A study about the use of Musicomovigrams in musical education

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Abstract: Since the turning of the twenty first century, information and communication technologies (ICT) have definitely impacted the way people express learning and how they interact to each other in all activities of sciences and arts, among them, musical education. This article introduces the concept of Musicomovigrams. These are an interactive audiovisual resources, similar to videogames, that work as software tools for the development of sound perception and musical structure. They are based on the former concept of Musicogram, a term created by the musical pedagogue Jos Wuytack and his concept of Active Listening (Wuytack and Boal Palheiros 2009), a contributing factor for the learning of concepts of Musical Forms, as defined by the musical educator Keith Swanwick (Swanwick 2003). Therefore, this work presents the development of this concept in the form of Musicomovigram, a videogame created through free software eAdventure. This work also intends to investigate how current ICTs are actually accepted and used by music teachers and students who work and interact in musical education classrooms.

Keywords: Musicomovigram, Video game, Music education, ICT.

1. THEORETICAL BASIS

One of the great challenges of musical pedagogy is the need of the teacher to position him/herself in a way to ensure that students are actually developing the ability of efficient music listening (specially with regard to musical structure), so that the students are able to transcend the limits and habits of a passive listening.
In this sense, the interactive action of video games may become in a great help to the music educators. Instead of becoming an element of rupture and students mischief during the didactic process, video-games can turn to be a great music education ally, motivating students to interact and contributing in the learning process, allowing teachers to use the students' fascination for interactivity, through adventures in a virtual reality (the computer technology simulates in real time fictitious environments and the user can interact through audiovisual resources) provided by ICTs (Information and Communication Technologies). This can contribute to the transmission of educational values and curricular contents in a playful, attractive, and innovative way.

This work presents the theoretical basis for the conceptualization, development, and use of musicomovigrams. They are defined here as video games specially developed for music education. Musicomovigrams were envisioned from the concept of Musicogram, created by the Belgian musical pedagogue Jos Wuytack. From him it is also the concept of musical listening, which can be defined as the action of: listening, being listened, and the cognitive capacity of assimilating what we have listened (Wuytack and Boal Palheiros, 2009). Musicograms are graphic representations (symbols and images printed on paper) representing a musical structure, whose purpose is to establish the necessary relationships contained in a musical work, in order to promote their understanding, in different levels and musical elements. The concept of Musicomovigram adds to the Musicograms the element of video-game interactivity, in order to help students of music to improve the use of the current ICTs resources in order to broaden and deepen their musical skills.

Therefore, we encourage the use of free software tools, since these are accessible to the majority of the public. Besides that, they are opened to be modified and they are distributed free of charge by other programmers. Free software tools can contribute to the development of interactive computational models for music teaching, in order to favor the creative process by adding audio and video resources to Wuytack’s Musicogram. The purpose of the Musicomovigram is to provide, by the means of TICs, the acquisition of musical basic notions as well as the perception and dynamic identification of musical form. For this, there are accessible computational platforms that use drag-and-drop visual programming approach, which facilitates and accelerates

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1An interesting example of musicogram can be found in “Musicogramme Tritsch-Tratsch Polka Op 214 by Johann Strauss (1825-1899)”, [https://www.youtube.com/watch?v=8cUzsL9uDjs](https://www.youtube.com/watch?v=8cUzsL9uDjs)
software application development. The open-source computing platform\textsuperscript{2} for the development of musicomovigrams, is called eAdventure and can be freely downloaded at: http://www.e-ucm.es/portfolio-item/eadventure/

Then, the main objective here is to promote, through the application of musicomovigrams, the acquisition of basic musicalization notions for students, as well as the recognition and perception of the musical form, favoring the development of a musical sight reading through the creation and interpretation of basic elements. We intend to achieve this using open-source softwares.

In the development of the Musicomovigrams, it is necessary to take into account the different characteristics of the students and their heterogeneities for the elaboration of Musicomovigrams accessible to all the students, so that they can use them in an intuitive and playful way, creating and fostering a safe and trustworthy educational environment. The concept of Musicomovigram intends in this work to settle the theoretical foundations for the creation of a video game specifically designed for music learning. This initial research focused on students from 8 to 10 years old. With this future development, it is intended to foster musical education and create a greater motivation for students of this age group, in relation to learning concepts and elementary concepts of musicalization.

