of visual and social behavior on the web that influence digital identity.

The fifth didactic unit learning objectives was practicing teamwork while learning how to create knowledge collaboratively on a web site. The following skills were involved: communication, planning, decision making, information search and retrieval, design, sharing of responsibilities, and creation of digital content.

The sixth didactic unit objective was learning the following aspects of visual materials and images: nature and extent, search, meaning analysis, sources evaluation, effective use, design, ethical, legal, and socioeconomic issues.

The seventh didactic unit objective was learning how to prepare a presentation with digital technology.

4.4 Gaming

According to what was presented in the 5th International Congress of Video Games and Education [23], gaming is the use of video games as didactic materials, hence, for pedagogical purposes. Learning processes must not be guided by game experience.

First, learning objectives were. After that, pedagogical activities were designed to lead the students to the intended learning. In essence, video games have been used as (a) digital objects to be searched and retrieved; (b) a context about which communication on social web must be analyzed, to create knowledge by designing and development web sites collaboratively, and to prepare a presentation with digital technology; (c) an environment where digital identity is built up within video games and on the networks that allow gamers to manage their profile and personal data; and (d) rules-based systems and media in which game experience is an information source.

Video games provided by the teacher were Plants VS. Zombies [24], The Simpsons Hit & Run [25], and Zoo Tycoon 2 [26]. A Thyssen-Bornemisza Museum's video game [27] was also used.

4.5 Pedagogical Activities

All didactic materials and explanation of pedagogical activities undertaken are available on a web site in Spanish language [28].

First didactic unit pedagogical activities included: (a) asking students to complete a test regarding one's habits of using libraries, how to search on the Internet, and use of social networking sites and visual materials; (b) providing students with demographic data and graphics about the use of video games; (c) students talking and discussing their habits of playing video games and those of relatives; and (d) students playing the video games offered by the teacher [24–26] while analyzing their objectives, history, and aesthetics.

Second didactic unit pedagogical activities were: (a) a unit on 'learn to use': advanced Google search, a Spanish digital reference service [21], and the OPAC of Fuenlabrada libraries [22]; and (b) use these systems to search for video games available on libraries' collections and for information related to them.

Third didactic unit pedagogical activities were: (a) to be told the concept of information source and aspects to determine whether a web page is reliable and relevant for one's information needs; (b) complete an exercise that consisted of relating

different web sites regarding video games to a type of information source (digital newspaper, e-commerce, wiki, library catalog, online encyclopedia, and social networking site); and (c) play a video game offered by the teacher and design a web site.

Fourth didactic unit pedagogical activities were: (a) to be told about the concepts and characteristics of digital identity; (b) talk and discuss the relationship between video games and identity: to be the main character in a story by choose among a range of characters according to one's personality, creating a character based on oneself, and using an avatar to identify oneself on the digital platforms that are needed to play online; and (c) complete an exercise that consisted of analyzing and describing how, on a social networking site, visual information and social behavior affect people's digital identity.

The fifth didactic unit pedagogical activity was to carry out a project to create a web site about one of the video games offered by the teacher. The activity was guided by the teacher and consisted of the following steps:

- assemble groups of 4 or 5 students;
- choose a video game per group;
- assign each student to the role of an information researcher or a web designer where information researchers searched for the needed content on the Internet while web designers built the structure of the web site on a free blogging platform;
- decide the contents of the web site;
- ask all the members of each group to take the information retrieved and place it on the website.

Sixth didactic unit pedagogical activities were: (a) to be told the importance of analyzing visual elements on web sites in terms of navigation, information retrieval and copyright; (b) analyze the web site of a museum [29]; and (c) play a video game created by that museum [27]. The objective of that video game was to solve clues to find paintings in the museum. Students used both the video game and the digital collections of the museum to search and retrieve information regarding the paintings of the video game, create a digital document in which all the information retrieved is organized, and send it to the instructor by email.

