

Innovative Multimedia Resources Used in the Music Educational System: D.I.M.A. Experiment

Nelida Nedelcuț, Ciprian Gabriel Pop

Abstract— The multimedia application called D.I.M.A. is a multiform medium containing media combinations of video and photo images with texts that can be interactively accessed. Created by an interdisciplinary team within the Gh. Dima Academy of Music in Cluj-Napoca, Romania, the product will provide a pertinent theoretical frame concerning the methodology of registering data which will guide the development of this interdisciplinary domain. The original elements of this research are referring to the intensified technological approach of the national cultural heritage: performance, theoretical concepts and Romanian creations, building an interactive instrument that will facilitate digital access to the use of scientific and cultural resources.

Keywords— innovation, multimedia, resource, music, experiment.

I. INTRODUCTION: TECHNOLOGY MEDIATED EDUCATION

Information technology mediated education represent a current trend at the European level of instruction, being an important objective of the research domain. The ICT (information and technological communication through electronic means) represent the core of progress in all areas. Nowadays, the environment for Information and Communication Technology is changing vividly, leading to an increase of the importance of ICT research all over the world by facilitating the innovation processes and promoting wider and faster ideas exchanges, through more complex technological chains, as well as by the involvement of other related- disciplines: acoustic, sound processing, psycho-acoustics, coming together with the physics, electronics, informatics and social sciences principles (psychology, communication sciences).

On a more particular level, music research has been developed enormously in the following areas: music composition, sound generation and modeling (timbre), music

performance analysis, music interfaces, music and audio listening. New topics are used in research in fields as: soundscape's musicality (1) multi-physic instruments (2), Patterns of Sounds Waves (3) etc. This phenomenon has been deeply involved in the education structures. Today there are programs facilitating the implementation of basic knowledge which will be used to elaborate other programs with the aim of learning process diversification. Although music education can surely benefit and 'enjoys' by the educational potentials of creativity and technology, in order to do so vigorously, teachers need to recognize the besetting new challenges of the music education as opportunities for a long expected change [4]. Using computers in music teaching offered a wide scale of tools which lead to the change of the teaching process from one closed and rigid, oriented on teacher, to an inciting and interactive educational process centered on learners. ICT can help students to:

- Communicate, manipulate and exchange data with peers, communities and experts in a way that is inexpensive, instantaneous, interactive and global.
- Have unlimited access to and interact with relevant information sources.
- Engage in relevant tasks based on real situations and data.
- Recognize patterns, behaviors.
- Review and modify their work to improve the quality of presentation.
- Evaluate their work.
- Improve their own efficiency.
- Be creative and take risks.

Technology creates possibilities for performing un a way that may not have existed otherwise. In a sense, a computer can become a musical instrument that students may use for creating or performing music. With the help of ICT, the students' learning process becomes more flexible and more active. They learn in a more in-formal and attractive way, while discovering and acquiring a knowledge of music and, at the same time, exercising their critical and aesthetic thinking. Rapid diffusion of ICT requires everyone to renew professional knowledge and competence in the musical field. The e-learning platforms provide to the education institution specific instruments of implementation into their educational structures, with courses and other multimedia materials in electronic format, by applying a complex synchronous and

Manuscript received April 29, 2011; Revised version received May 7, 2011.

Nelida Nedelcuț is with the Department of Continuing Education and Distance Learning Academy of Music "Gheorghe D.I.M.A.", I.C. Bratianu street no. 25, 400079 Cluj-Napoca ROMANIA (phone: +40264 598 958; e-mail: nedelcutn@yahoo.com).

Ciprian Gabriel Pop is with the Department of Continuing Education and Distance Learning Academy of Music "Gheorghe D.I.M.A.", I.C. Bratianu street no. 25, 400079 Cluj-Napoca ROMANIA (phone: +40264 598 958; e-mail: ciprian.pop@amgd.ro).

asynchronous communication system. The elaboration of e-learning platform devoted to music education is a requirement that must observe cognitive ergonomic demands to ensure the highest level of efficiency. The cognitive ergonomics are a branch of economy, emphasizing the analysis of cognitive process (decision making, planning, etc) needed for the equipment and apparatus operation of modern informatics. Cognitive ergonomics concentrate on the goal of increasing in performance of the cognitive tasks through actions like: user-oriented organizing within man-machine interaction (HCI - Human Computer Interaction), instruction improving and task re-organizing to intensify the degree of cognitive loading, etc.