For that, we intend to use two questionnaires for the final analysis of the satisfaction and didactic effectiveness of this musical teaching experience using musicomovigrams. The first one will be applied at the initial phase and the second one will be applied at the end of the experiment. Both will have four sessions, each one with an application time of about sixty minutes. The questions in these questionnaires will be have evaluation scales between 1 and 5, with different subjects to evaluate, such as: content, satisfaction and usability of the musicomovigrams in the classroom. According to the analyzes of the answers given by the students, the impact of each Musicomovigram developed for musical education will be evaluated.

2. THE CONCEPT OF MUSICAL LISTENING

The need to define what is musical listening arises from the need to determine which segments of a musical piece are important to be focused on in order to later inte-
grate them to the musical education process, specially through the application of the Musicomovigram. This is based on the physiological (assuming that it has a normal physiological development) and specially on the psychosocial student elements. According to Botella and Gimeno (2015), musical psychology tries to explain qualitatively the phenomena of musical hearing from its different theoretical paradigms. Psychometrics, however, focuses on the quantitative (measurable) aspects given through standardized tests of listening skills of the studied individuals. This is based on an empirical perspective that rejects any unobservable process and focuses on hearing from the viewpoint of musical predilections. Cognitive theories based on Piaget's studies rely on subjective processes, establishing a correlation between biological development and musical abilities (Hargreaves, 2002; Swanwick, 2003). Within this group of theories lies the constructivist approach, for which the musical hearing is a cognitive and constructive process in which the perceptive activity allows to incorporate new ideals, facts and experiences to the cognitivist structure (Lizaso, 2003). In this way, as some research points out, the training of attention and memory, as well as a good level of motivation, contribute to the development of this process (Giráldez, 2014). Social psychology explains the effects of the medium's influence on the development of “taste” (predilection) linked to individual listening. In this line, Hargreaves (2012) differentiates three steps. In the first, musical taste is shaped by the conformity of individuals to the norms of reference community groups. In the second, there is a relation of musical taste to communicative persuasion in which facts such as the prestige of the performer or his/her extramusical content comes into play. In the third stage (Marxist oriented) it is argued that the dominant upper and middle class social groups want to defend and increase their relative prestige in the cultural and social hierarchy, which is obtained by regulating the population's access to artistic training.

Other authors have also tried to elaborate detailed analyzes of the musical hearing, establishing diverse categorizations and classifications. As an example, we can mention the results obtained by Schaeffer (1988), which distinguishes the act of hearing from listening. Hearing is a passive and an inevitable action. On the other hand, listening has an active sense given by hearing with attention that tries to understand the intention of what is heard and thus to understand a dialectical relationship between both. With this, the author wants to emphasize that the listener understands what s/he perceives in listening due to what he chooses to understand, at the same time s/he understands through the conscious direction of listening.
For Willems (2001), musical listening is a skill that is learned through an adequate attentive and educated hearing. The author distinguishes three dimensions in this ability. 1) Auditory sensory receptivity, which is related to the correct functioning of the auditory organ (the ears). 2) The affective sensitivity, which begins at the moment in which we pass from the passive and objective act of hearing to the act of listening (more active and subjective) motivated by emotional content. 3) The auditory intelligence, which allows one to become aware of the other two-dimensions. This is an abstract synthesis that works both on the sensorial and affective level and is given by comparing: judgment, association analysis, memory and creative imagination.

Delalande (1998) also proposes three categories, however in this case considering the type of manifested behaviorism. This author makes a distinction between: 1) Listening Taxonomy, which is the seeking of a structural and formal understanding of the work, giving more attention to the broad morphological units that facilitate memorization; 2) Empathic Listening, which points to emotionally connecting the listener with music, fundamentally through its tensions and contrasts; 3) Figurative Listening, in which the listeners construct imaginary figurative worlds produced by sounds, such as subjective actions, scenes or plots.

