

MUSIC TECHNOLOGY COMPETENCIES FOR EDUCATION: A PROPOSAL FOR A PEDAGOGICAL ARCHITECTURE FOR DISTANCE LEARNING

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ABSTRACT

This article proposes a pedagogical architecture (PA) focused on the development of competencies for music technology in education. This PA used free Web 3.0 technologies, mainly those related to production and musical composition. The pedagogical architecture is geared for teachers and those pursuing a teaching degree, working in distance education. The methodology used was a case study with a qualitative approach. XX teachers participated in the study. This article presents as a result a PA focused on the development of competencies for teachers and students in music technology in the educational context.

KEYWORDS

Pedagogical architecture, competencies, technological and musical context.

1. INTRODUCTION

Social and cultural changes arising from technological changes are directly reflected in educational activities. One of the biggest changes was the Internet, which makes it possible to carry out collective work, communicate through the network, and become an author of one's own material. Today teachers must be vigilant and constantly learning new information in order to keep up with their students, many of whom belong to the net generation. It is therefore important to understand the technological changes to reflect on new pedagogical practices.

As Palfrey and Gasser (2011) argue, the Internet with the properties that characterize the second and third generations, presents opportunities for digital natives to learn to create, express, and enjoy new works of art. Among these attributes of the Internet, tools that are dedicated to musical composition will be the focus of this study. Studies of English youth by Hargreaves (2005) argues that popular music strongly influences the lifestyle of adolescents who identify with certain styles, resulting in the construction of musical identities. In an investigation of the composition and recording of music with adolescents in public school, Lorenzi (2008) reports that the technological advances of recent decades have changed the relationship of young people with this art form. These changes are reflected in the educational context, especially in schools.

Given these assumptions, it is understood that in the current educational landscape, a large proportion of young people are familiar with technology. In the proposal presented here, the focus is on musical composition activities through free Web 3.0 technologies. They have the interactive features of Web 2.0 with cloud computing. As pointed out by Behar et al. (2013b) and Rosas (2013), composition performed by the computer associated with tools with these characteristics, can also assist in developing competencies for music technology in the educational context.

In light of this reality, it is important to reflect on musical composition in Distance Learning (DL), mainly the construction of pedagogical architectures that facilitate the improvement and/or development of competencies in this area.

It is first necessary to define pedagogical architecture (PA). In this approach, a PA is the combination and interaction of strategies and different elements that make up a teaching practice. Thus, there are possible ways to organize educational planning. There are four key aspects: organizational, content, methodological, and technological (Behar, 2009).

Hence, the construction of a PA for the music technology context is focused on the development of certain specific competencies and requires the teacher to review teaching practices. As Behar et al. (2013a) argue, a process of teaching and learning which focuses on the development of competencies is an alternative to the integral formation of the student and has a closer relationship between theory and practice.

In this article competencies are understood as a set of elements (knowledge, skills, and attitudes) that are mobilized to meet the needs arising from a particular situation or context (Behar et al, 2013a; Zabala & Arnau, 2010; Perrenoud, Thurler, 2002; Gaspar, 2004). Thus, this theme will be presented in the following sections.

2. PEDAGOGICAL ARCHITECTURE AND MUSIC TECHNOLOGY COMPETENCIES IN THE EDUCATIONAL CONTEXT

There is diversity in the combination of online courses offered. Distance education models also vary according to the institutions that offer them as well as combinations that specific teachers use.

Many courses available in this type of education use diverse materials such as videos, texts, animation, learning objects, and also benefit from the use of virtual learning environments to develop course activities.

Therefore, it is important to have a plan that encompasses these specific needs and characteristics of DL. In fact, the development of a pedagogical architecture to be used throughout the entire course is critical.