II. MULTIMEDIA RESOURCES IN MUSIC

Multimedia means to merge the text, image, sound and cinematics into one entity. The power of this entity lies in the way in which the pieces of information of any kind are linked together and become accessible one for another. Therefore, a new way of writing takes birth, allowing to compose more efficiently any type of article that can be rapidly and easily assimilated by the reader. When creating a successful multimedia product, a good interactivity will have to be taken into consideration and, nowadays, the new technologies can make it more efficient in attracting users. This product has to be attractive, having a groundbreaking design, functional, user-friendly, always up-to-date and surely fast. The new informatics technologies anticipate a multimedia approach in which different devices are affiliated: PCs, webcams, video interfaces, network interfaces, video projectors, interactive boards, etc. Together, multimedia technologies and systems offer a diversified teaching and learning potential thanks to the different mediums that are approached: sounds, voices, texts, drawings, photo images, movies, animations, graphs, etc. Visual semantic knowledge systemizing is one of the key challenges towards multimedia concept, and one that is complementary to optimizing visual classification for individual approach [5].

Such interest in giving birth to new multimedia resources has risen in the music education system, as well. This movement has been triggered by various aspects:

- The need of connecting the music education system to the present education requirements;
- The possibility of accelerating the process of learning about music by using new technology;
- The need of creating more simplified and adaptable teaching processes
- The tendency of today's education to pay more attention to creativity.

The accessibility and the flexibility of music education materials have led to an urgent need for the development of the on-line multimedia means in the art education. The aim of this development is to fill in the gap between the academic and commercial utilization of image processing. Thus, the on-line libraries must be interoperable, open source organised and easy to access. To provide fast codes, assembler optimization,

open platform, and classroom based, new technologies permit integration of GPU (Graphical Power Unit) use. [6].

At an European level, these requirements are comprised within the sphere of the musical technologies research, the TIC and ICT introduction into the education, creation (computerized music) and sound production processes having priority in many research programs: Teaching & Learning in the Digital Age, E-vocal learning, Prelude (Training Program on ICT in Music Education), Vemus (Virtual European School), I-maestro: Interactiv, Multimedia Environment for Technology Enhanced Music Education and Creative Collaborative Composition and Performance etc.

By using such means, the following type of intercommunication can be initiated:

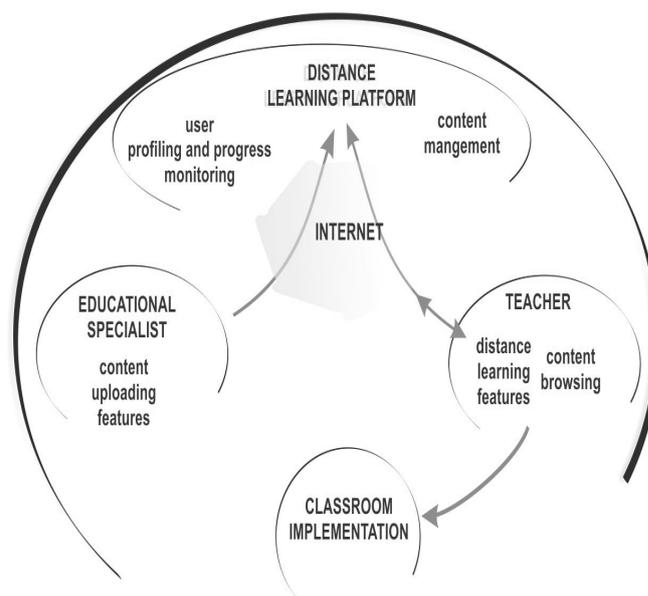


Fig.1. Communication circuits determined by the new education technologies

The new communication technology is an important mean in the music education system, since it allows a teacher to establish connections with other teachers in order to share their ideas, to create teaching projects, exchange class materials with students. E-mail accounts can nowadays include a large variety of files: texts, photos, graphs and audio-visual materials. The present teaching system makes use of strategies of involving computed teaching technologies which take aim at learning about the way of using computed instruments and especially at creatively using this knowledge in teaching music and even establishing connections with other fields of interest.

In this respect, the following have been developed:

- Educational software that can fulfill various teaching tasks that are efficiently adapted and integrated in the teacher's own strategy
- Fully integrated teaching assisted platforms, e.g. Prelude, an e-learning platform which provides specific instruments of implementation of the courses together with other multimedia materials into an electronic format by applying a complex

synchronous and asynchronous communication system.

- The resources delivered by the global computer network – the direct connection with the Internet development and with the joint communication means – represent an increasing involvement in the education process of all free resources dedicated to music (as Audacity, Darkwave studio, Solfege etc.)

- Various software products that have been developed through individual or institutional initiatives: due to a multimedia ‘boom’ over the last years, there has been a series of numerous educational programs that have been created for the artistic field, e.g. VR Encyclopedia of Art – an extensive collection of historical events that offers to the users the key happenings in the art field. An online learning environment for stimulating creativity with innovative technological practice is Sonic Postcards. This is a national education programme devised and delivered by Sonic Arts Network, which promotes and explores the art of sound via the Internet (www.sonicartsnetwork.org).

Recent researches have shown how on-line, mobile and wireless networks are creating new learning environments at the intersection of formal and in-formal educational settings [7]. The Internet has shown itself to be a dynamic teaching tool for exploring, discovering, creating, communicating about and playing in virtual music-making contexts.