David Huron (2002) deepened Delalande's approach, performing an extensive taxonomy to differentiate between 21 listening modes. These can be: 1) Distracted, when the listeners do not pay conscious attention to the sound phenomenon; 2) Tangential, in which distraction arises from the musical experience itself; 3) Metaphysical, where listeners ask themselves transcendental questions about the music they are listening to; 4) Signal, when more attention is paid to the element that precedes certain sound events; 5) Sing along, in which one sings mentally with the music; 6) Lyric, when more attention is paid to the text; 7) Programmatic, in which music causes certain reactions in the listener; 8) Allusive, characterized by relating what was heard with other works; 9) Reminiscent, when it reminds certain elements of previous listening of the same piece; 10) Identity, in which the listener asks about the identity of what he listens to; 11) Retentive, similar to the number one that takes place during musical dictations; 12) Fault, when the listener seeks performative imperfections; 13) Feature, in which the attention is focused on identifying relevant elements, 14) Innovative, which looks for characteristics not previously heard; 15) Memory scan, which occurs when the listener expects a certain event that he knows; 16) Directed, in which attention is focused on some elements, excluding others; 17) Distance, implies in realizing a global synthesis of the work du-
ring its own course; 18) Ecstatic, in which the listening act elicits some physiological response related to pleasant experiences, such as shivers; 19) Emotional, in which the listening act is deeply accompanied by feelings and emotions; 20) Kinesthetic, when it awakens the need for movement; 21) Performance, proper to the performers who listen to recordings from their performed repertoires and perform the corresponding gestures and actions.

These concepts allow us to elaborate an open and comprehensive definition (which is useful from the viewpoint of musical didactics) of the musical listening concept. Thus, in the psychological plane, it can be said that musical listening tries to direct the attention to the sound stimulus in an intentional way, converting the sense of hearing into an active, internal, subjective, affective and dynamic process that allows the construction of meanings in relation to its previous cognitive structures. The line of education and entertainment of this process makes possible to take the musical hearing towards a new level of understanding of purely musical elements, thus developing an auditory intelligence in the students. A wide range of auditory cues can also be developed, which are decisive when producing musical meanings. In relation to the sociological dimension, musical listening is conditioned by the listener's musical taste, which are influenced by questions such as adaptation to the reference group, communicative persuasion or the association between musical styles and social classes.

3. ARTISTIC CREATIVITY

Lev Vygotsky, a famous Soviet psychologist, developed studies that help to support the concept of creativity in relation to art. There are four principles for artistic creativity that this author considers, according to each level of student development and each period has its own mode of creation. This subject would be the intermediate point of this future research, where students will develop the necessary concepts to allow them to create their own didactic materials.

According to this thinker, the creative activity of the imagination is directly related to the wealth and variety of the individual's accumulated experience (material available to the imagination). Hence his studies seek to expand the child's educational experience by providing a solid foundation for his/her creative activity, which is the first part of the methodology detailed above. It seems to be true that there is always a direct relationship between imagined products and certain phenomena of reality. Imagination is
not limited to reproducing what has been assimilated in previous experiences, but from them to create new outcomes. This connection is only possible due to personal or social experience. For example, we can imagine a story that takes place in a desert, without necessarily having ever been there. Imagination can be guided by the experiences of other individuals. Emotion is also present in a double sense. On one hand, all the most frequent feelings arising from certain images consistent with it occurs "as if emotion could choose compatible impressions, ideas and images with the will to subdue us at that moment." It is easy to see that the influence of emotional factors should foster the emergence of totally unexpected imaginative groupings, providing an almost unlimited field for new combinations, such as the large number of images that have the same emotional significance. This relationship between imagination and emotion is mutual. On the other hand, all forms of creative affective elements are self-implicated. This is what Vygotsky calls "law of the emotional representation of reality," which explains why works of art created by the imagination of other authors can make a deep impression on us. This is quite evident in music that what we call sound stimuli can evoke deep emotions (Vygotsky, 1995).

