VIRTUAL INSTRUMENTS IN MUSIC TEACHING AND LEARNING AT KINDERGARTEN-AGE: AN EDUCATIONAL PROPOSAL USING SYNTH4KIDS WEB-APPLICATION

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Abstract

In today's digital era, the accelerated development of music technology has transformed the way people interact with music. The current digital-cultural environment shapes children's music preferences, forming new types of music literacies. To that point, the incorporation of digital media in music lessons can provide new and extended ways of music teaching and learning. Despite the rapid societal, cultural, and technological changes, music education has not given proper attention to integrating music technology into teaching processes. This is more intense to kindergarten-age, where the traditional music-educational methods, as designed decades ago, do not involve new technologies in their content and tend to focus on musical instruments and genres, absent in the new digital-cultural environment. This article presents an educational proposal for incorporating virtual instruments into music teaching and learning processes at kindergarten-age. For that purpose, music-educational activities will be designed using Synth4kids web-application, an original music-making software oriented to music lessons, in their content. Actions will be developed emphasizing improvisation development, sonic experimentation, experiential learning, kinesthetic experiences, and cooperative teaching, tailored to the musical needs and preferences of children in the current digital environment.

Keywords: *music technology in education, virtual instruments at kindergarten-age, music-educational activities*

Introduction

The rapid development of music technology in the current epoch has transformed the way people interact with music (Webster, 2012). In today's era, children are growing up in a digital and multimodal environment that shapes their music preferences (Kokkidou, 2016). In that context, the incorporation of new technologies and digital media in music lessons can offer new and extended ways of music teaching and learning (Tobias, 2016). However, despite the continuous societal, cultural, and technological changes, music education has not paid the appropriate attention to music technology (Williams, 2014). That phenomenon is more intense to the younger ages, where the traditional music-educational methods do not include new technologies in their content (Mygdanis, 2018).

This article attempts to provide an educational proposal for integrating virtual instruments to kindergarten-age. For that reason, music-educational activities will be designed, embodying Synth4kids web-application as the primary tool in their content. Actions will be composed with emphasis on improvisation development, sonic experimentation, kinesthetic experiences, experiential learning, and cooperative teaching, considering the needs of the current musical, digital, and multimodal literacies of the modern digital environment.

New technologies & digital media in music education

In an environment where communication is widely digital, music teachers should consider students' desires anew, designing musical activities including digital media (Tobias et al., 2015), tailored to the modern society's needs through a variety of new forms of literacies (Miller, 2011). The fast and substantial social and technological changes of the postmodern era have led to the formation of new types of literacies and the transformation of the existing ones (Kokkidou, 2016). Music technology has become an essential ingredient of children's music lives, emerging new meanings of musicality, and forms of experiencing and creating music (Chrysostomou, 2017). To that point, integrating digital technologies in music lessons can provide extended and augmented ways of teaching and learning (Webster, 2012).

Despite the immense social and technological changes of the last years, research on the field has shown that music education has remained unchanged and stable for over the last decades (Gouzouazis & Bakan, 2011), and is deemed insufficient to align with the requirements and needs of today's students (Kratus, 2007). From a historical retrospective, approximately forty years need to be passed for music education to implement the "new,"

for every era music styles, elements, and instruments into the music lessons (Williams, 2014). In correlation with the fact that technology becomes obsolete with a significantly high speed each year, the need for implementation in music teaching and learning is becoming more critical (Chrysostomou, 2017).

Music education maintains a distance from the new technologies and today's digital era. This is enhanced by music teachers' unwillingness to apply new technologies in their teaching processes due to hesitation, uncertainty, and lack of experience (Bauer, 2013). Common technological issues, as well as students' skills to handle technology more efficiently, are factors that reduce educator's self-confidence (Chrysostomou, 2017). In cases where digital media are implemented, teachers use them to do the same tasks they did in the past, with the same objectives, ignoring the newly formed educational environment (Kokkidou, 2016). In this way, applying music technology is restricted to the theoretical background and knowledge of music, like music theory courses (Riley et al., 2013). In such cases, the only change in the educational process, is the alternation of the methodological tools, through replacing acoustic instruments with software applications, while the pedagogical context remains unchanged and conventional (Mygdanis, 2018).

Regarding young ages, the interaction of new technologies can develop and transform digital and multimodal literacies, as new media consist of a fundamental part of children's everyday lives (Kokkidou, 2016). However, the absence of technology in music teaching and learning is more intense to kindergarten-age, where the traditional music-educational methods (*Dalcroze Eurhythmics, Kodály Method, Orff Schulwerk*), as designed many decades ago, do not involve digital media and virtual instruments in their content. As a result, they tend to emphasize instruments and music styles, vanished in the new digital-cultural environment, resulting in a vital part of children's music preferences and needs not to be expressed (Mygdanis, 2018; Williams, 2014).