III. THE D.I.M.A. EXPERIMENT – A MULTIMEDIA RESOURCE FOR THE MUSIC EDUCATION SYSTEM

The on-line D.I.M.A. product (Direct Impact Multimedia Application) is a multimedia resource in the music education system created by an interdisciplinary team of the Gh. Dima Academy of Music in Cluj-Napoca, Romania. The objective of this project was to design and develop multimedia online music courses in order to meet the challenges of modern education. The internet based music data base aimed at facilitating and widening students’ opportunities of music learning in a more flexible way and at providing them with specialized knowledge. The title of the project is: ‘Exploring the adaptation of online learning means to music education the main product being the anthology named D.I.M.A.’. The product contains the requirements of the on-line musicologic and performing data base that fulfill the specialized users’ and students’ exigency regarding the characteristic features of the approached subjects and, also, has the particularity of concerning the assimilation of the new technologies. The D.I.M.A. product is a multimedia on-line data base created on Romanian performing examples including an approach of the Romanian artistic field at the terminology aspect, creation and performing level. The musical and bibliographic patrimony of Gh. Dima Music Academy was the research reference point in creating the product and in testing it, as well. For stimulating the participation of the entire artistic community in Romania, an open portal towards the academic community was created - easy to access, permanently upgraded and ready to be supplemented. The achievement includes specific procedures

and interactive resources which facilitate the individual study according to the students’ own pace and capability. It is also easy to be accessed, by offering diversified information means. Our multimedia user interface is both a design method and an assistant tool which covers the specifications of the users requirements and the information architecture by selecting appropriate media to represent the information content. It is meant to direct the attention to the most important informations and the interaction was designed to enhance the users’ engagement. The method was evaluated in a case study design of a crowd controlled training system simulation, which demonstrated that the method was usable and gave good solutions against an expert gold standard design. The tool provided counseling on media selection and the attention effects matched the specifications of the information content expressed as information types and communication goals. As usually, the evaluation was carried out to measure the usefulness and effectiveness of the tool in comparison to the method, and the results showed that the tool has a positive impact on multimedia design [8].

The D.I.M.A. tool, seen in a material form as a multimedia anthology of terminology, includes the following titles:

- An approximate 1000 musical creations (focused on Romanian works and performing activities). The musical example corpus will serve as a base for all levels of education, study and research.
- An anthology of musical terms interactively connected to information about their cultural and historical context and with links towards other websites. This anthology is based on a Romanian reference book comprising specialized works, courses, guide books, dictionaries and lexicons.

The platform takes full advantage of the ICT that will be used as a tool to accomplish various tasks. By accessing the D.I.M.A. platform, the students will be able to search for the list of terms, will have access to various informations, and materials format (text, video, audio, link on the web), they’ll can download teacher assignments for various homeworks, reflect on suggested materials and upload their feedbacks, use the communication facilities and present his/her own questions and answers

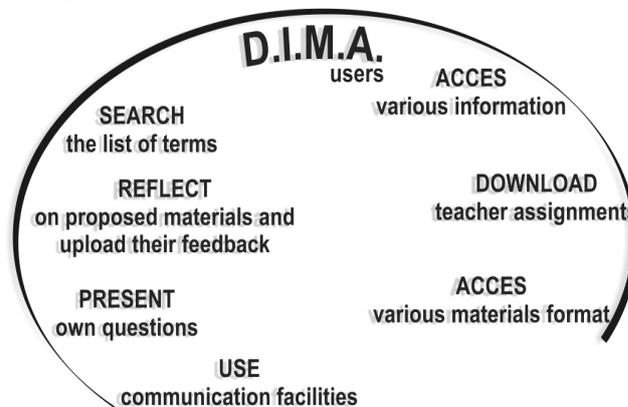


Fig.2 - D.I.M.A. platform

Having been made ready in about a year by a team with no previous experience in developing such products, this platform proves that the multimedia field can be efficiently approached in the music education system as well. Multimedia is no longer a trend or a miscellaneous need for specialists – it has to be regarded as a high technology that has to be assimilated during school.

The on-line world is able to combine professionally various ways of communication: text, audio, photography, video, infographics and our D.I.M.A. product uses the following configurations in order to give value to these means of communication:

- Text – printer-friendly and written in an informative manner. This configuration gathers information from the field of interpretation (instruments, singing), about composers and music styles, musical theories and their applications and includes teaching tutorials for using computing and communication technologies in music. This configuration’s availability to be constantly updated by the making team of this product, but also by musicians and other outside users, has to be reinforced.
- Images – bringing text to life. This rule remains unchanged for both the print media and the online world. The current technology allows the insertion of images in both texts and attractive photo galleries.
- Audio samples – represent a true piece of information. The audio samples and the music notes turned into images add a great value to the tool of exemplifying.
- Video examples for which there are two options: either uploading the original file on the own server, or embedded [...] For the first option the user can download the file from the site and then he/she can view it off-line at any time (this is an advantage for users that have slow Internet connections). The second option offers video-streaming directly from the site and this is an advantage for the workflow, even though the server and the application connection become more overloaded.
- Infographics contain schemed information that offers results „at a glance” and they can be animated or static. In the case of animated infographics there is the possibility of choosing software technologies that ensure the interactivity.