The concept of Zone of Proximal Development (ZPD) was introduced by Vygotsky. ZPD could be defined as the distance between the actual level of development (determined by the ability of a child to perform a task autonomously) and the level of potential development (determined by the ability to do so under the guidance of an adult or a capable pair). The central idea lies in the student's ability to experience and exercise mental activity which is the result of interaction with other people or contexts in which the student is inserted (social context). The distance between these two points defines the impact and margin of the educational action (Jobim and Souza, 1994). This principle is defined by what a student is able to do or to learn with the help of others through the interaction and shared activity as well as what the teacher provides to the student progressively to create a structural support system needed to continue the task. In this way, knowledge is acquired as the student progresses and the teaching-learning process guarantees the transference of control from the specialist or teacher to the student or trainee. This mechanism is therefore responsible for the learning process. Thus, the present research intends to help both students and teachers and in this way to foster creativity and motivation so that students can handle and interact with themselves with the didactic resources here called interactive musicomovigrams.
4. MUSICOGRAM AND ACTIVE LISTENING

The work here presented arises from the attempt to correlate theoretical proposals derived from the concept of active musical listening with the creation of a particular type of graphic music scores; the Musicograms. They were developed by Jos Wuytack, along with his proposal of Active Musical Listening (Wuytack and Boal Palheiros, 2009). This is a musical didactic methodology which aims to teach musical listening for children. For several years, Wuytack has developed such concepts from his own professional experience as a teacher of children and adults with different levels of musical knowledge. This system of education calls for the active participation of the listener and the use of visual information to encourage musical perception. Typically, listeners who do not have musical training are not able to read a score in traditional musical notation but may come to understand a simplified visual representation of the music shape piece as well as the musical elements that emerge while they are listening to music. Thus, the ways of listening to a musical work vary according to different variables, such as: the musical genre, listener's emotional state, and the context of the work. When they are listening to erudite music, whether in school or in a concert hall, listeners are expected to remain silent, while other musical genres, such as jazz, rock or samba, often allow and even encourage listeners to participate more actively. Therefore, something that is not necessarily assumed in a particular mode of listening, such as the body gesture, can become fundamental in another way of listening. Children have different ways of listening to music, according to each context, which presuppose several levels of attention and musical emotional involvement (Wuytack and Boal Palheiros, 2009). Researches such as the one developed by Madsen (1997) indicate that musicians and non-musicians focus their attention on different musical elements. Other researches point out that musicians change their focus of attention throughout the event of listening (Clarke and Krumhansi, 1990). Musicogram aims to capture the listener's attention with a graphic representation of the temporal development of a musical work, thus establishing necessary relationships through symbols or images in order to understand different elements of music. This turns to be a synthesis for the correct perception of the musical work and a way to reduce the difficulty of a complex perceptual process such as reading a musical score (Wuytack, 1996). Figure 1 shows the example of a Musicogram, (in which it is presented symbolic elements that represent the bars, instruments, intensities).
The Musicogram, as conceived by Wuytack, attempts to provide a synthesis for the correct perception of the work and the reduction of the difficulty of a complex perceptual process as it can be the reading of a score in traditional notation (Swanwick 1991; Wuytack and Boal Palheiros, 2009). Wuytack had in her mind the goal of facilitating the acquisition of musical contents through the use of multimedia in the conception of the Musicograms, bringing to the musical art forms of visual artistic expression and connecting visual perception with musical form, providing students with the creative ability to represent music through images.

This teaching conception presents the Musicograms as visual planes containing graphic elements that aim to reduce the difficulties related to musical writing, which is in fact something abstract, distanced from its performative reality. This is due to the fact that music elements (such as: height, duration, timbre and intensity) can be perceived through listening, but to perceive the musical form is something cognitively more complex. In the Musicogram, the information is graphically registered on paper, establishing a correspondence between auditory and visual perception in order to allow the listener/reader to anticipate what will happen in the musical work (Wuytack and Boal Palheiros, 2009). Figure 2 shows an example of one of the original Musicograms drawn by Wuytack, in which Tchaikovsky's work “Suite Nutcrackers, March” is depicted.

