Eco-composition and everyday creative musical practices: Theory and practice experience in Ubiquitous Music research at UFRGS Application School with high school students in and out of the classroom

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Abstract In this article, we describe a longitudinal study featuring group collaborations within the context of educational research done by teenagers in high school. An eco-compositional activity took place during 2015 in an elective course offered to secondary students at the UFRGS Application School (CAp). Fifteen students took part in the course, four of which were already Scientific Initiation students within the context of the Ubiquitous Music Research Project at CAp. The course addressed theoretical and practical aspects of Ubiquitous Music (ubimus). Its goal was to produce a collective composition - Sounds of CAp - applying ubimus eco-compositional strategies. During the course, several activities were planned and conducted by the research-students in and outside of the classroom, under teacher/researcher advice. The focus of the experiments was to foster creative experiences through technological support. We describe the experience, the procedures, tools, and the process of collective composition, presentation and assessment of creative products. We also present contributions from the emerging and multidisciplinary research field of Ubiquitous Music for creative studies and educational practices. Ubimus' research focuses on music making in everyday settings, employing creativity-centered design strategies to support creative experiences within artistic and educational endeavors. More specifically, we discuss undergraduate research in the field, done by basic education students advised by the authors and lead researchers. Hence, we also explore the implications of these experiences to promote and enhance the students' educational activities.

Keywords ubiquitous music research; eco-composition; everyday musical creativity; multidisciplinarity; transdisciplinarity

Introduction

For Paulo Freire (1999), the teacher is in essence a researcher. One of the educator's main tasks is to instill the investigative and researcher essence in the students, to encourage their curiosity. Within this perspective, research activities can be a decisive educational practice when implemented upon the students' entry into the educational system. Paulo Freire's educational philosophy pushes the teacher's role beyond a mere conduit for technical-theoretical information and encourages active protagonism by the stakeholders of educational activities. Freire's dialogical approach encourages pupils to assume an active role in the educational process, reflecting and justifying their creative choices and independently seeking resources within the context of open proposals. In line with other socially oriented perspectives, the dialogical view is based on the premise that knowledge is

Musichildren
*Proceedings of the 1st International Conference
Music for and by children*, p.139-151

constructed collectively and collaboratively, as a result of permanent exchanges among peers. This knowledge is considered the basis for reflective actions.

Educational actions are tailored on the idea that the teacher should provide questions that encourage students to reflect on their previous experiences through interactions among peers. By establishing relationships between their own background and the new contexts encountered through exploration, the pupils become producers of knowledge rather than passive receptors of information - they are instigated to also assume the role of researchers during the educational process. This collective construction of knowledge opens a space for coexistence of diverse and sometimes opposing views. Thus, Freire's proposal yields exchanges without confrontations.

This 'Freirean' approach - dialogical and of collective construction of knowledge - fosters since 2006 several music education and research endeavors at the Application School (CAp) from the Federal University of Rio Grande do Sul (UFRGS), in southern Brazil. These initiatives are all concerned with musical creation/composition supported by everyday technological tools in the context of basic education (Lima, 2009; 2010), and they led to the establishing of partnerships with the Ubiquitous Music Group (g-ubimus) and to carrying out the Ubiquitous Music Project at CAp (Lima, 2016).

In this article, we describe a longitudinal study featuring group collaborations within the context of educational research done by teenagers in high school. An eco-compositional activity (Keller, 2006) took place during 2015 in an elective course offered to secondary students at CAp. Fifteen students took part in the course, four of whom were already Scientific Initiation students within the context of the Ubiquitous Music Research Project at CAp. We describe the experience, the procedures, tools, and the process of collective composition, presentation and assessment of creative products. We also present contributions from the emerging and multidisciplinary research field of Ubiquitous Music for creative studies and educational practices.
More specifically, we discuss undergraduate research in the field, done by basic education students. Undergraduate research programs in Brazil, usually called 'scientific initiation', allow the participation of undergraduate and high school students. The research-students were advised by the authors and lead researchers, hence we also examine the implications of these experiences to promote and enhance the students' educational activities.