A material source of assistance for the D.I.M.A. users will be provided through the following applications:

- on-line tutorials for IT skills improvement and for an introduction into music notes reading;
- a data base including Romanian publications (music related books and articles).

The approach is the key to the successful completion of any project. D.I.M.A. is split up into individual phases, each phase with its own tasks and deliverables. Each phase provides functionality and reward for the users. Several steps are necessary to be taken so that the solution would develop in the most effective and efficient way and also according to the

main objectives. Here is a brief outline of the steps taken at the beginning of the project.

- Detailed planning of each element on the project plan.
- Defining of the timeliness of the required resources.
- Assignment of responsibility.
- Cost estimate
- Determine ongoing support and maintenance costs.

The implementation of this application is based on the research team, the methodology and the infrastructure.

The research team is made up of 6 musicologists who collect the terms during the most part of their activities, approximately 40 teachers from the distance learning field who will test the resulted materials in educational programs and, finally, a technical support team.

Concerning the hardware aspect, D.I.M.A. is assisted by an IBM server and the software factor is ensured by a MediaWiki version adapted to the needs of a musical data base – audio and video examples, scores, etc. Maintenance is carried out by an experienced firm. The data will be entered either by using the network of the “Gheorghe Dima” Music Academy, or by using any browser connected to the Internet.

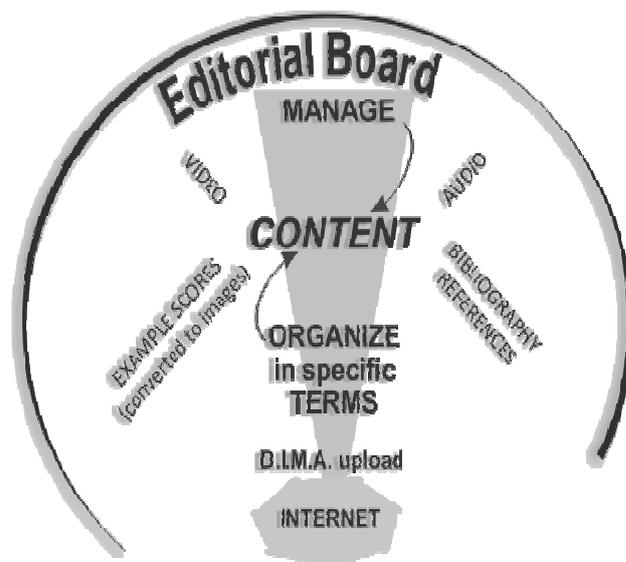


Fig. 3 Information flow on editorial board

In fact, the methodology proposed for creating the database is divided into four stages. Each stage has a number of specialists in musicology that is content responsible and assisted in the technical issues by a specialized team. In the following table is described the term formation stages in multimedia form.

The D.I.M.A. application is sustained by a MediaWiki portal adjusted, as told, to the specific needs of a music media anthology. The main objective is to offer a suitable platform for developing new ways of offering high level information in the music field that should be easy to access and that can be used in learning environments.

One of the D.I.M.A. project’s objectives is to implement this product in the distance learning process system and to

observe, verify and monitor the users' rate and the research impact in coordinating teachers and students, as well.

Table 1. Article building stages

Methods used	Content	Technical means
Conceptualization stage	Suggestion	Evolving choice
	Alternative examination	Evolving adopted option
Evolution stage	Ideas distribution	Choices examination
	Mixed media scheme	Technological fulfillment
	Outset audit	Particularized architecture
Application stage	Activity scheme control	Achievement generation
	Assess contexts	Assess and audit
Finishing stage	Estimate aim achievement	On-line production
	Fulfillment examination	

There are some of the facilities provided by the D.I.M.A. platform that are illustrated below:

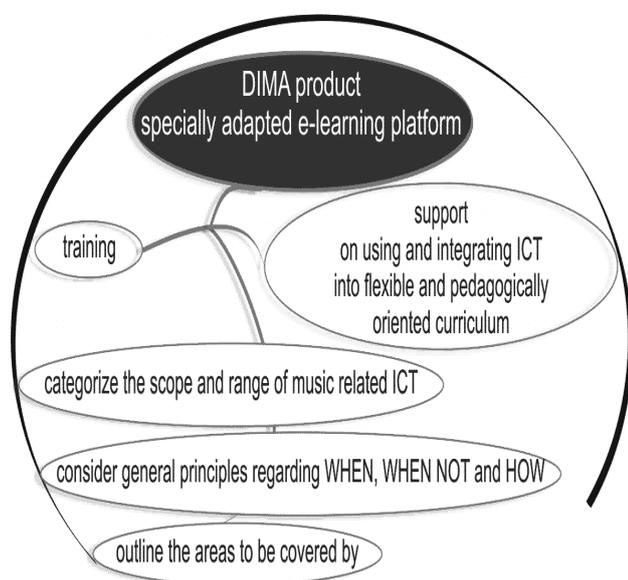


Fig. 4 - Facilities provided by D.I.M.A. platform

IV. STUDENTS FEEDBACK

Informal assessment and evaluation was carried out during website creation. The D.I.M.A. resource was assessed internally by the teaching staff of the Gh. Dima Music Academy. The overall project has an external assessor report, the main end user evaluation was done in february 2011 during

project year three. 60 students who had used the online system have completed a Questionnaire (they had the same one at the beginning at the project (2009) and in the final stage of the analysis we addressed the same questions to an other group of students who had never used the multimedia resources resulted from the project. (about 49 students). From the student satisfaction point of view the results are encouraging with 48 out of 60 respondents considering the web based information good or excellent. 44 out of 60 will prefer the online educational resources, 10 who would still prefer a paper version while 6 having no preference.

The students were involved also in creating educational content, especially music registrations. The implementation required a lot of efforts but offered plenty of advantages such as the acquisition of new repertoires and especially gaining teamwork abilities. The idea of making a responsible content as a factor within work based learning is comparatively simple. The analysis of responsible content forms the basis of many human resource processes including those of recruitment and training.

V. THE ADVANTAGES OF USING MULTIMEDIA EDUCATIONAL RESOURCES IN THE MUSIC EDUCATION SYSTEM

One of the major advantages offered by the multimedia resources is interactivity. High levels of interactivity are made possible by putting together multiple forms with media contents. The online multimedia content becomes more and more focused on objects and databases and this allows the enduser to insert her/his own innovations and personalization. One can find such examples on websites with photo galleries and image labels that are uploaded and modified by users at any time or on websites where the described events, the illustrations, animations and the video files are changeable. This allows the users to experience the multimedia world without having to possess any programming knowledge that could be so challenging and inaccessible for the most of the public.

One of the purposes of our research consists in investigating suitable methods of creating a multimedia resource with different cultural specific features for optimizing the man-machine interaction adapted to the music education. In this respect, a data base with Romanian performing examples, including an approach of the artistic field at the research level (terminological aspects), was created. Moreover, this database also includes an approach of the creation field. After implementing such multimedia resources on a group of our students with different levels of education we created a distinct system of evaluation of the product: the students gained a different point of view regarding the content of the curricula. Previously they thought about it as being too vast, but working on it, including in the on-line approach, they considered the curricula as a compulsory factor for their education (fig.5 and 6)

- The students opinion before and after using D.I.M.A.:

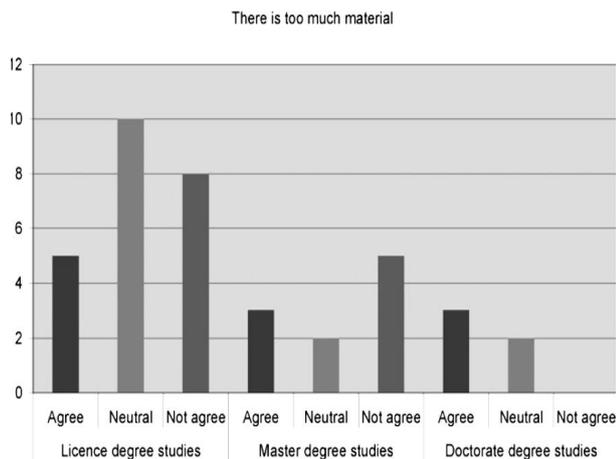


Fig. 5 - before using D.I.M.A.