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3http://ceipsanagustinmusical.blogspot.com.br/p/blog-page.html
Active Musical Listening, as a conscious process of organization and construction of temporal events that appear in a musical work, depends on appreciation as an indispensable form of engagement with music. Active Musical Listening activities should lead students to focus attention on sound materials and the structure of the work (Swanwick, 1991).

One difference that is observed in music, in relation to other concrete arts (such as paintings, sculpture, dance, etc.), is that it can only be appreciated through hearing. Music is the art of organized sounds, as established by Edgard Varèse (Goldman, 1961). However, it is not easy to perceive the intricate musical structure through listening alone. With the use of Musicograms, the ability to perceive details of such structure during listening (through a graphic representation) is increased. The Musicogram is thus a map of the musical work, through a drawing or a set of linked images that help the listener to understand the structure of a musical work, through an audiovisual process of observation and active listening (Olarte Martinez, 2009).

The fact that music is an art that occurs in the time domain makes it difficult to perceive it as a total unity (such as, for instance, a sculpture), specially those musical pieces that have a longer duration (for example, a symphony), which makes difficult to the musical mind's concentration and apprehension of the details in musical work.
structure, specially for children. Some researchers suggest that for the listener's attention local structures prevail over global ones and that listeners in general have difficulties in relating events that occur far in time (Tilman and Bigand, 2004). One of the great difficulties of active musical listening is that when we listen to a piece of music we cannot see its structure since the musical perception happens in the acousmatic⁴ course of the musical work over time. On the other hand, visual arts occur in the dimensions of space and their perception is predominantly visual since these occur in a certain place and moment. A clear example is when we pay attention to a work of art, such as a painting or sculpture, and we can appreciate each detail randomly, paying attention to the time we want to each of its constituent elements. As the analysis of such details occurs simultaneously with the perception of the totality of the work, active musical listening can be an advantage, as a form to support the perception of the totality of a musical work (Wuytack, 2009).

Outside the classroom, when children listen to their favorite songs, they often use a listening mode that allows them to be physically active, such as singing or dancing along with music. On the contrary, in classrooms, music teachers tend to use more contemplative and passive approaches, such as those that can be used to tell a story, with musical instruments that intervene in the works. According to Wuytack and Boal Palheiros (2009), it has been observed that in music education classes students tend to listen and understand better, besides enjoying more of music, when teachers use strategies that are more active than passive. The fact that students are active before and during active listening greatly increases the attention and concentration of children in music. Thus, we can understand that active listening means an intentional and consciously focused way of listening in which the listener applies physically and mentally, while passive listening supposes a low level of listening attention.

To understand musical reading, through its traditional musical elements, has always been difficult to some students, specially at the beginning of musical learning. Wuytack and his predecessor Carl Orff were the pioneers in the concept that musical experience is essential before the student is exposed to the abstract musical technique of reading a musical score. The purpose of these musical pedagogues was to teach the training of listening, allowing students to create and experience music by the process of active listening. These researchers believed that in order to understand music, students

⁴ from Greek ἄκουσμα akousma, "a thing heard", refers to the process of listening without any related visual information. http://dbpedia-live.openlinksw.com:8890/resource/Acousmatic_music
should actively participate in its construction and execution. In educational terms, the idea is that students are not just passive listeners but they play an active part in musical learning, interacting cognitively with musical sounds (Wuytack and Boal Palheiros 2009, Mendoza Ponce 2011). Thus, the active musical listening system is based on three principles (Wuytack and Boal Palheiros, 2006): 1) The active participation of the listener, both physically and mentally, through the previous interpretation of graphic materials that represent the musical work; 2) The focus of the students' attention during the listening act and the conscious recognition of each part of the musical material analyzed; 3) Analysis of the entire musical form through the association of its musical elements with the symbolic graphic representations.