Behar et al. (2009) describes a pedagogical architecture as one of the constituent elements of a pedagogical model, along with strategies for it to be implemented. Bernardi (2011), in accordance with Franciosi (2005), defines PA as “the construction of pedagogical strategies based on a certain theory and its assumptions in order to assist in the effectiveness of learning with the help of technology resources such as Virtual Learning Environments (VLEs) and/or videoconference” (Bernardi, 2011, p.56).

A PA is structured by (1) organizational aspects, (2) content, (3) methodological aspects, and (4) technological aspects. Below is a list of each constituent element of a PA (Behar, 2009):

a) Organizational aspects: Refer to the pedagogical planning. Beginning with the definition of objectives, organization of time and space, definition of the duties of each participant in the process (student, teacher, etc.) and the competencies that will be developed;

b) Content: These are the materials and components that will be used during the course. The content should be created to meet the demands of a virtual course, making it possible to develop the competencies of these students. The content of a PA may be any type of material used for the purpose of appropriating knowledge (BEHAR et al., 2009). When selecting materials, it is necessary to take into account whether they are graphic, pedagogical, interactive, and motivational (or not) for the student. Bernardi (2011), agreeing with Behar (2009), maintains that the content may be in the form of learning objects (LO). As Behar et al. (2009) explain, learning objects are any material or digital resources such as videos, images, text, audio, web pages, etc. that have an educational purpose. Bernardi (2011) adds “[...] these are therefore materials focused on the development of learning situations in the VLE mode, semi or fully in person” (Bernardi 2011, p.60). This author also points out the importance of the LO as a theoretical and pedagogical support in a PA;

c) Methodological Aspects: Although only referring to the “how” will be addressed in the course content, it can be considered the forms of connection, associations of technological resources, and procedures adopted, taking into consideration the objectives defined in the pedagogical planning;

d) Technological Aspects: The definition of a VLE and what tools will be used, as well as other technological resources, is essential in distance learning. In fact, it is especially crucial when considering what is best suited to the proposal of the course and students.

Therefore, reflecting on the constituent aspects of a PA one can see that the development and/or improvement of competencies in virtual courses is present in all the elements of an architecture. Thus, it is necessary to define selected competencies and primarily focus on music technology in education, which is the topic of this article.

2.1 Competencies for the Music Technology in the Educational Context

As Perrenoud and Thurler (2002) have argued, competence is the ability to deal effectively with a number of problematic situations. Perrenoud (1999) uses the genetic epistemology of Jean Piaget, whose paradigm is interactional, as the theoretical basis. Thus, he argues that competency includes the mobilization of multiple cognitive resources, knowledge, and skills, in an increasingly rapid, relevant, and creative way. He further argues that an educational practice should be focused on the development of core competencies for an individual's integral formation. Behar et al. (2013a), in accordance with Zabala and Arnau (2010) and Perrenoud and Thurler (2002), believe that competence is the mobilization of three elements which together form the acronym KSA. They are: knowledge (K), skills (S) and attitudes (A). These three elements are deployed in a "[...] given context in order to solve a problem, deal with a new situation" (Behar, et al., 2013a, p.23). Knowledge refers to knowledge, skills to know-how, and attitudes are learning to be. For this author, the term competencies is used in the plural, because there is no single competency, but a group of them that have developed or develop simultaneously. Education from this perspective sees the student as a whole, in their multiple dimensions, educating them for real situations throughout their life.

Rosas (2013) points out the importance of music composition in the development of musical competencies. In the opinion of this author, competencies for the music technology in the educational context imply the mobilization of knowledge and skills in these areas and attitudes towards technology and content. Such competencies can be developed by both musicians and lay people.

Music technology in the educational context in this proposal is the use of digital technologies dedicated to music involving composition and appreciation activities in the classroom or distance learning environment. Although Swanwick (2003) holds that activities involving literature and execution are also of equal importance to that of composition and appreciation, because the target audience will have lay people in music, we emphasized practices aimed at musical composition using a computer. Thus, in the educational arena, teachers and lay students can produce music using digital technologies provided they receive adequate training, like the courses mentioned in this article.