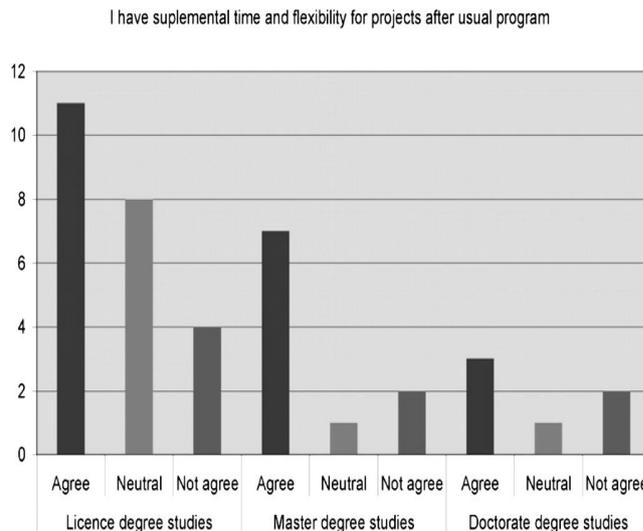


Fig. 8 – after using D.I.M.A

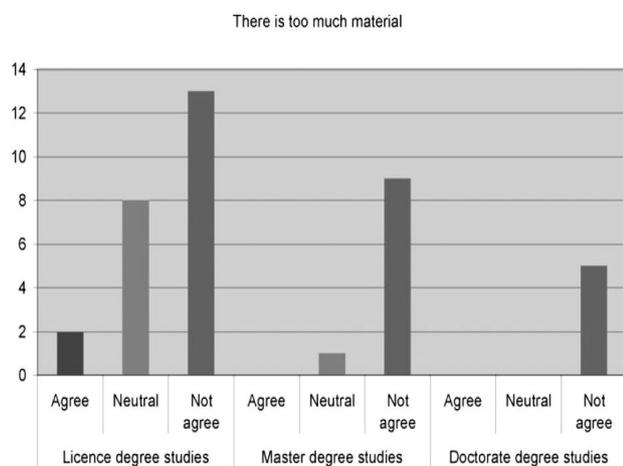


Fig 6 - after using D.I.M.A

The students are more keen on learning at home at their own pace and in using the multimedia resources as an interesting way for practicing their knowledge.

The students' opinion regarding their free choice regarding their learning process (Fig 7 and 8)

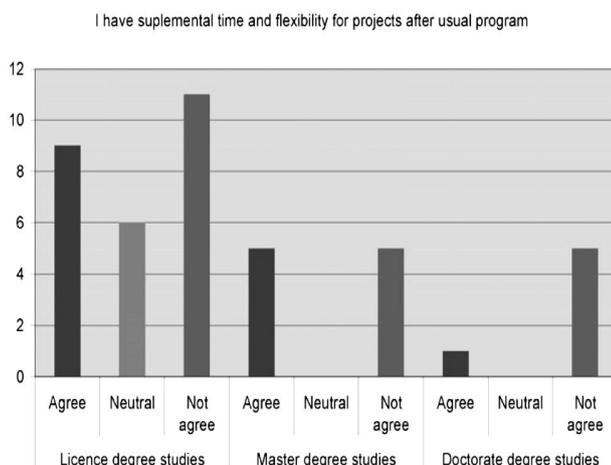


Fig. 7 – before using D.I.M.A.

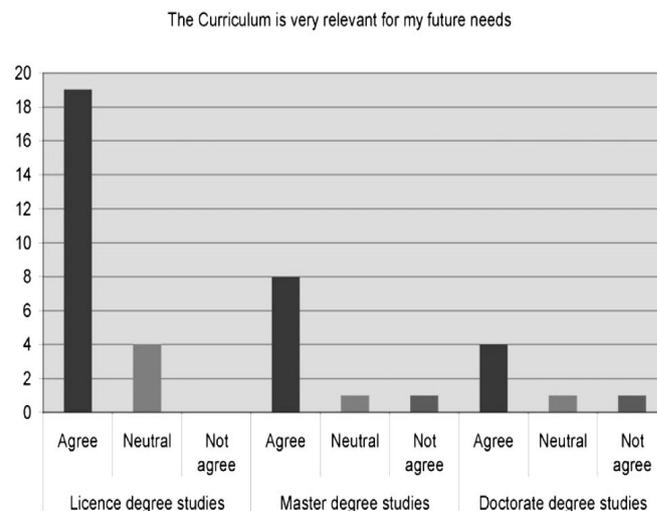


Fig.9. Students' opinion regarding the relationship between the curricula and their needs

In students' opinion, the curriculum must be created in relationship with their needs of developing skills and competences and in this respect the use of a multimedia resource as D.I.M.A can respond to a such request (fig.10 and 11)

