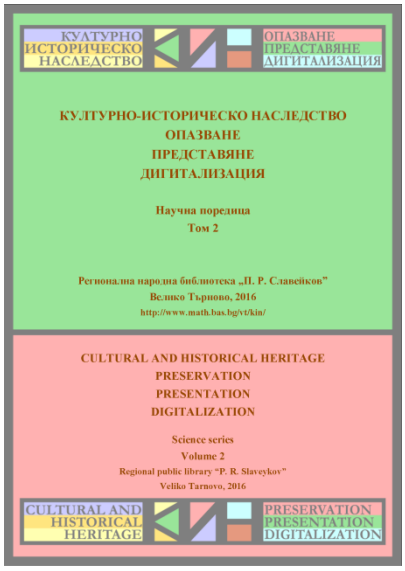

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TECHNOLOGY-ENHANCED TEACHING OF EXACT SCIENCE THROUGH ART

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Abstract: *The paper[1] presents an approach of teaching of exact science using arts and technological tools. It is foreseeing the implementation of numerous activities for achieving the main aim - to improve math literacy of young people by providing contemporary ICT-based approach for better understanding of math through arts.*

Keywords: *Teaching-learning processes, technology-enhanced teaching, mathematics, art*
2000 Mathematics Subject Classification: *97U50, 68T05, 97C70*

Резюме: *Статията представя подход на преподаване на точни науки с помощта на изкуство и технологични средства. Предени са множество дейности за постигане на основната цел - да се подобри математическата грамотност на младите хора чрез осигуряване на съвременен подход, основащ се на ИКТ-базиран подход за подобряване на разбирането за математиката чрез изкуства.*

Ключови думи: *Процес на преподаване-обучение, технологично-разширено обучение, математика, изкуство*

Introduction

Understanding science is crucial for personal development and to help individuals to adjust to life in modern society. It is important, that future citizen understands the interrelationships between science, technology and other facets of society, including social and economical development. The described here educational strategy foresees to implement

[1] Partly funded by program BG08 “Cultural heritage and contemporary arts”, project “Digital cultural heritage “North+”: documentation, preservation and public access to cultural heritage in libraries, museums, archives and galleries in North and Central Bulgaria”

numerous activities for achieving the main aim - to improve math literacy of young people by providing broad and open-ended approach to math trough arts specialisms. The approach aims:

- To integrate arts and math science and communicate it as a technique for teaching less math science proficient students.
- To improve math teaching methodology by creating an approach that would free teachers and students to develop a wide variety of innovative responses to the call for and increased understanding of math science.

Main tasks are to create specific instructional strategies for teaching and learning math by comprising integrative elements as math and arts and to develop a virtual 3D laboratory Math Art Cafe for math-art collaborative projects.

There are recent researches about role of arts in promoting of innovation in science [1, 2, 3, 4], and about chances to identify "exceptional talent" in children, which shall enable their success in research and innovation field in future. Amongst such exceptional talent are mathematic ability, imaginability and music talent. Laboratory developed in this research aims to provide virtual space for discovering and enhancing such talents amongst young people. Similar solutions in cultural heritage field are offered by [6, 7].

Description of the approach

The approach is based on integrating of art of science learning in 3D virtual platform "Math Art Cafe", which will be used as a main communication tool for learning, practicing and sharing of experience.

The platform "Math Art Cafe" will cover the following virtual components:

- Meeting point – place where participants will be able to meet each other, to exchange contact information, and to form groups of interests;
- Agora – place where participants will be able to exchange ideas and opinions concerning the thematic areas of common interest;
- Application Pool – here all registered participants will be able to publish documents, applications and/or links for downloading applications, which they consider interesting, useful, and cheerful. In this area will be assured a possibility all published materials to be voted, commented and evaluated by the platform users;
- 3D Lab Gates – this area will provide entrances to the 3D virtual laboratory. In these immersive 3D spaces participants acting via their avatars will be able:
    - To create using their Mathematics and Sciences knowledge and skills different art performances;
    - To present their works of art to the other 3D world inhabitancies – exhibitions, theatre, concerts, and other stage performances;
    - To receive feedback from the audience by means of textual instant messages (group messages or private ones), voice communications, and non-verbal communications (applauses, avatars' mimics and gestures, etc.).
- Mobile application for tablets and smartphones working under iOS, Android and Windows - this application will allow participants to track the news and

information about events even when these people are not logged in the platform or the 3D virtual environment.