5. VIDEOGAMES AND MUSICAL EDUCATION

As previously stated, musicomovigrams are specialized video-games developed from the concept of Musicogram. The importance and application of video-games as a didactic-musical strategy is currently a reality that extends beyond the attempt to attend the contemporary diversity found in a typical musical education classroom. Music education professionals should aim to find new horizons and contemporary methods that foster innovation and creativity in the student, in order that their applied didactics are not boring and therefore not attractive for musical learning. It is in this challenge to innovate and to make musical learning more attractive that, in the last years, different technological methods and software tools have been created with the objective to develop the latent capacities that the students already have.

Video-games are primarily playful, interactive, and often have real-time features that encourage users to quickly learn about their virtual environment by instigating them to make decisions from the first moment (Pindado, 2005). These are able to develop strategic-cognitive abilities (Siegler, 1995) including: overcoming, verbal forms, attention, memory, visual spaces, interpersonal exchanging and collaborative work. These resources can also boost the players' self-esteem, increasing it each time the player reaches a certain goal, favoring the development of psychomotor skills, understanding, initiative, decision making, conflict resolution and even cognitive and academic skills.

Considering the low participation of music education in the current digital system of learning, the first educational innovation that is now needed is the simple raising of
awareness among current and future music teachers and professionals of education, on the current possibility of creating educational video-games as customized tools for learning music.

It is known that games present many possibilities of self-improvement, starting simply from the player's mental disposition to play until the acceptance of the possibilities of both defeat and victory. The concept of game also embraces ideas of limits versus freedoms; invention, innovation and command. This scenario leads to the inference that any type of game contains rules of conduct (Vygotsky, 1995). Different researchers, such as Aldrich and Prensky (2007) and Prensky (2006), bring an analysis of the possibilities of electronic games (videogames) as generators of educational resources. According to them, we can be emphasized that the use of video-games in music education can result in a very useful, interesting and advantageous tool for the teacher's work with his/her students. From an educational point of view, results can be obtained to encourage students to deal with problems in today's classrooms, improving, for example, the motivation for a particular subject (Azorin, 2014).

Nowadays, video-games have undergone significant changes due to the exponential evolution of digital technology, even more than most video-game users had expected or envisioned. Due to these technological booming teachers must take into account how present pedagogical rules are still accepted and which ones will be valid in the near future, making a step-by-step the inclusion and acceptance of different kinds of equipment in the classroom, such as tablets and smartphones. This coincides with the growing demand for new video-games caused by the proliferation of these mobile devices. In addition, one of the main concerns of music teachers is how to conduct students to enjoy and listen to music critically, since they usually have difficulties, specially in relation to the scholarly and contemporary repertoire, due the common lack of familiarity with them.

6. CREATING MUSICOMOVIGRAMS

The new ICT (Information and Communication Technologies) and some equipment such as digital TV, digital blackboard, smarthphone and tablets have been pushing music education through a serie of transformations, urging the reformulation of educational foundations and their concepts. These new perspectives, resulting from the proliferation of ICTs, make it possible for music educators to review and to expand their
training, increasing their possibilities for didactic work and consolidating the formation of new technological skills. The concept of "technology in education" can be defined as the compendium of organizing and educational tools nowadays available to the educator in order to favor educational practice planning and evaluation of teaching (Krüger, 2006). The purpose of these resources is to motivate the pedagogues of the area to develop and acquire skills in these new technologies, in order to develop contemporary didactic resources, such as the interactive and dynamic contact of the student with multimedia materials, as well as to facilitate the development of critical thinking and creativity allowing the direct contact with the contents of musical works (Krüger 2006). In the last decades, Musicograms have took advantage of it due the insertion of ICTs (Mendoza Ponce, 2011), since in the current didactic resources have been added animation provided by the video, creating a new concept that is called here Musicomovigram. This one allows to present unconventional scores (such as contemporary music) in an animated way, which serve to work fundamental elements, such as: rhythm, pulsation, time, musical form and even timbre. These are audiovisual documents in which the music has been synchronized with a graphic animation that represent some elements that can be worked by the active musical listening (Mendoza Ponce, 2011). Thus, musicomovigrams can be defined as Musicograms with dynamic animation provided by computational resources, which serve as an intuitive approximation to the temporal dynamics of music, thus promoting an active musical appreciation.

