Participative Teaching with Mobile Devices and Social Networks for K-12 Children

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Abstract

This article details a set of participatory pedagogical experiments conducted within a research grant PN II IDEI (”Time Maps. Real communities, virtual worlds, experimented pasts”) performed with the purpose of helping rural communities in identifying their cultural heritage and transmitting it to the younger generations by means of modern IT technologies, including web 2.0. In a Danubian rural community, several points of archaeological interest (POIs) were identified, which were then included in a geographic Augmented Reality application for smartphones and tablets. Subsequently, the geographic data were collected from the archaeological site by the K-12 children, under the coordination of an academic staff member of the National University of Arts in Bucharest, and stored on their devices using Google Maps. The augmented information provided on the site was annotated and shared with other K-12 children, through different social networks sites (SNS) and content postings. This first stage experiment was extended to the development of a social learning environment complementary to the educational site (www.timemaps.net) to support the transmission of several traditional technologies (textile, ceramic, glass) in a collaborative manner. We consider that our experiments can significantly increase the visibility of the information pertaining to the identity of target places and communities among the younger generation. A mobile-learning paradigm, in combination with web 2.0 technologies, was the support for a distributed and low-cost platform for communication and collaboration. Social networks linked the archaeological heritage and the academic research with the larger community of rural K-12 children. The article analyzes this platform as a solution for creating, collecting and sharing educational content, and presents conclusions on using social media for effective blended learning and transmittal of the cultural heritage.

Keywords: immaterial heritage, blended-learning, social learning, augmented reality, social media, Google+, microblogging, user-created content, learning community.

1. Introduction

Social media is a concept associated with information and inter-personal communication in virtual communities. Azuma (1997) asserts that “a person is in a more advantageous position to gain and control novel information if s/he is connected to others who themselves are not directly connected to one another”.

Social media is an umbrella term embracing several technologies that implement the web 2.0 concepts, as first defined by O’Reilly (2005) in 2004 during the first Web 2.0 Conference: content creation, aggregation, tagging, retrieval, or distribution with the purpose of fulfilling social functions and activities, such as the promotion of ideas or news, sharing content, perform user’s or communities’ promotion, socialization, collaboration, communication, networking, blogging or annotation (Zeiler & Schauer, 2011). This results in distributed informational clusters or “ecosystems” (Brown et al., 2011) organized in categories or topics. In Levin (2013) a definition of social media is given as a “new way of forming social consciousness” and “online identities”.

According to Nentwich & Konig (2012), social media represents “a group of internet-based applications that built on the ideological and technological foundation of the web 2.0. allows the creation and exchange of user generated content”.

Web 2.0 tools comprise media sharing (e.g.Youtube, Trilulilu, Flickr, Pinterest, Slideshare, Panoramio, Scribd or Google Drive as a cloud service), social-networking (e.g. Facebook, MySpace, LinkedIn), blogging (e.g. Wordpress, Blogger, Google+) and micro-blogging (e.g. Twitter, identi.ca, cirip.ro), mini-blogging (Tumblr), wikis (e.g. wikipedia, wikispaces), social bookmarking (del.icio.us), syndication (RSS feeds, digg), service mash-ups, and also virtual worlds as social platforms (e.g. Second Life, Active Worlds) [21]).

Used in e-learning settings, social media can play an important role by facilitating the creation and distribution of information, and the creation of communities where both teachers and students are stimulated to assume participative roles.

In a knowledge-based society social media is most important for facilitating the decentralization of the access and control of the information "on a massive scale" [20]. In this context, social media led to Learning 2.0, a new concept of social learning, in which the student is offered not only the access to an archive of information in order to be self-paced studied, but also to a dynamic environment in which the knowledge is constructed through socialization, participation and as needed (Brown *et. al*., 2011).

As a technology supporting and enhancing teaching and learning, social media can make the educational process continue beyond the actual presentation of a lesson and beyond an educational system, on a life-long perspective.

According to Bassani (2013), the social media technologies, particularly the micro-blogging, are seen as a way of constructing "Virtual Learning Communities (VLC)", adding and enhancing the social aspect of the learning process.

In this paper we propose and present an experimental learning system for K12 children which uses mobile technologies, Augmented Reality and social media, focused on teacher-learner and learner-learner communication and cooperation, and on research, experimentation and play-like learning, all creatively combined. With the support of social media services and other web 2.0 technologies, the proposed learning community can be extended to larger groups of children and schools.

This article will present and discuss a part of the experiments carried out in Vădastra village, a Danube rural community in Southern Romania, Olt county, with the local school teachers and children (aged 10-14 years), specifically those involving the use of social media at different stages of the project implementation - educational content creation, processing and sharing. The experiments consisted in using social media from desktop stations and from mobile devices, and also from a Mobile Augmented Reality application (MAR), with the purpose of implementing a *distributed learning platform* for a community situated in a remote and relatively isolated Romanian village. From the existing social media services, Google Maps, Panoramio, Google+, Twitter, YouTube and Google Drive were chosen and also mixed with mobile technologies to create a solution able to bridge and mitigate the obstacles of digital divide and poverty, and also to stimulate children's creativity and interactivity in a social learning environment.