According to Behar et al. (2013b), the computer functions as a musical instrument and an amateur studio. Thus, the active participants in DL can create their own music for their videos or other digital educational materials. They just need to have a computer with Internet access.

Hargreaves (2000) supports the definition of musical competence proposed by Stefani (2007). These authors argue that the concept means "[...] the ability to produce meaning by or through 'music' in the broad sense, that is, in all that vast and heterogeneous mass of collective practices and individual experiences involving sound [...]" (Stefani, 2007, p.01).

Rosas (2013) understands musical competence as the ability to mobilize knowledge, skills, and attitudes for the production and musical composition in music technology in the educational context. For this author, training courses for the development of competencies for the music technology in the educational context are also essential for subjects to act effectively in this area. Because of the proposal of digital musical composition includes lay people, instrumental performance is not addressed, although it is of equal importance to the development of competencies in specialized musicians.

Webster and Hickey (2009) are also in favor of the practice of composition in music education. The authors mention that in countries like Australia, the United Kingdom, and the United States "[...] the interest in improvisation and its role in the musical development and compositional thinking have grown as a strategy for teaching music [...]" (Webster; Hickey, 2009, p.379). Given this statement and as Rosas (2013) confirms, activities involving composition can promote musical knowledge, a fundamental element for the development of competencies.

Based on these definitions of pedagogical architecture and competencies, it was possible to build a PA to help in the development and/or improvement of competencies, as described in the methodology which follows.

3. METHODOLOGY

A qualitative approach in education is adopted regarding the methodological aspects. A study of multiple cases in two blended extension courses. The methodology was composed of four recursive and summative

stages. Stage 1: The construction of a Pedagogical Architecture (Organizational, Methodological, Content, and Technological Aspects). Stage 2: Development of research tools: An online questionnaire (entitled 1) to diagnose the subjects' previous music technology experiences and a second online questionnaire (entitled 2) to assess the skills developed during the extension course and the learning object Digital Music composition (CompMUS) (Stage 3). Both instruments were built with the Google Docs tool. This step also included the development and clarification of informed consent forms to be completed by study participants in Stage 3. Stage 3: Completion of two blended model extension courses. The first had a workload of 20 hours and the second 30 hours. These courses were designed for teachers and students pursuing teaching, music, other teacher qualification degrees and public school teachers. The total number of participants in the two courses were 18 students, with 8 in the first edition and 11 in the second. In Stage 3 the instruments constructed in Stage 2 (questionnaires and signing and clarification of informed consent forms). Stage 4: Analysis of data collected during the previous stages.

To address the ethical issues of this research an informed consent form was prepared and participants of the courses agreed to participate in the research.

The following instruments were used for data collection:

- 1- Musical productions and compositions performed by students using online digital tools and posted in the virtual learning environment (VLE) ROODA.
- 2 - Questionnaire applied before the course (questionnaire1).
- 3 - Questionnaire containing the evaluation of courses, the LO CompMUS and AP (questionnaire 2).
- 4- Records written in VLE ROODA: Forums, Diary, comments in the Webfolio.
- 5 - InterROODA functionality to check student attendance in this environment.

The productions made using digital tools and records in ROODA features were analyzed qualitatively. Musical compositions performed using digital tools and posted on the ROODA Webfolio, were analyzed, verifying what knowledge, skills, and attitudes subjects developed or improved. Questionnaires were applied and compared in order to examine what musical and technological competencies in education were developed during the extension courses. In the following section, we present this mapping which reveals the competencies that subjects developed/improved.

4. RESULTS

At the end of the study, it was shown that the PA built along with the course entitled "Digital Music Composition for Education" helped develop competencies for music technology in the educational context.