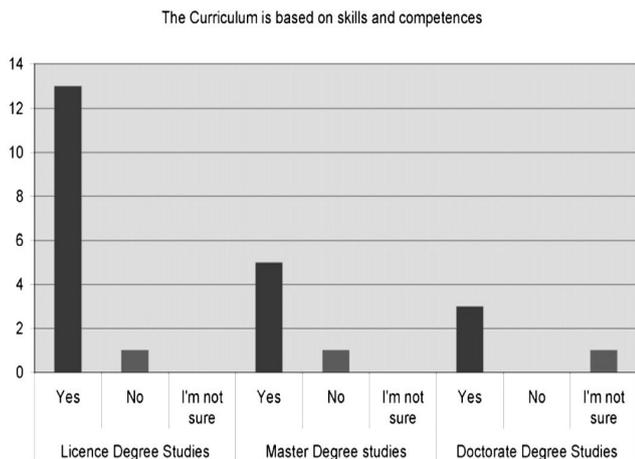


Fig. 10 - before using D.I.M.A

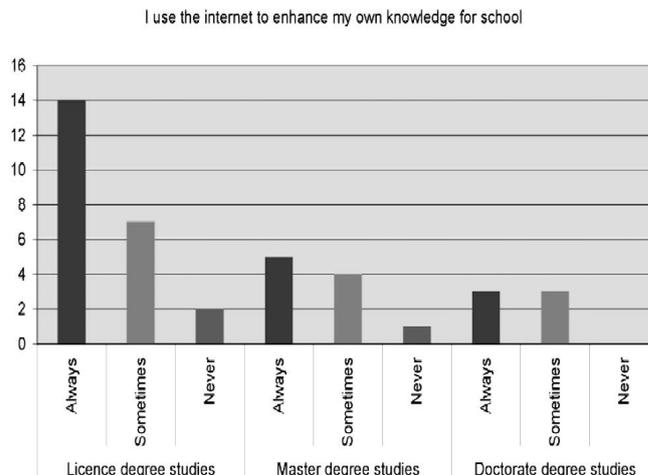


Fig. 13 - after using D.I.M.A

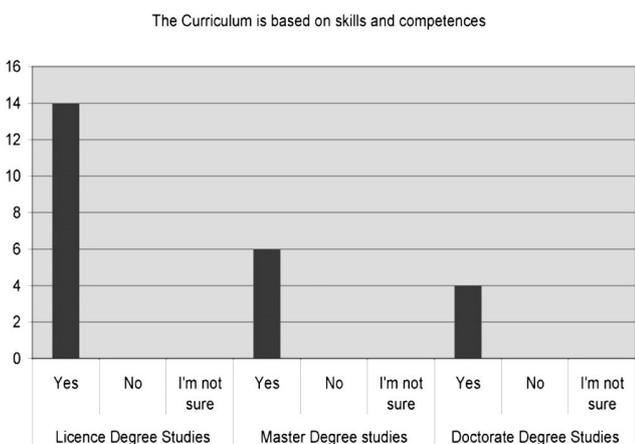


Fig. 11 - after using D.I.M.A

Students have increased the level of the ICT used in their learning process (fig. 12 and 13)

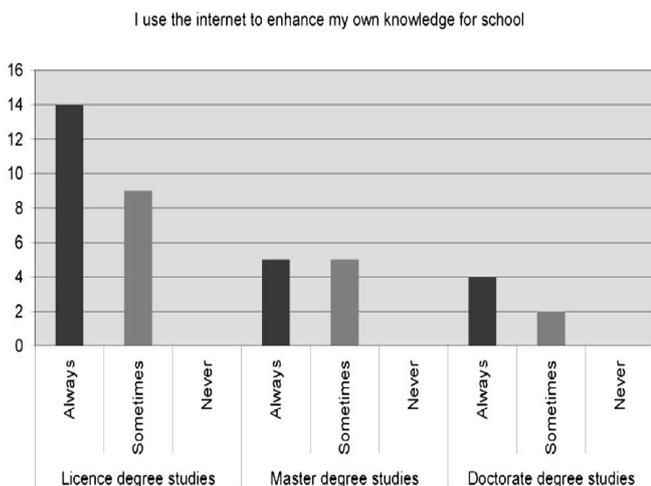


Fig. 12- before using D.I.M.A

Other advantages of on-line learning materials (in a multimedia format):

- smaller global costs in comparison with the traditional teaching practices;
- information is delivered when and where the student requires it, at her/his own pace and in her/his own environment. Many studies have pointed there are at school-level and teacher-level barriers and practical constraints within the workplace [13].
- interactive schemes bring a considerable contribution to develop one's self-teaching abilities, while still staying in a comfortable environment. Contemporary music can be a field of application, different instruments having parameters that can be used with various new sounds effects. [14]
- this teaching method is more flexible and it leaves room for improving the act of studying, having a direct result on the co-operation with persons from external fields of activity that show interest in completing their grounding with the music education which became now more approachable to them.

Studies of collaborative creativity using music technologies [9][11] and polls of students' perspectives on composing with MIDI or using web-enhanced learning established that technology provides an enabling environment in which learners and teachers enter in a co-participative process around activities and explorations, where learners can take back control of their learning [12].

VI. CONCLUSIONS

The traditional music education system that uses traditional, 'old' methods and strategies has become anachronistic and unattractive. The media impact on the individuals that find themselves also in the current education system is so important that, using similar IT teaching methods, could convert them to a new set of aesthetically values.

Focusing the teaching process on using multimedia resources, it will bring a direct advantage for concentrating on

the characteristics of the studied phenomenon, leaving the details aside. This aspect makes room for better understanding, remembering and latter usefull use of the studied subject area. The multimedia resource created in this project can provide the students with thematic music subjects, the content material developed in the antollogy will help music students to acquire a practical knowledge of different domains of music. The system supports many different kinds of activities, which may be used in conventional lectures (selfstudy), exercises or consultations.