The present article is part of the educational strategy subset of a larger exploratory research project Time Maps, funded by a PN II Idei grant[1], which intends to reconstruct the memory of forgotten places and share it with the local communities, thus helping them to preserve and safeguard their material and immaterial heritage and on the other hand sustaining the education of those communities. The paper is organized as follows: in section 2 the Time Maps project rationale and its larger educational objectives are presented; in section 3 a literature survey on using social media for setting learning environments is summarized; section 4 contains an overview on important research work addressing issues related with our project; section 5 gives details on the development stages of the Time Maps social learning environment, starting with a theoretical background of the employed education technologies; in section 6 are presented the pedagogical methods of our learning environment which uses social media for complementary educational information; section 7 gives details on the experimentation of the learning environment, followed in

[1] "The Time Maps. Real communities, Virtual worlds, Experimented Pasts", Director Professor Dragoş Gheorghiu.

section 8 by a description of results evaluation and discussion based both on surveys and statistical data on the usage of different social media, and in section 9 by conclusions on Time Maps e-learning solutions based on social media, Augmented Reality and mobile learning as modern and effective educational tools complementary to the traditional methods.

2. Project Rationale

The following imperative arguments of contemporary society justify the project: the necessity to relate art and science to create new instruments for visual epistemic exploration in the humanities and science; the necessity to apply and develop hybrid concepts between real and virtual; the necessity to work in real and virtual networks at the urban and rural levels; the necessity to preserve the cultural memory and to bring the Past within the Present; the necessity to reveal culturally invisible places; the necessity to help poor communities who can benefit from it, to build a new identity through the exploitation of the local Past.

In addition, this project demonstrates how art can act as a social link between urban (academic) and rural communities. Particularly, the article is concerned with new methods of learning in the 21st century in rural Romania and is based on a case study conducted in Vădastra village in southern Oltenia, for which we experimented mobile technologies and social media. The distributed learning space was constructed in social media networks in order to allow the children to play an active role and foster dynamic, interactive relationships between them and their teachers (Brown *et al.*, 2011; Chaloupka *et al.* 1998). Social media also allowed the teachers to more easily follow the progress of the learners.

From a technical point of view, we considered that the technologies and services of web 2.0, were appropriate for the design and implementation of a distributed network for sharing multimedia educational content, and mostly to support an informal learning model based on an active community involving K-12 children, school teachers and university professors, technicians and artists. This network can be accessed from anywhere and at any time, both from fixed and mobile terminals, provided that an Internet connection is available.

From an economic perspective, we used social media to create a cost-effective learning solution for a community that has scarce financial and technical resources and only a basic communication infrastructure. Free web services which do not require a permanent Internet connection were employed. We considered this strategy to be a practical and realistic means of linking the academic system with a remote K-12 educational system. Beyond the short-term objective of enhancing learning our system has also a long-term objective to identify skilled children able either to further transmit the immaterial heritage as craftsmen or to follow a higher artistic education.

3. Social Media Supporting Learning Environments

Applied in education, social media can add or enhance the social components of different e-learning environments with the clear objective to improve the teaching performance and the learning outcomes. Social media can support different learning purposes by "implementing new ways of learning, fostering collaboration, increase motivation and learning results, accessibility, personalization, management of learning" (Popescu, 2013).

A social learning environment has the advantage of offering to learners "a less stressing environment" (Popescu, 2013), or an environment more suitable for those having communication problems (e.g. more introverted). Holland (2013) presents specific challenges for introducing social media in higher education which also pertains to K-12 education, when the re-design of the pedagogical content is considered.

The learning affordances associated with different social media tools in terms of functionality, cognitive dimension and specific activities are presented in detail by Hew & Cheung (2013).

As a learning tool, social media can be considered a form of blended learning which supports the existing theories of learning (e.g. social or constructivist learning, see Siemens, 2005) but also lead to new e-learning paradigms (e.g. personal or learner-centered learning environment) or pedagogical models (e.g. the flipped classroom, see Holland, 2013).

Such new e-learning paradigms developed in relation to the web 2.0 affordances are: "social constructivism" (Vygotsky, 1978), "learning communities" (Wenger et al., 2002; Brown *et. al*., 2011), "trusted social spaces" (Kester *et al.*, 2007), "community as a whole" (Koper *et al.,* 2004), "communities of inquiry" (Garisson & Anderson, 2003) or "socially mediated knowledge" (Alevizou *et al.,* 2012).

4. Related Work

Our research continues and creatively develops the current practices and state-of-the art in using social media technologies in education.

According to Popescu (2013), citing Inagaki *et. al.* (2012), 16.1% of projects concern the K12 education, while 63% concern the tertiary education; 14.7% concern technology, and 8.8% art education. Also Popescu (2013) cites Redecker *et al.* (2009), pointing out that 15% of experiments "address more than one learning in parallel", and that web 2.0 "has the potential to overcome the division between formal and informal learning". Vocational courses are also driven by social media environments.

Several research projects started by investigating students' opinion on the use of social media in the educational system (Holotescu & Grosseck, 2012). A very interesting study was done by Fitzgerald *et al.* (2009), in which students were asked to categorize the social media activities in a) browsing, b) participation, and c) contribution.

Some projects using social media in higher education rely on students' access to the internet and on the availability of desktop PCs and mobile devices (Kennedy *et al*., 2009), while in other projects, professional social media-based platforms are implemented (Popescu, 2013, Moga, 2013).

Experiments related to our research on combining Augmented Reality (AR) and social networks for learning and teaching purposes are presented in Belimpasakis (2009), Bell (2009), Liu *et al*. (2008), Rusu *et al.* (2013); Holotescu *et al.* (2013), and experiments with media sharing services and 3D virtual reconstructions for vocational education and preservation of local technological tradition are described in Rusu *et al.* (2013).

In Holotescu *et al.* (2013) the research is focused on using "mobile micro-technologies as a new strand of integration within educational practices" and proposes cirip.ro as a Romanian micro-blogging platform to be employed on mobile AR applications for educational purposes.

Related to our experiments with Twitter for the community of teachers there are those of Junco *et al.* (2010) and of Ziden *et al.* (2013) where Twitter is integrated in the high-education systems for academic discussions, tasks, assignments and for the enhancement of students' engagement.