Some adjustments were necessary in the pedagogical architecture to meet the needs and develop/enhance competencies satisfactorily. From the data that has been collected and analyzed, it is possible to present a PA proposal. Therefore, the PA is presented below:

- Organizational aspects: The objectives proposed for the course were adequate and the workload of 30 hours was satisfactory. The competencies that will be developed and/or improved in the course should always be considered, especially those related to the music technology in the educational context.
- Content aspects: The use of a learning object makes all the difference in this kind of course. The use of CompMUS helped over the past two editions of the course, including the development of competencies, three in particular: Music technology fluency, cooperation, and autonomy.
- Methodological aspects: The blended model of the course for in-state students and fully distance for students from outside the state and with difficulty participating in regular classes was suitable for the characteristics and needs of target audience. The virtual diary feature was found to be important so that students could express their feelings during the course. The students used this tool to write about their difficulties, how they overcame them, and to give words of encouragement when they completed an activity. Moreover, students could post their productions and receive feedback from the teacher through comments made in the Webfolio feature.
- Technological Aspects: The ROODA features that was used proved to be adequate, with some adjustments, such as in the case of ROODAPlayer. This was rarely used and students could have used it

more. There were a sufficient amount of forums. Digital composition resources proved complex and restricted because they were free and in English.

It is clear that few adjustments to the first PA presented were necessary. It should be noted that it is advisable not to reapply the same PA, but instead to adapt it according to the social and cultural setting in which the course/subject is inserted.

Another important result was the mapping of skills that are presented in summary form in Table 1:

Table 1. Competencies in music technology in the educational context and their elements

Competence	Music Technology fluency
Description	This refers to the use, creation, and production of music through digital technologies.
<i>Knowledge (K)</i>	Learning various audio formats; learning effects to treat audio; learning the basic assumptions of electroacoustic music; notions of form and musical structure; read, interpret, and critically reflect virtual and multimedia messages.
Skills	Producing and composing music using digital technologies; converting audio formats; configuring the sound board according to the operating system; using mainly free online tools for writing, producing, editing, and mixing audio; installing and uninstalling musical software.
Attitudes (A)	Openness to new sounds originating from digital technologies.
Competence	Cooperation
Description	Cooperation includes social interaction where the subject learns not only in relationship with themselves and with the environment, but also with others. Knowledge is built on the relationships based on collaboration, cooperation, and communication.
Knowledge (K)	Learning digital composition tools that enable collective work.
Skills (S)	Collectively producing and composing music using digital technologies; using (ICT) for social exchanges.
Attitudes (A)	Being proactive, ability to control the structure and content of a musical composition; having the flexibility to change; being responsible in the use of ICT; openness to different musical languages, such as popular, classical and contemporary.
Competency	Autonomy
Description	Establishing favorable conditions for social relationships, maintaining self-motivation and motivating others. Ability to deal with their own and others' difficulties.
Knowledge (K)	Self-awareness and awareness of the other.
Skills (S)	Analyzing, discerning, and facing obstacles.
Attitudes (A)	Self-confidence; being able to motivate themselves and others.

The elements of competencies presented in the table are:

Competence: MUSIC TECHNOLOGY FLUENCY

Knowledge (K): Learning various audio formats: In order to send or download audio files on the Internet, it is essential that the subjects know about compressed digital audio formats such as MPEG Audio Layer-3, whose acronym is mp3 or similar formats like as ogg Vorbis and digital players where these formats are

played. Learning effects to treat audio: This element refers to the knowledge of different audio processing functions, like audio effects such as fade in, fade out, normalize the volume, etc. Notions of form and musical structure: These are important, however, depending on the tool that is used, these notions are not necessary to write in the aforementioned context. In fact, these concepts may refine the compositions according to the skills and knowledge level of the subject. Understanding of chords according to the Western tonal system to create accompaniments in tools like JamStudio: This element refers to learning to compose a musical accompaniment or play a chord using digital tools that have this language in their interface, like the JamStudio. Learning the basic assumptions of electroacoustic music: This knowledge relates to the historical assumptions of electroacoustic music composition and the new sounds of contemporary music, such as the soundscapes; Read, interpret, and critically reflect virtual and multimedia messages: This element implies the understanding of the contents presented in digital multimedia, in addition to the technical skills to access them.