This goal arose from the need to adapt different materials of Musicograms to the technological resources currently available in music teaching classrooms. The theoretical basis presented here complements the idea previously proposed by Wuytack's Musicograms, since these are in paper and, therefore, deprived of the dynamic movement and interactivity that the current resources of ICT are able to provide. In order to achieve this, it is necessary to use software tools accessible to the majority of the target audience, which favor the creative process and add interactive audiovisual resources to music education.

7. DESIGNING SOFTWARE TOOLS

There are several software development platforms (Jost, 2014). For the development of musicomovigrams visual programming, there are platforms easy to use
and to install for most users. Some of them count with the advantage of being free software. The programs surveyed in this project were: Scratch (https://scratch.mit.edu), Kodu (http://www.kodugamelab.com) and eAdventure (http://e-adventure.e-ucm.es). All of them have similar characteristics for the creation of interactive video-games. The choice for the development of musicomovigrams was eAdventure, due to the facility of transmitting educational possibilities which allows the students to create video games without great or no background in programming since they are presented as visual objects inside this platform. This software was developed and maintained by the e-UCM group at Universidad Complutense de Madrid, Spain. This video-game development platform is a research project that facilitates the integration of educational games and computer simulations based on educational processes and Virtual Learning Environments (VLE) in particular. This platform was created with three main objectives: 1) Reduction of development costs for educational games; 2) Incorporation of specific educational features into game development tools and 3) Integration of the resulting games with educational material in the context of VLE. The figure below shows an example of the eAdventure display:
This software allows the user to create point-and-click graphical virtual adventures which lets students to create drag and drop visual elements in the software interface, in secure environments (with an embedded image gallery in this software), nourishing the free exploration of students. In addition, it has a powerful and simple interface, which can be used without the need of programming skills, reducing the complexity of the task and encouraging the creative process, since the games created in this platform can be compacted as learning objects (intended objects for the learning of special contents) to be used in virtual teaching environments, such as Moodle (http://moodle.org), a famous open source distance learning platform. The program eAdventure runs in Windows, Mac OS X and Linux operating systems, thus promoting the possibility that the video games developed here could be used by many, which can be compiled as stand-alone application, or as an applet; a small application that can be transmitted online and run locally in the user's browser, specially suitable for online education. In this way it is possible to study a contextualized musical work with the creation of a virtual character animating and interacting with the students. This character will accompany the students during all this musical adventure on the form of a video-game, being indicated through the directed dialogue, explaining to them how to overcome the obstacles and to reach the game goals. The teacher takes the role of a
designer game elaborated from a didactic concept. For example, Guillermo Tell could be presented as the main character in a story and he would invite students to learn music from the adventures in which the user may enter, such as: history, solfege, intensities, melody, practicing with the flute and instrument sound recognition. Such game can turn to be an evaluation mechanism that generates modifiable responses by characters, which serves to evaluate each student who is playing at each moment. This must be done based on the school curriculum in order to insert contents according to the students age, knowledge and ability.

8. MUSICOMOVIGRAMS IN THE CLASSROOM

The main objective in the creation of musicomovigrams is the promotion of musicalization in students so they can recognize and perceive musical form. This is done by favoring students' musical reading through the creation and interpretation of musical material with the help of ICTs for didactic support based on free softwares. The purpose of these resources is to motivate music professionals and educators to develop and acquire ICT skills in order to create new and modern didactic resources for music education. The contact of students with musicomovigrams facilitates the development of music perception, creativity and direct contact with musical contents of fundamental musical works. It is also intended to motivate students by making them direct participants within their own learning process. With this, it will be possible to foster respect and cooperation among students while they improve their learning experience through the coherent and thoughtful use of video-games in the music classroom.