As a conclusion of our literature survey we can state that most of the experiments were designed to use different social media as professional educational tools, and for this purpose the students were given a previous hands-on lesson.

In our project we explored social media for K-12 children and school teachers to develop a learning community, as a tool complementary to other traditional face-to-face and e-learning methods, e.g. workshops, the Time Maps educational site (http://www.timemaps.net), video-conferences.

5. The Development of the Social Learning Environment

5.1. Methods and Technologies

The practical method proposed to implement the project's objectives was the creation of archaeological information layers, allowing a vertical immersion of the user in the past layers of times. The archaeological and pedagogical experiments took place in Vădastra, where two main layers of past dwelling were identified, that define the site identity - a prehistoric one, according to Mateescu (1959, 1975) and a Roman one, quite visible as surface finds, but not yet archaeologically investigated. These two layers were geographically marked and further used in the educational process in a mobile Augmented Reality application for smartphones and tablet PCs (Gheorghiu & Stefan, 2012) (Figure 3).

With Augmented Reality (AR) IT technology it is possible to overlap computer-generated ("virtual") information over real life objects or scenes. The result is what it is called an "augmented" reality, which offers an enhanced perception, an improved understanding and a new user experience. The technical definition of the Augmented Reality is given by Azuma (1997): "*an environment that includes both virtual reality and real-world elements*". The information generated by the computer according to the technical AR definition (Azuma, 1997) consists of 3D images, thus acting on the visual perception, the sense with the most important cognitive impact.

Mobile Augmented Reality (MAR) allows the visualization of location-sensitive information using modern mobile devices equipped with video camera, GPS receivers, and orientation sensors, i.e. compass and accelerometer. The MAR paradigm has the technical advantage of being based on readily available portable equipment, thus a gateway to the broader mass of users, and not only to the academic research circles. This is why MAR has become, especially in the latest years, a driving technology for the mobile learning paradigm. MAR supports the contextualization of the learning process and a situation in "true learning contexts" (Dede, 2009; Geddes, 2004). At present, the AR technology encompasses a broader range of augmented content, such as 2D images, texts, audio, video files.

Educause (http://www.educause.com) states that Augmented Reality is important for educational implementations because it is an innovative technology for the search, visualization and manipulation of information.

Micro-blogging services (e.g. Twitter) are powerful social media platforms for publishing and sharing short messages and also for networking and following other users on specific or related interest topics. In educational projects Twitter can stimulate a synthetic communication, because it imposes a limited number of characters for message postings. Recently, the service has been extended with the facility to attach 6 second-short movies, furthermore stimulating the ability to express essential ideas. Another important feature of the Twitter is that it uses t.co (http://t.co/), an URL shortening service, with the declared purpose of protecting users from malicious sites and offering the possibility to track the clicks on the links inside the tweets (http://www.pearanalytics.com. Twitter-Study. (2009)) and providing a useful statistics.

In our research we explored the Augmented Reality as a technology operating with similar concepts and media:

Geotagging and geolocation. A geotag is: "a GPS coordinate that associates content such as videos, textual information, audio or any user-generated content to a specific location" (JISC Observatory, 2011). AR applications can use geotagged content offered by third party providers or user-created content, collected by means of geo-referenced services like Google Maps or Panoramio, or provided by geo content aggregators (geoRSS). The augmented media is triggered by a pre-defined geographic location or device orientation. This category of AR applications are named geo-AR or Augmented Reality Browsers, because they are context-aware. Geo-tagged information is used as a collection of POIs (Points of Interest). A larger set of POIs can be aggregated using KML, the Google Maps' file format.

Video files. These are similar to podcasts, very familiar in web 2.0 environments.

The development of AR applications makes use of processes similar to those found in social media technologies, such as:

Authoring - the process of creating a link between the real world objects and the virtual (digital augmentation) and defining a behavior (not initiated by a user's action) of this virtual object (JISC Observatory, 2011). The content creator can specify a reference to a POI but also to an image or fiducial marker to which the digital object is related. The result can take the form of markup, which provides a structured format for describing the POIs and the augmented information. Markup languages for AR are ARML (http://openarml.org/wikitude4.html http://openarml.org/wikitude4.html), KARML (https://research.cc.gatech.edu/polaris/content/karml-reference) or standard XML.

The provenance of the content - the process of content source specification before being used in an authoring/publishing process (JISC Observatory, 2011).

Publishing - the process that allows the discovery of the augmentations. Metadata are used in the data transfer between the servers (JISC Observatory, 2011).

Regarding the existing commercial AR platforms, two important features may differentiate them: a) *crowd sourcing*, which allows content creation by regular users using facilities available in the browser itself, and b) integration with *social media*, i.e. social networks sites (SNS) or other environments for content sharing. Users can comment and invite others to share their AR experience, by posting short text messages, images or movies, i.e. contributing by means of microblogging. If users contribute with content, this can be visualized by future users of the AR application.

Different e-learning solutions combined with social media tools represent an original approach developed within our project and will be described in the following sections.

5.2. Development of the Social Learning Tools

The learning experiment in Vădastra village began by geo-referencing some points of interest in the archaeological area (Gheorghiu & Stefan, 2013a; 2013b), which were identified from the archaeological published materials and from information provided by the villagers, as well as resulting from fieldwork conducted for over a decade (i.e. archaeological experimentation) in this village (Gheorghiu, 2001; 2008). The geographic data (POIs) was collected on the archaeological site by the K-12 children under the coordination of a project team member from the National University of Arts Bucharest (NUA).