Skills (A): Producing and composing music using digital technologies: This refers to musical composition and production using a computer with digital, primarily free, tools. Converting audio formats that can be transmitted via Internet: This skill is essential for the subject to exchange and share audio files and their own compositions on social networks, websites, emails, etc. Using mainly free online tools for writing, producing, editing, and mixing audio: In music technology in the educational context, it is understood that the subject needs to know and be able to use editing software to treat and transform digital audio. We must emphasize that free tools are more accessible, given the reality of Brazilian education. Installing and uninstalling music software: This skill is not necessary to make compositions or edit using online audio tools. However, there is not always a good Internet connection, depending on the location. Therefore, this skill is basic to function in the context in question. Using mostly free software and online tools for music composition: Since this is a proposal for education, the ability to use mostly free Web 3.0 tools is key. Thus, musicians and laypeople can engage in music technology in the educational context, both in the classroom as well as fully distance learners. Configuring the sound board as the operating system: Certain software dedicated to music requires the configuration of the sound board according to the operating system. However, this skill is not required for all programs.

Attitudes (A): Openness to new sounds originating from digital technology: An open attitude is understood as one which is favorable to sounds that have undergone digital processing, and is essential to act in this context.

Competence: COOPERATION

Knowledge (K): Learning digital composition tools that enable collective work: Knowledge of the possibilities offered by digital tools is paramount to collective musical composition. When dealing with aspects of young people's socialization from the music, Setton (2009) understands this form of art as a language with strong socializing potential. For the author, analyzing the social dimension of music can clarify the relationships of meaning between it and its possible influence on individual actions (Setton, 2009, p.15).

Skills (S): Collectively/collaboratively composing and producing music: According to Behar et al. (2013a), digital fluency emphasizes the importance of collaboration between subjects and the construction of collective works to generate knowledge. Silva (2012) agrees and mentions teamwork as one of the competencies of a Distance Learning student. This context includes the two modes of teaching and therefore a collective/collaborative composition is paramount. Using (ICT) for social exchanges: Behar et al. (2013a) support the use of ICT for interpersonal communication. It is a basic skill for the subjects to perform collective and collaborative work in the intended context.

Attitudes (A): Being proactive and having the ability to control the structure and content of a Digital Music Composition (CDM): Being proactive requires anticipating problems, needs, or changes as well as having initiative. In education, a proactive attitude requires autonomy and an active role in carrying out tasks. In music technology in the educational context, the subject is proactive when they are able to control the structure and content (sound combinations such as pitch, duration, timbre, instrumentation, etc.) while composing music. Having the flexibility to change: For Silva (2012) flexibility requires dealing with different situations and looking for possible actions. It implies changes in opinion and attitudes. Flexibility is very important for individuals who use online resources and tools. Often a website that is being used starts having problems or is even taken off the Internet. Or due to technical problems, files posted on a particular

site may not open or there may be a connection failure. Faced with unusual situations, flexibility is an essential attitude. Being responsible in the use of ICT: Coll and Illera (2010) suggest the use of ICT in a responsible manner as one of the basic skills in the basic competencies of adults. To be responsible is to be ethical when communicating and when downloading and publishing files on the Internet. It also involves being critical when faced with all of the available information. Openness to different musical languages, such as popular, classical and contemporary: Having an open, ethical, and respectful attitude when listening to music from different cultures, eras, styles, and genres, from classical music to popular is critical for subjects to engage with music technology in the educational context. In contemporary times, sounds which in earlier times were considered non-musical such as nature or urban environments are now considered musical, as long as the composer intends to include them in the work.