1. Dialogical and collaborative practices in Ubiquitous Music
The dialogical and collaborative practices are also key concepts in ubiquitous music research. Ubiquitous Music (ubimus, in short) is an emerging and multidisciplinary research field that focuses on music making in everyday settings, employing creativity-centered design strategies to support creative experiences within artistic and educational endeavors. Today, the Ubiquitous Music Group, or 'g-ubimus', comprises the Amazon Centre for Music Research (NAP/UFAC), the Computer Music Lab (LCM/Institute of Informatics at UFRGS) and the Application School at UFRGS. Beside these research centers, permanent collaborators participate in the group, affiliated with other Brazilian institutions which include CEUFES São Mateus, UFSJ, NUMUT/UFU, NICS/UNICAMP, FAESA, IFRS, and international partners from Maynooth University (Ireland), Linneaus University (Sweden) and Griffith University (Australia).

Given the multidisciplinary quality of the g-ubimus endeavors and the diversity of views from

Musichildren
Proceedings of the 1st International Conference
Music for and by children, p.139-151

its researchers, it seems reasonable to keep the concept of ubiquitous music under constant debate (for a broader coverage of ubimus initiatives, refer to Keller et al., 2014). However, there is a confluence of ideas about the study of musical activities in ubiquitous contexts, which comprises the axes of composition, performance, human-computer interaction and education. These shared issues serve as guidelines for ubimus research approaches.

> In a recent discussion at the online group forum, a broad definition of Ubiquitous Music was suggested: 'Ubiquitous systems of human agents and material resources that afford musical activities through creativity support tools'. This definition suits the interdisciplinary character that this research group seeks for the area. (Flores et al., 2014)

As an emerging and multidisciplinary field, ubiquitous music deals with several topics, which recently have raised emergent behaviors and demands with deep impact into the social and human aspects of musical practices. Therefore, ubiquitous music goes beyond technical questions, thus being not a phenomenon that is limited to technology, but one that emphasizes the impacts of the musical activity in a much broader way: by adopting investigative approaches on the social forms of music-making by non-musicians, including modalities of music listening and sharing, and aiming at transforming the consumers into active producers of musical content - something that we call 'everyday musical creativity'.

2. Everyday musical creativity and ubimus research

We highlight here three aspects which we think comprise the main focus of research into ubimus and everyday musical creativity: everywhere, everywhen, by everyone. Lima (2013; et al., 2014) describes them in the following terms: (1) Availability for creative activities, as a result of technological support, in any place: through pervasive infrastructure, spaces are broadened, ceasing to be limiting factors for music making; (2) Opportunities to exercise creativity at any time: like space, time is widened through asynchronous support techniques, and through fostering of exchanges via communities of practice; (3) Promotion of creative action by anyone: independently of their knowledge level, training or age, participants in ubiquitous musical activities are encouraged into developing their creative potential (most recent investigations aim at creative engagement, favoring aspects related to well-being in the context of everyday activities).

The concept of everyday creativity is related to non-professional activities carried out in venues not intended for artistic practice (Richards, 2007). Everyday musical creativity demands technological support to provide access to musical resources by non-musicians and by musicians doing activities in domestic and public spaces (Keller and Lima, 2016; Pinheiro da Silva et al., 2013).
Ubimus research into everyday creativity targets music making in everyday settings, employing the ubiquitous music framework for the purpose of conceptualizing the study of creative experiences and for the development of the necessary support infrastructure.

The focus on human agents and the centrality of sustainability issues raised by the ubimus research agenda is grounded on two current approaches to educational practices: the dialogical perspective pioneered by Paulo Freire (1999) and the free circulation of know-how and material resources proposed by the open educational resources initiative (Lima 2013; Lima et al. 2012, 2014). Our research agenda is based on a participatory, community-based, subject-centered view of education, targeting both formal (Lima et al. 2014) and informal educational settings (Ferreira et al. 2015).
Converging trends in creative practice research (Keller and Capasso 2006; Truax 2002),

Musichildren
Proceedings of the 1st International Conference
Music for and by children, p.139-151

educational research (Loi and Dillon 2006) and music education (Burnard 2012) point to the local context as yet another key factor in shaping creativity in educational settings. Loi and Dillon (2006) propose that adaptive educational environments can be designed as creative spaces that foster interaction through situational and social dynamics. Technology becomes a key resource to enable active participation by all the stakeholders.