In the first session of the seventh didactic unit the pedagogical activities were: (a) to be told what aspects are relevant in a public presentation with digital technology in terms of what to tell, organization of content, visual material, verbal and non-verbal communication, and necessary digital technology; (b) to be told the types of gamers and their characteristics; (c) work in groups of 4 or 5 students to prepare a presentation with digital technology about a type of gamer; and (d) do a rehearsal of the presentation.

The pedagogical activities in the second session of the seventh didactic unit were: (a) conduct a rehearsal of the presentation prepared in the last didactic session; (b) deliver the presentation in front of classmates; (c) receive feedback from classmates and the teacher in terms of successful features of the presentation as well as and what needed to improve; (d) complete a test about students' habits of playing video games and eagerness to be involved in education projects with them; and (e) measure improvement in information, visual, and media literacies competences.

4.6 Outcomes

Outcomes stem from the teaching of methods and tools, discussion of topics, exercises, tests, and projects. The program was scalable, as exercises were based on the competences acquired and modular, as there were blocks aimed at achieving specific didactic objectives. Due to the nature of this case study, outcomes are presented qualitatively and quantitatively. Finally, I offer a selection of the most remarkable findings that resulted from activities undertaken and according to learning aims.

The first session test consisted of 8 questions: 2 closed, 4 open, and 2 with true and false statements. No student knew what an OPAC is. When asked about criteria to determine the suitability of information sources, 50% of students mentioned the importance of contrasting information sources. As for behavior on social networking sites, 96% knew they should not accept friendship invitations from unknown people, 83% knew they should not publish content or comments about things they would not do in real life, and 79% understood that what is done on social networking has consequences in real life. As for visual materials, 71% understood that they must ask to publish images when people appear on them. When asked about relevant aspects of images, 17% mentioned that relevance was tied to some aspect related to the nature and extent, 8% to the search, 13% to meaning analysis, 33% to sources evaluation, 0% to effective use, 4% to design, and 8% to ethical, legal, or socioeconomic issues.

The second session consisted of familiarizing the students with three information systems not known to them. All students did well with Google advanced search and the OPAC [23]. Seventy one percent managed to answer a question with the digital reference service [22].

In the third session, all the students managed to complete the exercise of associating types of information sources and design a layout about a video game web site on a sheet.

The fourth session exercise consisted of 10 questions: 4 open, 5 closed and 1 with true and false statements. Tasks involved searching for information on a social networking site and describing and demonstrating reasoning about digital identity. Students' responses were rated 'well-answered'; on average their responses were well-answered, or 8.27 out 10.

In fifth session project there were 6 groups of students. All groups successfully created the web site. However, one group did not manage to structure the pages created.

In sixth session exercise, all the students did well when searching and retrieving information. Although 9 pieces of information were asked, the average retrieved per student was 5.71.

The last session test about students' habits of playing video games consisted of 10 questions: 1 closed, 1 of associating, and 8 open. The results showed that 96% of students liked video games and 83% of them would like that video games were used in education. On average, they played 8 h and a half per week. The other test consisted of 20 questions: 6 multiple-choice, 6 of associating, 4 closed, 3 with true and false statements, and 1 of ordering. Questions were grouped according to literacies. As for information literacy, we looked at an OPAC functions, the utility of information search

and retrieve systems, information search strategies, and evaluation of information sources. The average percent of students answering the questions correctly was 80%, 66%, 83%, and 67%, respectively. As for media literacy, we looked at information organization on web sites, elements and their functions on a web site, and digital identity on social media. The average percent of students answering correctly was 74%, 63%, and 67%, respectively. As for visual literacy, we looked at visual materials as media to access to knowledge, sources of information about artworks, ethical use of images, and how to use effectively visual materials to create presentations with digital technology. The average percent of students answering right was 70%, 72%, 96%, and 79%, respectively.

Overall, findings suggest a significant improvement in information and visual literacy, especially in using advanced search and creating digital content with visual materials. Although students already knew the importance of safety on social media when sharing personal data, they become much more conscious regarding the impact of their behavior on digital identity. They also understood how to analyze and design web sites according their layout, functionality, and content.