Social media techniques were used in all the stages of the experiment, as recommended by Nentwiwich & Konig (2012): a) the content production; b) the content processing; and c) the content distribution, publication and sharing.

A POI collection was established using the application "GPS Test" from the Android Play Store and loaded on Google Maps, the Android version. The geographic coordinates were corrected, filtered and used in the authoring process of a geo-AR application for smartphones and tablets, and also in Panoramio, Google Maps and Google+, for sharing multimedia artistic and educational content (photos and videos).

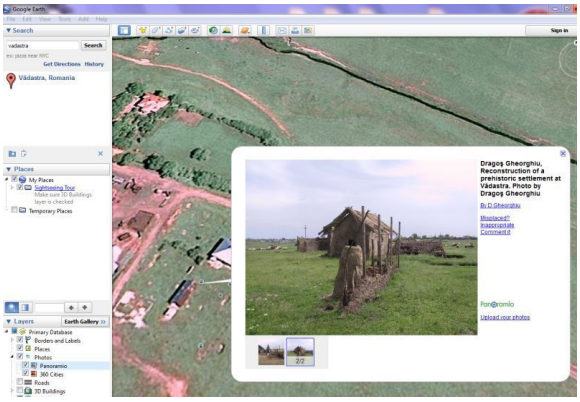

Figure 1. An experiment of building a prehistoric house, carried out by Professor Dragoş Gheorghiu in Vădastra. Posted on Panoramio at: http://www.panoramio.com/photo/46824541

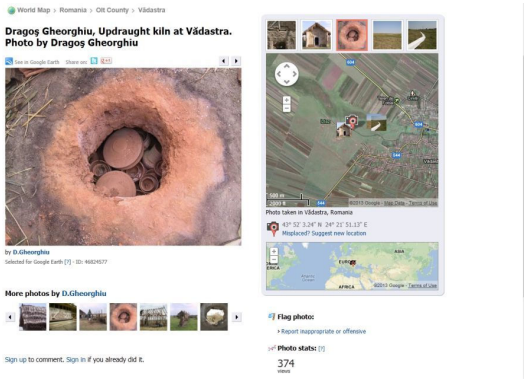

Figure 2. An experiment with sunken up-draught kilns, carried out by Professor Dragoş Gheorghiu in Vădastra, posted in Panoramio at: http://www.panoramio.com/photo/46824577

The second stage was represented by the physical reconstruction at real scale of a prehistoric house and of a corner of a Roman *villa rustica*, designed and coordinated by Professor Dragoş Gheorghiu. In these physical reconstructions video recordings and photo shoots were produced by specialist members of the project team, in order to be used later as augmentations in the AR application and for distribution by means of SNS.

The third stage was represented by the 3D virtual reconstruction process of the historical contexts, in our case a prehistoric village and a complete Roman *villa rustica*, with the help of students from the Design Department, NUA, coordinated by Professor Arch. Andreea Hasnaş.

The AR application was created and tested on two commercial AR platforms, Layar and Junaio, and recently moved on the Aurasma platform (https://www.aurasma.com/). The POIs were augmented with the 3D virtual reconstructions, and also with 2D images and videos representing 3D virtual tours and technological processes (Figures 3, 4, 5). The AR application was connected to teachers' emails and to Twitter, Facebook and Google+ project's pages.

Figure 3. Augmented Reality with archaeological stratigraphy (a prehistoric house and a Roman villa reconstructed in 3D)

Figure 4. Augmented Reality with video movie and social media (a vertical loom in front of two reconstructed kilns and a wall of a Roman villa rustica)

Figure 5. Fiber artist Alexandra Rusu (NUA) working at a Roman vertical loom (video movie)

The fourth stage was the use of social media to build a social learning network based on content and experience sharing and creation. The following web 2.0 services were used as a distributed platform able to support our experimental learning system: a) Panoramio (http://www.panoramio.com/user/7606828) (Figure 6) as a geo-referenced photo-sharing service over Google Maps and Google Earth for sharing project's essential results; b) Twitter (https://twitter.com/maps_of_time) (Figure 7), as a social network and micro-blogging service for short announcements and comments; c) Google+ (https://plus.google.com/114705936110835992130?hl=en#114705936110835992130/posts?hl=en) (Figure 8), as a platform for sharing and tagging multiple content (photo, video), blogging and

video chatting service with the recent Google Hangout, for sharing educational content; d) Google Drive (Levin, 2013) for cloud storage and collaborative document editing. We also created a YouTube channel for public distribution of video content (https://www.youtube.com/TimemapsNet), (Rusu *et al.,* 2013) and a Facebook page of Vădastra School (https://www.facebook.com/scoalaVădastra).

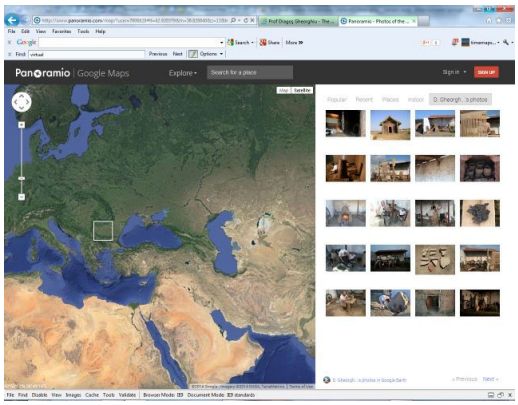

Figure 6. Virtual Space on Panoramio+ with the experiments carried in Vădastra village