These situated, socially informed approaches stand in stark contrast to the standard educational views on musical creativity. While standard models have been generally concerned with activities that (in theory) can be carried out without the need for social interaction or place-specific experience, such as 'problem-solving' and 'thinking' (Webster, 2003), situated approaches bring socially acquired musical experience to the forefront of the educational agenda. Thus, they highlight two aspects that need to be considered in creativity-centered design: the place factor and the mutual processes of adaptation that emerge through social interactions. Both aspects can be handled by methods proposed in the context of ecologically grounded creative practices.

From an educational perspective, several ubimus studies and activities have been conducted in formal and informal educational settings, encompassing students and teachers from various knowledge areas of basic education, musicians and non-musicians, and integrating in-class music making with virtual environments. Through these investigations, we try to understand how the general public is making use of everyday technological tools in shared musical creative experience situations (Lima, 2013).
Our focus herein are the educational applications of this emerging research field, as explored, within the Ubiquitous Music Research Project, in the context of basic education at the UFRGS Application School. This project involved students and teachers as protagonists of ubimus research activities, facing the challenge of a research approach grounded upon complexity, inter- and transdisciplinarity paradigms.

3. An interdisciplinary, transdisciplinary, complexity, creativity and dialogical research approach

The research approach in undergraduate research within basic education is a special challenge. The diversity and complexity of the school environment is at the same time rich and demanding. The variety of knowledge and disciplines to which students are presented have to be adequately chosen, and related to research subjects. Therefore, the Ubiquitous Music Research Project at CAp tries to follow a complexity, inter- and transdisciplinary approach, seeking an expanded view for the research in music.

Domingues (2012) points out that both transdisciplinarity and interdisciplinarity switch the focus of course disciplines and subjects, with their rigid limits, to themes and problems of any kind, and especially those originating outside of discipline limits, i.e. in intersections of disciplines and in the interfaces between various knowledge areas. Within his approach, interdisciplinarity and transdisciplinarity offer a more plastic viewpoint, so to favor experimentation and disciplinary transgression.

But even if both approaches share common factors, Nicolescu et al (2000) identifies important distinctions between the inter- and transdisciplinary perspectives. Interdisciplinarity, while going beyond disciplines, still remains inscribed in disciplinary research, and acts on transferring methods from one discipline to the other. Transdisciplinarity, instead, as indicated by its prefix, 'deals with what is, at the same time,

Musichildren
Proceedings of the 1st International Conference
Music for and by children, p.139-151

between disciplines, crossing different disciplines, and beyond any discipline, aiming to understand the present world through knowledge unification' (idem). Nicolescu stresses that transdisciplinary research is complementary, though radically distinct from interdisciplinary research, since its purpose is 'the understanding of the current world, something impossible to inscribe in disciplinary research' (ibid., p. 13).

More specifically, transdisciplinarity offers a complementary view to a disciplinary approach, bringing out the confrontation of data from new disciplines that articulate with each other. Its approach does not aim at the knowledge domain of several disciplines, but to open all disciplines to what they share and to what exceeds them (Freitas Lima; Morin; Nicolescu, in: Nicolescu et al, 2000). From the transdisciplinary viewpoint, we see music as a complex phenomenon - social, scientific, technical, educational - that can, and should be studied as a physical, measurable, computable, but at the same time also as a social and semantically complex phenomenon. Therefore, this kind of research considers music as a potential field for diverse research approaches, open to a multitude of associations and potentially transdisciplinary, rather than as an isolated knowledge area.

The school environment - in which students live most of their time - acts as instigator of thinking across a variety of disciplines and fields of knowledge. Exchanges are grounded on readings and bibliography covering a wide range of areas. The research developed by students covers aspects related to computing, physics, mathematics, sociology, philosophy, education, psychology and music. The inter- and transdisciplinary approach to dealing with issues involves open discussions. The tight relationships across knowledge areas has a positive impact on the students' musical knowledge apprehension.