4.7 Recommendations for Similar Projects

Students did not sometimes perceive the learning objectives when they are made to play. It happened when they had to analyze a video game and design a web site. To solve this, it is recommended that in certain activities the time to play be spent at home instead of in the classroom, as well as indicating what tasks learners must do and hand in. Nevertheless, there will be times when playing in class is necessary.

A more ambitious project could involve first, requiring students to create a blog in which they had to report the progress of a video game experience. The blog would assist them in developing their writing skills in a digital medium. They would also combine different information media (text, image, video, and hyperlinks), learn to organize information in a medium that is destined to grow continuously, and understand how to use copyright licenses to protect their intellectual property rights. In this way their visual and media literacies skills might improve. Second, a larger project might involve developing information management skills and creating knowledge collaboratively knowledge with virtual desktops and wikis. Such a project might create a virtual learning community within video games to make students learn to manage Digital Identity. And students might use digital collections of cultural institutions that have video games to improve information literacy competences.

To enable other students to enhance their information, media and visual literacies competences, it is recommended to manage an ad hoc digital repository of learning objects and learning objectives the description of pedagogical activities that must be undertaken, and a list of the necessary resources. If so, the inherent interoperability of digital repositories allows the saving of resources in terms of designing similar projects, preserving didactic material, and sharing of knowledge.

5 Conclusions

A knowledge society demands competences consists of technical skills, knowledge, and methodologies to solve problems in an environment characterized by a heterogeneity of information sources, different media (text, image, video, hyperlinks), digital identities to allow people express themselves and share knowledge, and democratic systems with interculturality, equality, respect for others, freedom, solidarity, ethics, and participation. These competences, studied by multiliteracies, must be inculcated into citizenship through education, which, hence, must be changed. Learning must be the connection and sharing of knowledge that allow the development of information, media, and visual literacies competences. Teaching must be the design of learning, by choosing adequate environments, pedagogical activities, and didactic materials to become students into their learning protagonist and teachers into their guide.

Video games have several pedagogical upsides: sensory, cognitive, motor, management and communication skills, literacy, cultural socialization, active and immersive experience, immediate feedback, engagement, motivation, development of identity and group affinity, collaboration and cooperation, expression and choice freedom, creativity, material intelligence, multimodality of information, exploration, curiosity, and responsibility. In every single learning process, it is especially important to know how to design pedagogical activities that lead students to achieve the intended learning. Video games should not determine learning but, instead, be a part of it, by choosing the appropriate ones for audience and learning objectives. In addition, video games' versality allows to design learning processes that transcends game experience. Gaming must be a didactic strategy, never an end itself.

In this case study, video games have been used as (a) digital objects to be searched and retrieved; (b) a context for enabling students to study which social web communication must be analyzed, create knowledge by designing and developing web sites collaboratively, prepare a presentation with digital technology; (c) an environment where digital identity is built; and (d) a medium whereby which game experience is an information source. Findings suggest students (a) demonstrated improvement in the searching and retrieval of information and evaluation of information sources competences; (b) gained knowledge and consciousness about digital identity; (c) acquired understanding of web sites structure and functionality; (d) learned relevant aspects of visual materials; (e) acquired skills in making presentations with digital technology. Educators' knowledge about how to use effectively video games in learning contexts has especially been useful to design and carry out this case study.

However, the learning resulting from this case study program does not enable students to cope with knowledge society problems, since information, media, and visual competences require a scalable learning integrated into the curricula. Isolated literacy programs fill gaps in small-scale contexts but to aspire to multiliterate citizenship, schools must integrate these competences in their didactic methodology transversally. To design and carry out those didactic methodologies, there will be needed a considerable number of didactic materials. Digital repositories for learning objects are of the utmost importance, since they allow the management, organization, interoperability, and use and digital preservation of didactic materials.

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