Target groups:

- young people at school age.
- teachers.
- artists and scientists, both those currently being involved in arts and science integration activities and intending to. (We will enhance young artists understanding and appreciation of math by encouraging them to get involved in science projects and to develop an appreciation for science as a cultural force.)
- other facilitators: those responsible for administrating and facilitating science literacy such as education planers, public authorities, e.g. education and science ministries, etc.

The target community will have an interest in arts&science representation in the 3D platform. It includes those who are interested in science and want to promote their scientific work and those facilitating such projects. For that reason, they have vested interest in the experience of scientists, artists and teachers leading innovative learning projects and the quality of those projects. Learning-by-authoring and doing are base learning methods in this research.

The enduring relationship between arts and math science is showcased through following examples: mathematics delivered through music, movies, textile arts, etc. showing, that arts provide innovations through analogies, models, skills, structures, techniques, methods, and knowledge.

Some evidences of maths in art and show business are listed:

- math in popular movies (imaginary travel through the collections of video clips, where math issues are involved);
- math and music (game, where are learning math concepts like patterns, shapes and comparative sizes through guided play as performers);
- math and textile arts (collection of puzzles).

Implementation

The “Math Art Café” platform is in a stage of design (incl. identification of main menu points, topics, and information sectors) and technological development. Clear software architecture is specified. The Math Art Cafe platform, including smartphone, etc., applications will be managed as an open source platform, which means, that all reference and training/workshop material will be available to its users for free. No commercial exploitation is foreseen. This approach is consistent with open innovation idea, where focus will be set to mobilisation of knowledge using formal intellectual property protection and informal barriers of knowledge (knowhow and regulatory data) where appropriate.

The research work also includes:

- an analysis of existing best practices in arts and science integration and its incorporation in educational product to be made (possible products, structures, needs);
- identification of local school conditions for implementing "Math Art Café" platform to be acknowledged;
- activities to identify data sources and copyright issues.

Conclusions

The new strategies for teaching and learning to the investigation and the deployment of workable learning methods for better understanding and creative thinking, engaging learners in more active participation during the perceiving of knowledge [5]. But the integration in any area, be it with the arts, seems to be the buzzword to curriculum designers everywhere. Integration requires collaboration, research, intentional alignment and practical application on behalf of the teachers who take on this challenge. This paper presented a technology-enhanced solution (viz. virtual 3D arts&math laboratory), that could provide a capstone experience in which students synthesize exact math and arts principles. Further efforts will be set to choose and describe teaching experiences that have a particular value for the development of an appreciation of science as an intellectual achievement, as a procedure for exploration and discovery, and which illustrate the spirit of scientific discovery, but its also very important to bond science and arts.

References

1. **Lamb E.:** Bridging the Gap Between Math and Art, Scientific American, August 2012, Available at: http://www.scientificamerican.com/article/bridging-the-gap/
2. International Journal of Mathematics and the Arts.
3. Teaching Math with Art Helps Children Remember Key Concepts, Teaching support force, Available at: http://www.teacher-support-force.com/teaching-math-with-art.html
4. **Schwartz K.:** How Integrating Arts into Other Subjects Makes Learning Come Alive, KQED, 2015, Available at: http://ww2.kqed.org/mindshift/2015/01/13/how-integrating-arts-into-other-subjects-makes-learning-come-alive/
5. **Paneva-Marinova D.:** Understanding Algorithms by Designing Them in a New Way, Forty Second Spring Conference of the Union of Bulgarian Mathematicians, Bulgaria, April, 2013, pp. 356-360.
6. **Bogdanova G., Todorov T., Noev N.:** Digitization and 3D Scanning of Historical Artifacts. In: Proceedings of the International conference on Digital Preservation and Presentation of Cultural and Scientific Heritage - DiPP'13, Veliko Tarnovo, 2013, ISSN: 1314-4006, pp. 133 – 138
7. **Noev, N.:** Approaches and Methodologies of Creating, Storing, Presentation and Protection of Digital Resources in the Field of Cultural and Historical Heritage via Technologies Based on Knowledge. In: Luchev, D. (ed.). DIPP International UNESCO Conference, Veliko Tarnovo, Bulgaria, September 28-30, 2015. Innovation and Culture – Regional Problems and Solutions. Workshop Proceedings. IMI-BAS, Special Edition, 5, 5, 2015, ISSN: 1314-4006, pp. 19 - 28

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КУЛТУРНО-ИСТОРИЧЕСКО НАСЛЕДСТВО: ОПАЗВАНЕ, ПРЕДСТАВЯНЕ, ДИГИТАЛИЗАЦИЯ

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