4. The school context and the undergraduate research activity
In the field of educational research, several members from g-ubimus have been promoting student engagement into research through undergraduate research activities (called Scientific Initiation in Brazil). Undergraduate, and even high school students can be sponsored through research projects coordinated by teachers/researchers, which advise the students in theme-specific projects. In the case of the Ubiquitous Music Research Project, scientific initiation is offered to high school students as an elective course.

The 'CAp' ('Colégio de Aplicação', or Application School) is part of the Federal University of Rio Grande do Sul, and targets basic education - primary and high school. Its activities comprise teaching, research, and community outreach. In terms of research practice, students can voluntarily join a project coordinated by a music teacher, and develop, with the teacher's supervision, individual research related to subtopics of the base project. A variety of knowledge fields, a wide range of project approaches, and thus, a range of opportunities are offered to students to engage in specific areas of their interest, and to deepen (since before college) specific knowledge, as well as to experience the scientific research practice.

The Ubiquitous Music Project at CAp (Lima, 2016) aimed primarily at offering the opportunity for high school students to develop and participate in ubimus research, in partnership with the g-ubimus. Research into ubimus, in the basic education context of the school, involves interaction between high school research-students and students from other levels of basic education, since the primary grades, besides teachers and undergraduate students who take part in activities at CAp. Each of the thematic student research proposals makes an essential contribution to the base projects, and to the design, development, and dissemination of

Musichildren
Proceedings of the 1st International Conference
Music for and by children, p.139-151

actions in research and teaching developed at CAp.

Research in the Project is based on: Educational Investigation-Action (Carr and Kemmis, in Lima, 2002), which suggests total immersion of the researchers into the research context; dialogical practice and collective knowledge construction (Freire, 1999); and inter-/transdisciplinary based approaches.

Music research practice is conducted both as an individual and as a collective activity. The weekly research activities are basically divided in cyclically alternate moments between, collective and individual activities:

- collective moment to discuss general content themes: readings and review of related topics: philosophy, sociology, music, technology, science, research, education. It is a moment to discuss transversal themes and provide an expansion of the research and the music vision. Various readings and authors, references and interviews have been addressed during that moment, these readings are related to the general lines of research, for example: Heidegger (the need for reflection on the technique and science), Arendt (humanity and dehumanisation), Morin, Nicolescu (complexity, transdisciplinarity), Spinoza (ethics), Bauman (human relations, society, technology), Sacks (mind and music), Keller, Pimenta, Flores, Lima (Ubiquitous Music), Schafer, Cage, Truax (composition, music, creativity). These moments are characterized as small seminars, when the readings and the discussions of texts and contents are conducted;
- collective moment to discuss themes and specific content: to relate research themes developed by student-researchers; in addition to the reading and discussion of specific contents of individual research areas, students have the opportunity to present and share their own research, collected data, results, questions and demands, discuss with colleagues and hear suggestions and ideas for the research, plan and develop strategies for collective action and experiments, method choice, application protocols for data collection and analysis;
- individual moments for researching: the student's individual research time, in which each student focuses on their specific theme, time to make notes, to review and read thematic and bibliographic information, and to plan individual research strategies and experiments;
- moments of the application of experiments: the moment when the experiments, that has been planned by the students, are practiced. Some experiments are applied in the music class with colleagues, during the elective Ubiquitous Music class, and with the research students group. Data collection comprised previously prepared questionnaires, and field diary. The analysis of information collected and from the data tabulated are shared and discussed among the research group students;

Although each student develops an individual research project focusing on a theme connected with the teacher's line of enquiry, the group of students works in an integrated and collaborative manner, discussing issues and planning, and conducting joint experiments to collect data that, when shared, serves as the basis for reflections, analysis and motivation of individual research. Additionally, the students also collaborate with researchers from other education levels, linked to the g-ubimus group (NAP/UFAC, LCM/UFRGS, CODES/IFRS).

From the beginning of the Project, we have seen a growing demand from high-school students for research related to the field of music and its connections with technology. The

Musichildren
*Proceedings of the 1st International Conference
Music for and by children*, p.139-151

development of proposals linked with the exploration of technological, creative, and compositional means, reflects ideas suggested in the beginning of the 1990s by Kemp (1993). According to Kemp, education should encourage sensibility for performance and composition, as well as the ability for auditory discrimination, through technologies which are already familiar to the students, from their own out of class experiences.