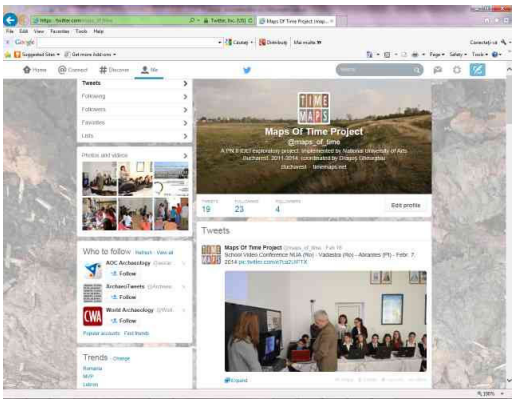

Figure 7. The projects's Twitter page for educational and research micro-blogging

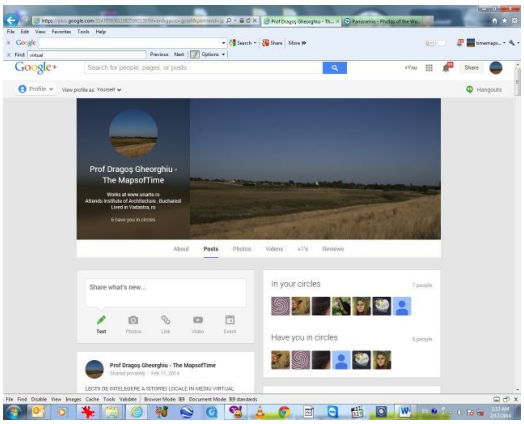

Figure 8. Virtual social space on Google+

For micro-blogging we hashtagged the main topic as #maps_of_time and created keywords related to three ancient technologies specific for the studied contexts (textiles, glass, ceramics) to facilitate a categorization of the topics and their retrieval.

To achieve a unified and coherent platform, the personal spaces of the social networks were customized with logos and landing pages, designed by Associate Professor Marina Theodorescu (NUA).

6. The Pedagogical Methods Based on the Complementarity of Social Media Educational Information

As it can be observed starting with our early experiments, the educational information can be transmitted using a mixed usage of different social media, and also between these and the educational Time Maps web site (http://www.timemaps.net).

In the second stage of the experiments, we proceeded to a more advanced and original use of social media services, i.e. the combination of Google+, for building a learning and teaching community between Vădastra and NUA, with Twitter, for building a community of teachers and researchers, members of the Time Maps project and followers of our tweets on related interest topics (heritage and education).

Consequently the information from the website could be studied by children in a more coherent manner, by also using the Google+ project's page on which images and films, along with teachers' instructions and questionnaires were posted.

The Google suite (Google+) has one login for all its services and offers a social platform with several functions: content share and tagging; social networking and blogging; or video-conference.

To build the learning and teaching community we developed on Google+ project's page (https://plus.google.com/114705936110835992130?hl=en#114705936110835992130/posts?hl=en) an educational blog, accessible only to a restricted number of users (i.e. teachers and school children). For this protection we used the Google+ concept of Circles, and we chose the most restricted one, i.e. "Friends" Circle. The header of the educational blog is presented publicly, i.e. is visible for every Google user, but the postings are visible only after users were accepted in the "Time Maps" Circle of Friends.

The authorization of users was performed as follows: the Vădastra School entered with its existing account, the same for its Facebook page, accessed in common by teachers and school children, with the purpose that children be assisted by their teachers and also for facilitating the management of the page in this stage of the experiment. The teachers from NUA have used their individual accounts, with a specialized profile: archaeology and virtual learning applications, textile and glass.

The children answered the questions with the Comment function of Google+ micro-blogging. In this way each child could see the answers given by other colleagues, from which he/she can learn or be stimulated to give a better answer, as this is signed with her/his full name. Although the children entered the page from a common user account, i.e. the school's account, they could be easily traced for their answers.

In this section we are presenting 3 cases of complementary experimentation of the social media tools created within the project.

General knowledge about Prehistory and Roman period

For this subject two video films were posted on Google+ (a performance and a 3D reconstruction), slightly different from those available on the Time Maps web site, but containing the same information. The children had to make a little effort to relate this information with the one presented on the site, to make a connection between the questions, the fragments from videos at which the answers referred to and the information from the site.

The set of questionnaires lead the school children through the majority of data offered by the web site regarding to the two historical periods (Figures 9, 10).

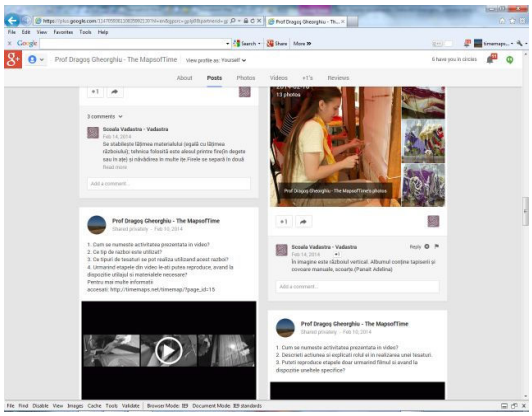

Figure 9. The educational blog on Google+ Time Maps page – the weaving techniques

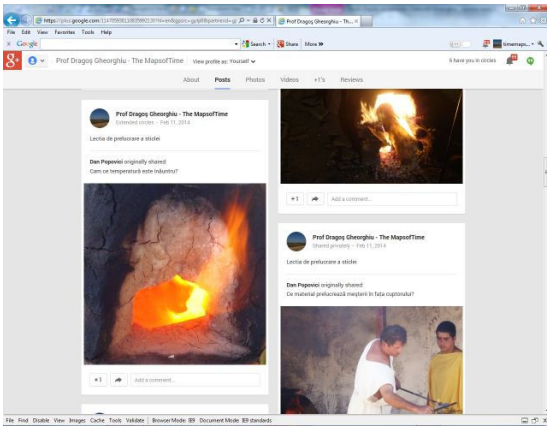

Figure 10. The educational blog on Google+ Time Maps page – the glass manufacturing techniques

