

MUSEDU – On-line Resources and Web Technologies for Music Education

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Abstract—The development of web formats, languages, and technologies is introducing relevant changes into the field of computer-supported education. The recent advances in music teaching and learning deserve special attention, since some characteristics of the web can play a peculiar role in this context. The 9th International Conference on Mobile, Hybrid, and On-line Learning (eLmL 2017) hosted a special track called *MUSEDU – On-line Resources and Web Technologies for Music Education*. This initiative was focused on the possibilities offered by the web to the field of music education, ranging from high-quality content sharing to ad-hoc formalisms, methodologies, and web applications. This work will summarize the research results emerged during the special session, which provide multiple points of view about the issue of web technologies for music education.

Index Terms—Web; Technology; Music Education.

I. INTRODUCTION

In recent times, the pervasiveness of network technologies and the availability of high-speed connections have resulted in a rise of on-line resources, and this phenomenon is causing a paradigm shift in many traditional human activities and research fields. Unlike traditional applications, web systems and on-line resources are accessible anytime, anywhere, via a device simply equipped with an Internet connection. Content can be customized not only to address different user categories, but also for presentation on different devices, including, e.g., PDAs, mobile phones, smart devices. Customization further extends the user's capability to retrieve, exploit, and interact with information.

The paradigm shift introduced by the web is revolutionizing also the field of education. The web is currently a preferred medium for distance learning, due to a number of advantages: high availability of resources and applications, cross-platform compatibility, content distribution for a potentially worldwide audience, easy and instant upgradability, and so on. On-line technologies introduced and are encouraging aspects such as web-based learning/teaching methodologies and assessment, social learning environments, ubiquitous learning, and artificial intelligence in education [1].

Narrowing our field of investigation, also music education was profoundly changed by the advent of computer-based technologies in general, and specifically of the web. In order to investigate the different facets of this revolution, during the 9th International Conference on Mobile, Hybrid, and On-line Learning (eLmL 2017), held on March 19-23, 2017 in Nice, France, a special track called *MUSEDU – On-line Resources and Web Technologies for Music Education* took place. This initiative was focused on the possibilities offered by the web to the field of music education, ranging from high-quality content sharing to ad-hoc formalisms, methodologies, and web applications. The present work will summarize the methodological approaches and proposals of the papers presented during *MUSEDU*, which provides multiple points of view about the issue of web technologies for music education. The application scenarios have in common the goals of creation, representation and manipulation of music information, and they cover different school levels: preschool, primary, secondary, and university education.

II. MIDI RELOADED

The first paper presented at *MUSEDU* is entitled “The Web MIDI API in On-Line Applications for Music Education” [2], and it deals with a World Wide Web Consortium (W3C) initiative to bring the Musical Interface for Digital Instruments (MIDI) protocol – still in use in professional and prosumer musical equipment – into a web environment. The Web MIDI API is a browser technology that aims to enable a new category of web applications for music by providing support to the MIDI protocol, interfacing with MIDI input and output devices on the client system, and allowing standard communication on MIDI ports (i.e., sending and receive MIDI messages). A browser application that adopts the Web MIDI API can be seen as a new element in a standard MIDI chain, capable to interact with other physical as well as virtual musical devices.

The Web MIDI API is not yet a standard technology, consequently its adoption for the development of web applications at present has several drawbacks: among web browsers, only

Google Chrome and the latest versions of Opera provide full support to the Web MIDI API; moreover, this technology requires the availability of MIDI devices attached to the client, at least a software synthesizer to produce sound.

Nevertheless, there are promising perspectives in the context of computer-based music education. For example, it can be profitably applied to *music coding*, a way to foster computational thinking in students by adapting typical concepts of computer programming to music analysis and composition. In the case study mentioned in [2], the Web MIDI API allows to select any of the patches (i.e., timbres) of General MIDI, to produce the full range of pitches and dynamics supported by MIDI, and to easily implement musical operators thanks to the specific representation of score symbols in MIDI. Conversely, a similar application based on sampled audio would require the production of a huge number of sound files, and some computations – e.g., obtaining long rhythmical values from short samples – would give poor results.

This approach takes into consideration a cutting-edge technology originated by an apparently outdated standard, whose application to a new domain – i.e., on-line music education – unveils promising perspectives.

III. UNDERSTANDING MUSIC PROCESSES

The second paper discussed during the special track is entitled “A Web-based Petri Nets Application to Teach Music Analysis and Composition” [3], and it was authored by one of the world leading experts on music Petri nets (MPNs). A Petri net is an abstract and formal model aiming to represent the dynamic behavior of a system with asynchronous and concurrent activities. Such a model can be described through a standard graphical representation, very useful and effective to explain the behavior of a system to non-experts. The original idea, explored by the author in some previous works such as [4] and [5], was to apply Petri nets to music scores, addressing musicological analysis (i.e., discovering and formalizing compositional processes, structures and relationships among musical objects) as well as score reworking and composition of original pieces of music.

In the present paper, the author discusses his teaching experience of MPNs with the students of *Music Informatics*, a degree in Computer Science of the University of Milan. The educational activities proposed during the course required the design and implementation of ad hoc software tools to prepare, edit, and visualize MPNs, and to launch their execution in order to evaluate the results of music analysis and composition. Consequently, a publicly-available web prototype for MPNs was released. Among its more relevant characteristics, it is worth mentioning the possibility to watch the multi-level structure of the piece while music is advancing, to debug the net execution step by step, and to alter net topology on the fly, thus originating new pieces of music from the original material. Also in this case, the adoption of web technologies presented a number of advantages, both for students and for users interested in the formalism of MPNs, including the

independence from the hardware and software characteristics of the local system in use, the possibility to view and interact with Petri nets on line, and the integration with IEEE 1599, another W3C-compliant standard for music description [6].

IV. COLLABORATIVE MUSIC COMPOSITION

The last paper presented at *MUSEDU* is entitled “Collaborative Music Composition Using Cloud Tools”, and it deals with the design and implementation of a collaborative digital learning environment based on web technologies and rooted in the active-learning methodological approach [7]. After providing the pedagogical background, this work describes a learning environment specifically conceived for the practice and composition of music. Participants can record their performances inside virtual spaces, create and overdub music tracks, asynchronously add their content to the materials shared by other participants, and realize or arrange a full sound track under the guidance of a teacher.

In this work a great importance is given to the pedagogical results of *making music together* through web technologies: the active participation of members in the educational activities, the expected results for students in terms of music knowledge, skills, and competences, and the development of more general abilities and aptitudes, such as the shared leadership, self and peer-to-peer evaluation and assessment, and so on.

V. CONCLUSION

During the *MUSEDU* special session held along with the *eLmL 2017 Conference*, the cooperation between music pedagogy and web technologies was investigated under different perspectives. All works contained both a theoretical and an implementative part, covering formats [2], formalisms [3], and methodological approaches [7]. The promising results described above demonstrate that a better integration between pedagogy and advanced technologies can lead to a real paradigm shift in music education.

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