With that in mind, the teacher must take into account the proper starting point of this learning process considering different characteristics of the students and their heterogeneities for the correct elaboration of video-games that will reach all the students so that everyone can take part of it. It is important that teachers aim to create and foster a security and confidence environment in which students feel excited to learn music and that all of them have access to entertaining and interactive musical content. In order to analyze the degree of satisfaction and effectiveness of this experiment, two questionnaires shall be further applied to the students, one of which will be conducted at the initial phase and the other will be applied after the final phase of the interaction work with the Musicomovigram. This will happen in four sessions of sixty minutes each. These questionnaires will consist of inquiries for qualitative answers with rank ranging from one to five points. They will argue about different perspectives in order to
evaluate the content (questions based on specific aspects of the music, such as: rhythms, duration of the figures, families of instruments), satisfaction and value (to understand how much the students liked playing with musicomovigrams, if they would be willing to repeat the learning experiment, if they would use these video-games in their leisure time, etc.).

9. FINAL CONSIDERATIONS

This work introduced the concept of musicomovigrams as a tool to be developed for and used by children in their musical education. The sociocultural importance of music is well known; as it is an artistic expression present in all human epochs and communities, as there is no historical record of a community, no matter how isolated or primitive, that did not have a form of musical expression (Patel, 2010). Since music is an integral part of human experience, it is common for children to show satisfaction in listening to and playing music. The music educator must not neglect this reality and should seek to explore the natural inclination that students have for music. This project dealt with the theoretical conceptualization of the development of musicomovigrams, as an interactive ICT tool, in the form of video-games. These are based on the concept of Musicograms and they are designed to be used for musical education, in principle, with students from 8 to 10 years of age, with the main purpose of fostering fundamental music education. In this way, musicomovigrams intend to promote the taste for music in its different genres. Their evaluation will be done through questionnaires, designed to measure their ability of making students learning elementary musical concepts, such as: simple measures, musical forms and rhythmic figures. The aim here is to introduce these new didactic methodologies and to apply them to musical learning, since they expose the students to a contemporary, dynamic and interactive area of knowledge in a different way from that provided by text and musical notation. The purpose of this research is to favor and to enrich music lessons by taking advantage of the natural students’ playfulness for the didactics of musical knowledge, acceptance of formal music materials and the motivation.

With musicomovigrams it will also be possible to help students with greater difficulty in learning and performance, which will foster learning autonomy. Once their functioning is known to the students, they can use them independently as they will be designed to be self-explanatory. If possible, data basis of musicomovigrams will also be
created, thus enabling the implementation of innovative methodologies such as the proposals of Bergman and Sams (2014). The teachers that embrace this methodology may enjoy a stronger presence in the orientation and conduction of music materials and didactic resources, by being them the designers and experiences players of musicomovigrams. They can further by included in the formal school curriculum as efficient tools to present musical resources to the students in an interactive and relevant way. In this way teacher will be able to move from an authoritarian role to the one of guidance or coaching, that stimulates the student to independent seek of knowledge.

With these resources we intend to observe the place that will fit and the function that musicomovigrams will have in the teaching of creativity and musical expression. In this sense, it is suggested here that musicomovigrams shall be inserted into didactic in steps, in different perspectives, initially as an extra didactic resource and to be applied through the supervision of a music teacher.

The design and application of musicomovigrams also infer the need for the creation of interdisciplinary groups with the aim of unifying forces between educators and digital artists. They use ICTs with pedagogical criteria which enrich the digital artwork offering aesthetic quality and the possibilities of interaction within didactic purpose. In the future it is intended that musicomovigrams also develop further the concept of educational video-game, where these may contain more complex interactivity, as well as the possibility of offering multiplayer versions. These can also allow that several students play simultaneously within the same Musicomovigam, working and improving communitary musical aspects, for example, the interpretation of a melody with less mistakes, thus opening a field of possibilities to fundamental questions, such as cooperative work fomented by playful motivation, facilitating the learning processes. ICTs have indeed evolved rapidly in the last decades and, at the present time, it is undeniable that they are facilitating tools in the learning process of music students. In the future, it is expected to be possible that this resource will enable the development of even more musical aspects in the analysis, composition and performance fields, promoting in this way the greater acceptance of ICT resources for teachers and students.

10. REFERENCES


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