After implementing the D.I.M.A. product in the Gh. Dima Music Academy, there has been an increasing interest of the students for using the IT resources. The reason behind was that a multimedia database can make an individualized learning process to become possible. Each student has her/his own learning rhythm and type of memory (audio or visual) during learning. D.I.M.A. can answer these needs by creating assimilating solutions that fit the every student's profile.

Moreover, the specific character of the multimedia resources creates the possibility of presenting a content in various forms; having movies, audio examples, animations and simulations as tools that can instantly bring the student from one medium to another allows him the possibility of making comparisons; the content is learned consciously and the interest is kept awake.

Several studies [13] have identified the way in which such approaches have pointed to time-saving activities when teachers are using on-line technologies and collaborative tools, which include blogs, podcasts and wiki's, used instrumentally in their practice. This approach amplifies and extends pre-existing instructional practices and develops reflective teaching techniques which increase collaboration within and beyond formal school settings [15].

Another advantage of on-line resources is the fact that most of the materials on the Internet are constantly updated and at a convenable price; the available information can be found in a digital format so that the text, images and sound can be used in music classes or in own projects.

ACKNOWLEDGMENT

This work was supported by CNCISIS-UEFISCU, project number PNII-IDEI Code 718/2008 named Exploring the adaptation of on-line learning means to music education

REFERENCES

- [1] Deng, Y.W.Z., Deng, R. (2010) "Soundscape Music: Sub-genre of New-age Music", in *Proc. 11th WSEAS International Conference on Acoustics&Music: Theory& Applications, AMTA'10*, Iasi, Romania, 2010, pp: 13-17.
- [2] Ravina,E., "Vibro-Acoustics of Violons based on a Multi-Physic Approach, in *Proc. of the 11 th WSEAS international Conference on Acoustics&Music: Theory& Applications, AMTA'10*, Iasi, Romania, 2010, pp: 46-50.
- [3] Dragulin, S.,Sangeorzan, L.,Parpalea, M. "Chromatic Patterns of Sounds Waves in Java Applets Coloured Sounds", in *Proc. of the 11 th WSEAS international Conference on Acoustics&Music: Theory& Applications, AMTA'10*, Iasi, Romania, 2010, pp: 92-97.
- [4] Iemma, M., "Six ways to iPod: MP3 tools for your classroom", *Music in Action for Australian Educators*, vol. 4 issue 1, 2006, pp. 26-27.
- [5] Xie, L. Yan, R. Tešić, J. Natsev, A. Smith, G.R., "Probabilistic visual concept trees", in *Proc. International conference on Multimedia, ACM* New York, 2010, pp: 867-870.
- [6] György Kovács, János István Iván, Árpád Pányik, Attila Fazekas (2010) "The open source image processing library", in *Proc. International conference on Multimedia, ACM*, 2010, New York, pp:1489-1492.
- [7] Webster, P. and Hickey, M., "Computers and technology", in, *The Child as Musician: A Handbook of Musical Development*, G. McPherson, Ed, Oxford University Press, pp. 375-96, 2006, Oxford.
- [8] Alistair G. Sutcliffe, Sri Kurniawan, Jae-Eun Shin, "A method and advisor tool for multimedia user interface design", *International Journal of Human-Computer Studies*, Vol. 64, Issue 4, 2006, pp. 375-392.
- [9] Dillon, T., "Exploring Young People's Collaborative and Creative Processes Using Keyboard and Computer Based Music Technologies in Formal and Non-Formal Settings", Unpublished PhD Dissertation, 2006, The Open University, Milton Keynes
- [10] Webster, P. , "Computer-based technology and music teaching and learning: 2000-2005", *International Handbook of Research in Arts Education*, L. Bresler, 2006, Dordrecht: Springer, pp. 1311-1328,
- [11] Dillon, T., "Collaborating and creating using music technologies", *International Journal of Educational Research*, vol.39, issue 8, 2003, pp. 893-897.
- [12] Challis, M., "The DJ Factor: teaching performance and composition from back to front", *Music Education with Digital Technology*, J. Finney and P. Burnard (eds), pp. 112-124, 2007, London: Continuum.
- [13] Nordkvelle, Y.T. and Olson, J.K., "Visions for ICT, ethics and the practice of teachers" *Education and Information Technologies*, vol. 10, issue 1-2, 2005, Ed. Springer, pp. 21-32.
- [14] Goldbach, F.C., "The Clarinet of the 20th century in March for Solo Clarinet Adaptation after Martian Negra", in *Proc. 11th WSEAS International Conference on Acoustics&Music: Theory& Applications, AMTA'10*, Iasi, Romania, 2010, pp: 61-66.
- [15] Savage, J., "Pedagogical strategies for change", *Music Education with Digital Technology*, J. Finney. and P. Burnard (eds), 2007, pp. 248-258, Ed. The Continuum International Publishing Group