5. Sounds of CAp: Group asynchronous composing as educational activity

In 2015 an eco-compositional activity took place during a complete semester in an elective course offered to secondary students of CAp. Fifteen students took part in the course, four of which were already Scientific Initiation students linked with the Ubiquitous Music Research Project at CAp (Lima, 2016). The course addressed theoretical and practical aspects of ubimus. Its final goal was to produce a collective composition - 'Sounds of CAp' - applying the proposals of eco-composition. During the course, several experiments were planned by the scientific initiation fellows, advised by the researching teacher. Note that the focus of the experiments was not the technology, but the actual experience of its use for creative ends. The following activities were carried out during the course: readings, hearings, video sessions and discussions of concepts such as creation, composition and ubimus; tryouts and analyses of tools for composition (CODES, Incredibox, Kristal, Audacity); audio data gathering using mobile phones; sharing of the collected audio data within the groups; choosing and using conversion and editing software; development of the collective composition.

5.1. Presentation and assessment of the creative products

After the composition process, the students were also involved in decisions related to planning and execution of setting up the venue for a public hearing of the piece (Figure 1). This experiment of musical audition was targeted at students from different grades of basic education. A total of 41 participants from the audience left their impressions registered after the hearing, through written records, and drawings made by the younger kids. This material was shared among the group of research-students, so they could reflect and discuss it. Students also planned and conducted experimental activities outside the elective class. These happened at various moments of the school routine, and engaged a distinct public, like teachers and undergraduate scholars from different areas. As an example, we will report briefly an interface usage experiment with the Incredibox application.

Figure 1. View of the room prepared for a public audition of the collective composition 'Sounds of CAp'.

Musichildren
Proceedings of the 1st International Conference
Music for and by children, p.139-151

5.2. Interface usage experiment with Incredibox

Incredibox was chosen by the students due to some of its features: It has an 'intuitive', engaging and easy-to-use interface for musical creation, and it employs interaction metaphors free from traditional musical references. For this experiment, we invited CAp teachers from multiple knowledge fields (namely Physics, Mathematics, Visual Arts and Geography) and undergraduate fellows of various areas. Participants ages varied between 20 and 55 years.

Before using the application, the subjects provided information about their age, musical background, experience with computers and with multimedia software. All users had 15 minutes to explore the application (Figure 2), and afterwards they also answered a questionnaire to assess the experience.

Figure 2. Participants (teachers) and student-researchers during the experiment with the Incredibox software.

6. Reflections and general conclusions from the research-students about the research process

The scientific initiation students came to the following conclusions, based on their observations and the data collected throughout the experience:

- About tools/software: The students highlighted the importance of the tools' interfaces, which minimized the need for tutorials. They noticed that much of the software still follows a traditional view of music making, enforcing individual authorship and demanding knowledge of instrumental music theory. From their perspective, these characteristics hinder a more extensive usage by laypeople and prevent the adoption in diverse learning contexts. It is their belief that music creation programs need simpler and more intuitive interfaces, to enhance the participation of the untrained public in musical creative activities, including educational usage. The students suggested that multi-platform tools would support activities across multiple devices - whether connected to the network or not. Another important feature was remote sharing between users, thus supporting collective asynchronous activities.
- About the creative process: Several students concluded that one of the frameworks within ubiquitous music research - eco-composition - may provide moments of reflection about the potential of creative, critical action in daily life. During the experiments, students noticed the differences between the construction of interfaces

Musichildren
Proceedings of the 1st International Conference
Music for and by children, p.139-151

for musicians and the demands of everyday musical activities. They realized that the use of metaphors associated with everyday life may help the development of applications targeting the general public. Hence, people that never thought of making music could have access to creative music making. After analysing the resulting data (from the questionnaires, in loco observations and annotations), the student-researchers concluded that, overall, the activities of materials exploration and of sound products creation during the experiment were described by the participants as being fun. The students also observed the game-like character associated with the exploration of technological tools, the sharing of ideas and the creative process, all which took place during the process. They also noticed that all of the participants declared that they did not apply any previous strategies or (traditional) musical knowledge while doing the creative exploration in the experiment.