Table 1. Questionnaire "LESSONS TO UNDERSTAND LOCAL HISTORY IN A VIRTUAL ENVIRONMENT"

Topic: *educational content*	Purpose	Questions
LOCAL HISTORY (Roman/Iron Age): *A video representing a virtual tour in the Roman villa rustica*	General knowledge about architectural elements and technologies from Roman period.	Describe the virtual tour through the Roman villa using the information from Time Maps site (Hint: http://timemaps.net/timemap/?page_id=44)
		Which are the building components of a Roman villa?
		Which are the technological operations which took place in a Roman villa? Use the information from Time Maps site (Hint: http://timemaps.net/timemap/?page_id=512&imgid=0)
		Describe a few objects manufactured in the Roman workshop , using the information from Time Maps site (Hint: http://timemaps.net/timemap/?page_id=514&imgid=0)

LOCAL HISTORY (Prehistory): *A video of making ceramics.*	General knowledge about the prehistoric technology of ceramics.	Describe the action from this film using the information from the Time Maps site.
		What operations are necessary for manufacturing a ceramic bowl? Use the information from Time Maps site (Hint: http://timemaps.net/timemap/?page_id=359)
		Describe ceramic objects found in a prehistoric house, using the information from Time Maps site (Hint: http://timemaps.net/timemap/?page_id=42)

Table 2. Questionnaire "LESSONS TO UNDERSTAND LOCAL HISTORY IN A VIRTUAL ENVIRONMENT"

Topic: educational content	Purpose	Questions
LOCAL HISTORY: Links to Panoramio and Google Earth	Use of Google Earth and Panoramio for searching geographical information and discovering the local history.	Try to find on Google Earth or on the village map the place with prehistoric or Roman remains.
		Search on Panoramio the places with these remains.
		Have you identified the experiments from Vădastra on Panoramio? (http://www.panoramio.com/user/7606828)
		What other NUA's team experiments did you found on Panoramio?

Table 3. Questionnaire "LESSONS TO UNDERSTAND LOCAL HISTORY IN A VIRTUAL ENVIRONMENT"

Topic: *educational content*		Purpose	Questions
LOCAL HISTORY: *Images of QR codes for launching the Mobile Augmented Reality applications*		Hands-on for using the geolocation function on smartphones.	What represent these images?
			Which are the IT tools which help you to use these images? Describe what happened after you scanned the images.
			Do you know what geolocation with smartphone means? Can you identify this technique in the Time Maps site?

General knowledge about traditional weaving

Table 4. Questionnaire "LESSONS OF TRADITIONAL WEAVING TECHNOLOGY"

Topic: educational content	Purpose	Questions
TEXTILE: 2 videos with NUA technicians and teachers working at vertical looms; Photo album.	General knowledge about the traditional textile technology	What is the activity presented in the video? Use http://timemaps.net/timemap/?page_id=44 access the Roman level and discover the film with this kind of kiln). Describe the working techniques.
		What kind of loom do you see in the picture? Access the Time Maps site on http://timemaps.net/timemap/?page_id=6 and find at each historic level (prehistory, Roman and modern) this kind of loom.
		What kind of fibers can you make using this kind of loom? Use the information from Time Maps site (Hint: http://timemaps.net/timemap/?page_id=15)
		Watch the images and try to briefly describe the preparing stage before start weaving.
		Watch in this video the weaving stages. Could you reproduce them if you had the necessary loom and materials? See also: http://timemaps.net/timemap/?page_id=15
		Use your reduced-sized loom and try to reproduce a motive (vegetal, zoomorphic or geometric) inspired by local textile tradition.

General knowledge about glass manufacturing

Table 5. Questionnaire "LESSONS OF ROMAN GLASS TECHNOLOGY "

Topic: educational content	Purpose	Questions
GLASS: Images of re-enactments with technicians from NUA	General knowledge regarding the Roman glass technology	What was the purpose of building this kiln at Vădastra?
		What was the purpose of covering the top of the kiln?
		Approximate the temperature inside the kiln.
		What objects are the craftsmen making in front of the kiln?

7. Experimentation of the Social Learning Environment

A summer school was organized in August-July 2012 during which the experiment was prepared and initiated. The children were provided with Android smartphones and tablet PCs with provided by the project. After that start-up several campaigns were organized for the experimentation of the system, at which 10 school children aged 10-14 years, 4 teachers from Vădastra school, 4 university professors and 3 assistant professors from the NUA participated.

Before the experimentation, a survey was done among teachers and children to evaluate the existing knowledge level.

7.1. Phase 1

A *first educational level* allowed village children and university students working in the project to go through an information discovery stage using smartphones and tablet PCs. It was a kind of play of discovering the historical information within the local landscape, but this play was restricted to a limited number of participants.

During the onsite experimentation of the AR application, in order to progress beyond the simple level of "play" involving a small group of participants, the beneficiaries of the application (i.e. school children and teachers) were encouraged to: a) comment and share their personal experience of participating in the authoring process (on the school's Facebook page and on Google+); b) send onsite comments and annotations, i.e. to contribute by microblogging (via Twitter); c) participate in the creation of new content and share it through the Google+ project's page.

The teachers from NUA accessed the project accounts created in Panoramio (http://www.panoramio.com/user/7606828) and Google+ (https://plus.google.com/114705936110835992130?hl=en#114705936110835992130/posts?hl=en) to post educational content. On Twitter (Figure 10) under the form of micro-blogging posts, they shared texts, photos and short movies, to make short announcements of the events that took place in relation to the project.