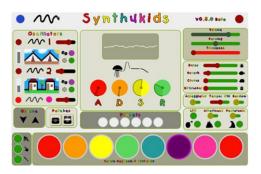**Virtual instruments in music education**

Digital media can contribute to the transformation of education through formal and informal types of learning, structuring new meanings, and setting new perspectives in music educational processes (Kokkidou, 2016). In the last decades, virtual instruments, a category of software applications for visual representations of musical instruments, have emerged (Goldberg, 2000).

Implementing virtual instruments in music lessons opens up new horizons in the music teaching and learning process, developing a new pedagogical model significantly different from the conventional one (Williams, 2014), providing possibilities for various new forms of expression, performance, experimentation and music composition (Stewart, 2009), with endless possibilities, restricted only by the capabilities of the individual (Blackwell & Aaron, 2015). Besides, their practical application can have a positive impact on musical skills, and creativity development (Crow, 2006), as well as understanding abstract musical concepts and terms (Riley, 2013), in a more in-depth and meaningful way (Ho, 2007).

Virtual instruments design presents a prominent role in how they can be implemented efficiently in music lessons, as only a few are oriented to music lessons, and their development often follows a traditional design model (Ruismäki et al., 2013). Most emphasizing users' existing behavior in acoustic instruments (Wigdor & Wixon, 2010), restricted to the digital reproduction of pianos, strings, glockenspiels, drums, etc. (Goldberg, 2000), ignoring the distinct and diverse modes of interaction that digital media and new technologies can provide (Mygdanis, 2018).

Synth4kids virtual instrument web-application

Synth4kids[i] consists of a virtual analog monophonic synthesizer web-application instrument, developed by the writer (Mygdanis, 2018). Supplying cross-platform and mobile browsing compatibility, it can be used on any tablet or computer, along with sensors, like Makey-Makey®, Leap-Motion®, tablet's tilt sensors, or web-cameras, providing rich kinesthetic experiences. Oriented to music lessons, it combines elements from the traditional music-educational methods, such as the use of pentatonic scale layout and movable-do technique. Besides, the music keyboard consists of eight buttons, colored from red to violet starting from the note C, as on Orff instruments and Boomwackers®.

Synth4kids is also equipped with the fundamental features of an analog synth. Two oscillators are generating the

Figure 1: *Synth4kids main window*

sound signal in four discrete waveforms (sine, square, triangle, sawtooth) represented by children's sketches, along with the detune function and partial configuration controller. In combination with components like the A.D.S.R., filter envelope, E.Q., L.F.O., and sound effects (delay, reverb, chorus, distortion), kids can get in touch with fundamental sound design principles. Furthermore, the module of drum-machine, ribbon layout and the

arpeggiator, which automatically plays the notes of a chord in repetition, provides opportunities for further sound experimentation.

All in all, Synth4kids can supply children with the opportunity to get in touch with fundamental sound design principles multimodally, offering expanded sound experimentation and improvisation capabilities. This article attempts to present an educational proposal for extending music teaching and learning using Synth4kid virtual instrument to kindergarten-ages, reflecting children's preferences, and providing rich musical experiences.

Music-educational activities

For the purposes of this educational proposal, a set of music-pedagogical activities are developed, using Synth4kids web-application, emphasizing children in the kindergarten-age (4 to 6 years). Based on current trends and approaches to music education, actions focus on the development of children's creativity and critical thinking through experimentation, active listening, and experiential learning, drawing on the methodological tools of cooperative teaching, game, interdisciplinarity, and multimodality, in the context of informal types of learning.

Children are expected to come in contact with new forms of music creation and expression, to perceive the interconnection of technology with the social and cultural context and the position of music in today's environment, as well as understand musical concepts and electronic sound features in-depth. For their practical application, only a laptop or a tablet with an internet connection is required.

We are the robots!

In the role of a "mad" scientist, the music educator attempts to "program" his robots (*children*) through improvisation in Synth4kids web-application. Children, divided into groups, are trying to represent robots with any robotic movement they desire. Depending on the complexity, restrictions on children's movement may be set (e.g., a specific movement can be agreed for the use of the arpeggiator module or a specific effect). If kids are familiar with handling the application, the activity can be organized by separating children into two groups of "mad" scientists and robots.