- About the results of the collective composition: From the data gathered during the public session of the Sounds of CAp composition, students observed that despite being immersed in a sonic ambient in their everyday life, most people do not notice the sounds that make up the soundscape. The recordings collected by the students throughout the semester highlighted the fact that we are active agents of multiple transformations of our environment. But as the seasons go by, we are not aware of the subtle sonic effects of our actions on our surroundings.

6.1. About the research process

About why to conduct research: The students concluded that a wider reflection, in inter- and transdisciplinary terms, must be stimulated and applied both in education and in research. The work and practice of research, especially in scientific initiation, constitutes an efficient means for reflections and changes in perspective, in relation to the construction of knowledge, and in the direction of inter- and transdisciplinary practices in teaching and research.

Some remarks by the student-researchers:

- 'This research worked not only for gathering data, but also to expand my knowledge.'
- 'The readings made us think about the connections between research topics that are linked and that extend through several knowledge areas. That is, the studies establish relations, even minimal, with practically every and the most diverse knowledge areas.'
- 'Scientific initiation has, as starting point, the curiosity of the student about some specific subject, and deepens this curiosity through learning and usage of scientific methods for development of the chosen topics. Scientific initiation prepares the youngsters for their future academic experiences, having natural curiosity as a basis.'
- 'Humans have always tried to understand the world to which they belong, their surroundings and themselves. Scientific research, as well as its methods, constitutes tools build by humankind, which aid the understanding of this world. We research because we want to understand what surrounds us, and also ourselves' (14 y.o. student-researcher).

About why to research music:

Musichildren
Proceedings of the 1st International Conference
Music for and by children, p.139-151

- 'We are musical beings. Studying and researching the field is also understanding ourselves culturally' (14 y.o. student-researcher).
- 'We are guided by our senses. Even if we recognize that we are day by day surrounded, affected and influenced by sounds at all times, we discover that we still don't give the fair importance to research related to music. Maybe because it is an area deeply linked with subjective, artistic/aesthetic, and even emotional aspects, the presence of music as a field in the scientific research domain is still somewhat limited, and is even diminished' (14 y.o. student-researcher).

7. Conclusions

The practice in research and scientific initiation with teenagers and children at the school, tends to benefit from inter- and transdisciplinary approaches, since 'learning to know' (Nicolescu, 2000) means being capable of establishing connections between the different bodies of knowledge, and between this knowledge and their meanings for our everyday life and our internal abilities. Thus, the transdisciplinary approach may be an essential complement of disciplinary procedures, since it will lead to the emergence of beings which are constantly re-connected, capable of adapting themselves to the changing demands of professional life, and embodied with a permanent flexibility, always oriented towards updating their inner potentials (Domingos, 2012).

This point of view is akin with Freire's Dialogical Approach (1999), which underlines the importance of the context where the students live (school, community, home), and the dialogical and reflective connections and sharing made with these references during their research experiences.

In the field of education, and in educational contexts, ubimus research has contributed, in the last years, with studies which focus everyday musical creativity with the use of everyday technology and linked with reflections about such musical creative practice. The multidisciplinary character of the g-ubimus group - since being a gathering of several researchers from diverse fields - contributes for the area to breach the disciplinary limit, aiming for inter- and transdisciplinary practices.

From a interdisciplinary, transdisciplinary, complexity, dialogical and creativity approach, the Ubiquitous music research in CAp seeks to lead it's actions and discussion and research related to behavior phenomena, issues and practices related to creative processes of music production (make, share and think about music) with the use and everyday technology infrastructure available, collaboration and share and express musically, the expansion of space and time in which these activities take place, and expanding the vision of making music as a social activity, exercised, shared, extended to an exponential number of people from varied backgrounds, musical knowledge (formal, non-formal), in various spaces and times (not only the spaces "official" of making music). Spaces, times, knowledge that is cross.

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Musichildren
Proceedings of the 1st International Conference
Music for and by children, p.139-151

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Musichildren
Proceedings of the 1st International Conference
Music for and by children, p.139-151

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