The information from a) and b) has been used by other colleagues in the local school and in the future will be used by other schools in the country or abroad. This represented *the second educational level* of the project, i.e. the analysis of the collected data. Information from c) was further analyzed by university teachers, filtered and added as an enhancement to the content of the AR platform. An example of user-created content are the movies made with smartphone cameras, recording the children[2] while performing traditional crafts (Figures 11, 12).

Figure 11. Children applying weaving techniques under the control of the staff from NUA Bucharest

[2] Based on parents' agreement

Figure 12. Children applying glass-engraving techniques under the control of the staff from the NUA Bucharest

7.2. Phase 2

In order to achieve the *third educational level*, we experimented the social media tools, i.e. the project's Google+ educational blog, by posting information complementary to that available on the Time Maps website, and also thematic questionnaires to foster a question-answer (Q&A) learning style. This allowed us to monitor and evaluate the information retention. In this stage we encountered the challenge to stimulate children and teachers to continue using our learning system, by posting new educational content, announcements and social messages. After a period of experimentation we proceeded to a statistical evaluation of children's answers, which is presented in the next section.

During this experimentation phase a symposium was organized at Vădastra School with the purpose to present our learning experiment to a group of 30 teachers from the Olt County. An open history lesson on the Time Maps web site was held by a history teacher, and a school girl described the Facebook page of the Vădastra School (Figure13), maintained by both teachers and children. The invited teachers gave a feedback on the effectiveness and utility of the Time Maps learning system by responding to a questionnaire-based survey, which was posted on the Google+ page (Figure 14).

Figure 13. School girl presenting Vădastra School's Facebook page

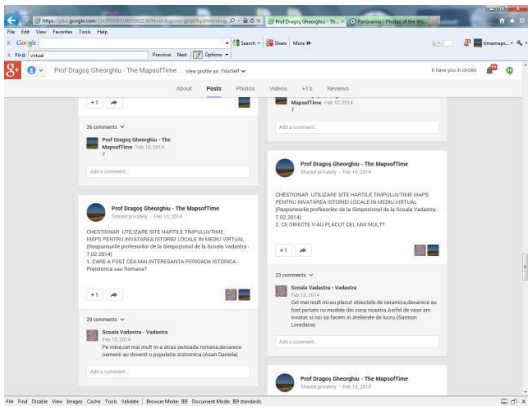

Figure 14. The survey as a public posting on Google+ Time Maps page

8. Discussion and Results Evaluation

Apart from other research projects which address the higher education (Popescu, 2013), we did not make a pre-experiment survey regarding the familiarity and proficiency of children on using social media. We created the tools and offered them for practical use in complementarity of other forms of learning experimented in the Time Maps project (face-to-face workshops, virtual reconstructions, video-conferences) and to extract useful information for further improvements. The social media services were chosen among those that we considered to be more suitable with the Time Maps project's particularities, i.e. Panoramio, Google+, Facebook and Twitter.

During our learning experiment NUA teachers created tweets (i.e. on Twitter project's page) to draw attention to certain topics and conclude on the level of interest in the technologies taught, and also toward our e-learning experiment. For more proficient children, Twitter contributed to their computer literacy, due to its higher degree of difficulty of use compared to other SNS, e.g. Facebook.

We considered Twitter to be the most sophisticated social media instrument in the project, which required a hands-on experience regarding the shorthand commands. As a criticism to Twitter we mention the fact that the children could also see other topics, including those from the "Twitter World", thus the environment had to be prepared beforehand with Twitter-specific security settings. Because of this particularity the page on Twitter was used in second stage only by teachers and researchers. Nevertheless, microblogging with Twitter postings allowed an accurate message tracking and information collection by means of retweets. For statistics, Twitter's free counters, the section "Trends", listing the most followed items and "Lists", listing the users interested in our posts, were analyzed. For more complex and detailed statistics, free services can be used, such as tweetreach (http://www.tweetreach.com).

Panoramio was chosen due to its management of the content copyright, which is useful as we posted copyrighted images, while Google+ was chosen for its rapid content sharing and social networking in controlled groups.

Google+ and Google Drive platforms were able to a more complex virtual environment, for collaboration, creativity, learning reflection and assessment. Google+ also enabled storage of the onsite user-created content, and allowed the creation of photo and video blogs. Google Drive allowed collaboration on the development of teaching materials by school teachers from Vădastra School, including an online survey.

Regarding the experience of Google+ social learning community we encountered the following problems:

- on using the environment: we had to give both teachers and children hands-on explanations;
- on processing the collected answers: we had to do it manually, as no suitable tools are available, like those offered by Facebook and Twitter;
- managing the virtual space: users had to adhere to the Google+ Circles of Friends before being able to access the educational blog; that needed Time Maps to act as a moderator to accept or reject users.

We also point out the following the advantages of Google+:

- Google+ is a more user-friendly than other social environments and very suitable for use by school children than other blogging environments (e.g. Wordpress); thus it stimulated the play-like learning.
- Google+ is more customizable than other social environments;
- By allowing teachers to post questionnaires and to share images and videos or links to content on the Time Maps website, the Google+ page acted as an aggregator of information and a for scaffolding the learning process.

After different stages of experimentation, we produced different statistical analysis of our results:

a. *concerning the most accessed social media*. It indicated that Panoramio was the most visited (Figure 15) and Google+ had the majority of postings (Figure 16).