Autonomy: Knowing how to work autonomously means being active in the process of teaching and learning and having self-discipline. As Silva (2012) argues, this attitude is part of personal initiative and is vital for the development of socialization and teamwork. Autonomy is essential for the subjects faced with digital music technologies in the educational context.

Competence: AUTONOMY

Knowledge (K): Self-awareness and awareness of the other: Getting to know yourself and trying to get to know others to establish social relations is fundamental to perceiving and making distinctions regarding the mood, motivations, and feelings of others.

Skills (S): Analyzing, discerning and facing obstacles: Refers to the analysis and understanding of intra and interpersonal actions to strategize and articulate communication with the subjects. Facing difficulties is also essential so that there is motivation.

Attitudes (A): Self-confidence: Hargreaves (2005) argues that self-confidence is essential to the development of musical skills. Dorge (2010) argues that it is a personal competence. Silva (2012) states that it is an attitude concerning the competence of self-motivation. Self-confidence leads to positive dispositions such as willingness, courage, hope, satisfaction, and is interrelated with the ability to motivate yourself and others. Being able to motivate yourself and motivate others: Motivation is fundamental for the subject to deal with the challenges faced with digital technologies in the educational context, that are often new for digital immigrant teachers. Also in DL, in conjunction with the use of ICT, teachers should be motivated to help students and give them challenging situations. The ability to motivate others is of paramount importance for a teacher's practice, whether in the physical classroom or distance learning.

The majority of the subjects participating in the course stated that they were beginners in terms of using musical technology, both musicians and non-musicians. According to the answers they gave on the questionnaire, the subjects are seeking to deepen their technological and musical knowledge to work in this context.

In addition to the skills developed that are presented in Table 1, as the strengths of the implementation of the PA, from the analysis of postings of students in AVA, the use of digital technologies dedicated to music were attractive for both non-musicians as well as musicians who have had no experience with online music technologies. One student said before he did not know it was possible to compose using the computer and that he would soon present some work at his school.

On the negative side, some students had problems with one of the pieces of software which was operated online. One student said they made a composition and days later it was no longer visible. Another drawback is that when using free tools, they tend to become paid in time or disappear. Thus the teacher has to always be aware and keep updated on the tools chosen for the course. This means that, in order to apply a particular PA again, all of its elements must be reviewed and adapted, from organizational issues to technology, where software and digital tools updates should be made.

Finally, the concluding remarks will be presented in the following section.

5. CONCLUSION

This research demonstrates the importance of a Pedagogical Architecture (PA) that foresees the use of digital technologies such as the computer, Web 3.0 tools dedicated to music and learning objects (LO) used in an

integrated manner for virtual learning environments (VLE) in DL, primarily focused on competencies. The PA presented in this study proved to have great potential to contribute to the development of music technology competencies in the educational context. Learning objects, such as CompMUS, can aid in the improvement of competencies if they fit with the teacher and target audience's proposal and provide consistent content. In addition to the integration of the LO and online digital tools described in this example, the use of a VLE is relevant to assist the interactions between subjects.

Due to the shortage of music teachers working in public elementary schools in Brazil, it is understood that all primary teachers can work with music education. The use of digital technologies described in this work do not require the ability to play traditional musical instruments and therefore can be used by lay subjects in music. Yet, in order to use such technologies requires adequate training, both musical and technological. One way to educate is through training courses that use a PA such as the model proposed here, focused on the development of competencies.

Furthermore, it concludes that the LO, such as CompMUS and musical composition activities, contribute to the construction of knowledge in the area through consistent content. In addition, through musical and multimedia examples with detailed explanations to handle Web 3.0 tools and proposed activities, they provided challenging situations for the target audience.

It is understood that there are other elements and competencies. This study presented those that were based on the PA developed, the technologies described, and according to the profile of the target audience. Therefore, the mapping of the competencies presented provides new perspectives for future studies with other architectures, technologies, and varied public.

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