- *Methodological tools:* Multi-sensory music teaching and learning, exploration, cooperative teaching, role-playing
- *Music goals:* Improvisation and expression development, active listening, experiential music learning, active listening

Music e-Paint!

The music educator presents to children a painting of abstract or abstract expressionism art and urges them to perform it musically, focusing on elements they find interesting (e.g., lines, color, or shapes). The kids, separated into groups, decode the painting as a graphical music score. The teacher records each attempt, and in the end all the sounding results are heard. With the following discussion, musical concepts such as sound, texture, or tempo may emerge. It is advisable for children to have tried similar actions in the past using acoustic instruments. *Composition VIII* (1978) by W. Kandinsky, *Bleu II* (1961) by Joan Miró, or *Summertime Number 9A* (1948) by Jackson Pollock are representative selections for that activity.

- *Methodological tools:* Cooperative teaching, active listening, dialogue, interdisciplinarity, experimentation
- *Music goals:* Creativity and critical thinking development, sound exploration, active listening, collaboration skills development

Inspector paint decoding!

A group of inspectors is trying to clarify a valuable painting's theft, analyzing witnesses' information. Children are divided into groups of two (witnesses, inspectors). Based on a hidden painting, witnesses start playing on the Synth4kids web-application, interpreting the picture as a graphical music score. Inspectors start drawing what they hear, attempting to decipher it. In the end, each one reveals its painting result. The group that has decoded the painting best is the winner. In the end, a discussion about the similarities and differences is taking place, emphasizing drawing elements like color or shapes (e.g., "Why do you think the A used circles while B did not?").

- *Methodological tools:* Development of critical thinking, sound exploration, active listening, development of collaboration skills, creativity development
- *Music goals:* Interdisciplinarity, dialogue, active listening, experimentation, teamwork, role-playing games

Space music composition!

The music educator shows children a non-dialogue muted video excerpt, up to one minute, emphasizing topics like space, robots, or technology, and encourages them to compose music for this video in groups with Synth4kids web-application. They can use every feature of their choice; however, depending on the children's familiarity with the software, some elements may be delineated. The educator records kid's creations. After completion,

composition results are heard, and all together discuss similarities and differences. Emphasis may be placed on musical elements such as timbre, texture, or tempo (e.g., "Why do you think that the group I used that sound effect and group II not?" or "Why did you choose that waveform?"). It is advisable for children to have performed similar activities in the past, using acoustic instruments. Representative selections for that activity could be *Pink Panther in "Star Pink"* (1978) or *Reksio Kosmonauta* (1972).

- *Methodological tools:* Interdisciplinarity, cooperative learning, active listening, learning through assessment, experimentation, dialogue
- *Music goals:* Creativity and expression development, experiential learning of sound effects, sonic experimentation, critical thinking development, cultivating imagination

Future Work

The above musical-educational activities are designed to provide expanding ways of music teaching and learning processes at kindergarten-age, attempting to reflect the digital-cultural environment and the current musical and multimodal literacies. As restricted on the use of only a laptop or a tablet, various musical and expression features are not included, like the connection and interaction with distance sensors, midi interfaces, and web-cameras. A future educational proposal could emphasize the implementation of external hardware for richer kinesthetic and multimodal experiences. Furthermore, the activities were restricted to the web-application without the simultaneous use of acoustic instruments or other digital media. Music-educational activities development combining Synth4kids with acoustic and Orff instruments is of the intended plans.

Finally, the ultimate purpose is a practical intervention of the above educational proposal in kids of that age. Future research will shed light on how children at the kindergarten-age react with music technology and virtual instruments, enlightening the aspects for effective incorporation in music teaching and learning, as well as outlining perspectives on educational application design and development.

Conclusion

Music technology has gained a vital role in music life, becoming an essential ingredient of children's music preferences, emerging new meanings of musicality, and ways of experiencing and creating music (Chrysostomou, 2017). To that point, digital media and especially virtual instruments, such as the Synth4kids web-application, can enrich the ways of music teaching and learning, even at the very young ages, tailored to children's musical needs and preferences (Mygdanis, 2018).

In conclusion, the integration of digital media in music lessons is neither an apparent nor a determined process. This procedure is quite obscure and requires small and well-designed steps, as various and unknown conditions, and uncertainties might appear. In that context, every educational change must occur with the view that the main pedagogical goal is not and should not be the integration of technology. Technology is only a tool, and our foremost aim is and must remain the educational process (Kokkidou, 2016).

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[i] Synth4kids web-application can be used at: <www.yannismygdanis.com/synth4kids/>