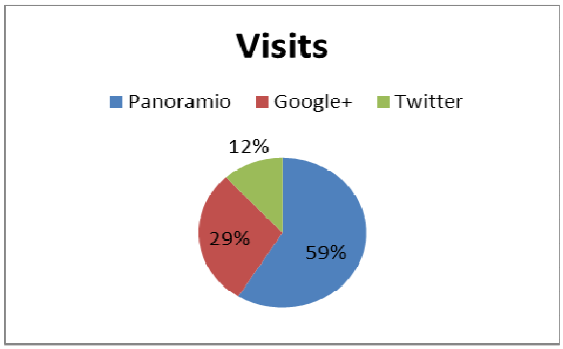

Figure 15. Social media visits

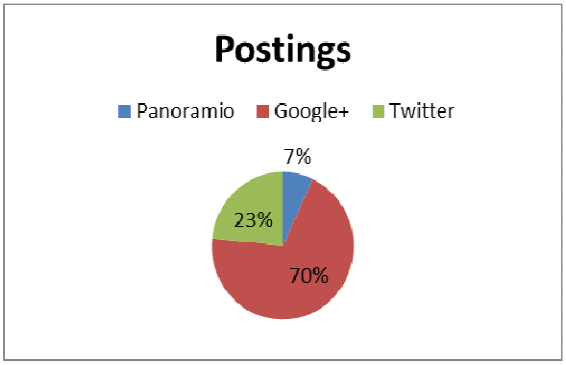

Figure 16. Social media postings

The statistics indicate that the different social networks had different levels of impact on the children and that in the future developments the focus should be on those more frequently accessed.

b. *concerning the pedagogical content.* A survey was done among teachers and children to evaluate the interest in our solutions and the quality of the educational content and therefore of the overall efficiency [Table 6]. The survey was posted on project's Google+ page (https://plus.google.com/114705936110835992130?hl=en#114705936110835992130/posts?hl=en) (Figure 14).

Table 6. Questionnaire on the efficiency of the pedagogical content

Questions	Answers
Which do you consider the most interesting historic period – the Prehistory or the Roman period?	Prehistory (16); Roman (16)
Which objects did you liked most?	Ceramic vases (10); the glass kiln or the ceramic kiln (11); the vertical loom (2); All (1).
How realistic did you consider the 3D architectural reconstructions (give a mark from 1 to 7)	Mark 3 (1); Mark 5 (9); Mark 6 (4); Mark 7 (15).
How realistic did you consider the 3D reconstructions of the objects (give a mark from 1 to 7)	Mark 3 (1); Mark 5 (9); Mark 6 (4); mark 7 (15).
Do you appreciate as useful the question-and-answer learning and evaluation using the Google+ blog?	Yes (25); No -.

c. *concerning the acquired knowledge.* Several surveys comprising 10 questions were conducted, with the purpose of evaluation the impact of different learning experiments on the information retention. As a conclusion of the survey, the best results were obtained consequently to a mixed valorization of different learning tools.

Table 7. Evaluation of the knowledge

Topic	Correct answers after face-to-face learning	Correct answers using e-learning with website and mobile applications	Correct answers using e-learning with website and social-media
Local history	6/10	8/10	9/10
Textile	5/10	7/10	8/10
Glass	4/10	7/10	8/10

9. Conclusions

We conducted an ICT educational experiment by creatively combining multiple technologies – mobile devices, geographic AR with social media. We consider that with our experiments the information related to the identity of several places and communities could become visible for the young generation.

Social media allowed us to enhance the informal educational process, initially implemented with contextual learning and user mobility, with participation, reflection and interaction outside of actual lessons and also provided us with tools for analyzing the efficiency of our experiment. We have created a distributed learning community around educational content presenting traditional crafts, for communication and collaboration among K-12 children and university teachers.

Several well-known social media services have been experimented for geographic and social content sharing and tagging, socialization and microblogging, each stimulating different ways of

learning and communicating ideas. For the K-12 children social media was a tool for engaging them and making more aware of the learning process. For teachers, it was a valuable assessment tool. The main challenge was to maintain the learning system and children's interest with periodic postings, status updates and communication messages.

The Time Maps project allowed a remote connection linking two learning systems employing IT technologies and social media, which led us to a creative usage of the ensemble of technologies with the purpose of implementing a complex remote education system.

The Time Maps social media tools also proved to be a cost-effective technology and infrastructure for our approach, in which academia can engage creatively and effectively in the development of K-12 education in villages. Thus, the gap that currently exists between the academic and the K-12 educational systems can be overcome. Our social media tools can also open a new way for future collaboration and information transmission in various knowledge fields. Initially designed as means of capturing and sharing of content and user experiences, their experimentation during several months proved that through systematic use and maintenance of the quality of the information it can lead to knowledge creation. The data collected during our experiment, further refined by teachers from NUA and from the Vădastra school can be further integrated at an institutional level.

Although the process of setting up the social networks was rapid, extra work was necessary to periodically update the information on the social networks and afterwards to find specialized tools for the analysis of the multiple postings, in order to extract valuable information.

We conclude that such de-centralization of the learning space, ed by social interactions, facilitated the overall learning process and allowed a collaborative and creative content development. Furthermore, it highlighted a differentiation among the children, regarding their involvement and learning outcomes.

10. Acknowledgements

We wish to thank Mrs. Laura Voicu, the principal of Vădastra school, Vădastra village, Olt county, Romania, and to Professor Narcisa Balteanu, for their help and participation in our experimentations. The authors also thank Professor Arch. Andreea Hasnaş, Assistant Professor Alexandra Rusu, technician Elena Hăut, and Lecturer Dan Popovici (NUA) for their collaboration, and M. Bogdan Căpruciu for useful suggestions.

The project was financed by an exploratory research, grant PN II IDEI (The Maps of Time. Real communities, virtual worlds, experimented pasts).

Images by D. Gheorghiu.

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