

# Building a Virtual Framework to Exploit Multidisciplinary Project Workshops – peeks & pits

Márta Turcsányi-Szabó<sup>1</sup>, Andor Abonyi-Tóth<sup>1</sup>,  
Nikoletta Ekker<sup>2</sup>

<sup>1</sup>{tszmarta, abonyita}@inf.elte.hu

<sup>2</sup>ekker@caesar.elte.hu

ELTE IK

**Abstract.** Multidisciplinary project work in connection to industry is highly favoured at University education, since it prepares students to envision their spectrum of profession, to be able to participate in production projects in co-operation with partners out of campus, and learn to communicate between disciplines. An effective combination presumes selection of right partners, set-up of proper virtual platform in order to bridge time, space, and differences in working styles. The set-up process requires several phases of design-based research to provide proof for the convergence of the melding process into the right direction to produce a productive workshop that is sustainable. The paper describes the review of literature, the platform and set-up established, a first phase in bridging Art and Computer Science through the description of MOMELTE project, a critical evaluation in order to learn from mistakes, and a new list of design principles to improve the next phase of the workshop process.

## 1. Introduction

The Faculty of Informatics at Eötvös Loránd University plans to launch its Multimedia M.Sc. and in order to prepare an industry-wise popular set-up, courses have to be blended into an interdisciplinary research & production workshop for developing innovative interactive media products that could well be accepted within the e.g. museum industry and also produce good publications. In order to design such a workshop a triple of Art & Computer Science & Museum Industry has to be combined on the long run, to be able to speak each others' language, communicate on needs, tools, and aesthetics, set-up a platform for the workshop scenario, and operate this integrated process in a sustainable way. As our aim is to enable the workshop to be involved in developing immersive environments as well, it is inevitable that participants should experience and get acquainted with virtual 3D worlds. So, even though there are several good alternatives to online collaborative project work (like *Trello*, <https://trello.com/>), some even specialised in programming as well (*GitHub*, <https://github.com/>), and others available with videoconferencing possibilities (*Adobe Connect Meeting*, <http://www.adobe.com/products/adobeconnect/tech-specs.html>) with the addition of suitable principles for the success in developing student's creative design capabilities [1]. Yet, we have to make sure that at the fare end, a platform for collaboration would be a 3D virtual environment. In order to achieve this plan we had to:

1. Establish the internal frame of the continuous workshop based on on-going courses at our Faculty (and beyond if possible) in order to build out co-operation between departments and integrate project work (tet.inf.elte.hu).
2. Exhibit all relevant edutainment developments throughout our campus in order to demonstrate to students the use of these installations within their everyday life and allow them to explore, enjoy and raise their interest to participate in similar projects (under publication).
3. Build out the infrastructure to allow collaboration of courses with different settings, timing & place, credit, theme, and co-coordinator in order to facilitate a virtual laboratory for integrated projects to develop smoothly.
4. Build out a platform & methodology for collaborating with museums in order to allow the flow of ideas and innovation to converge into distinct projects with our internal frame workshop of courses.
5. Build a platform & methodology to disseminate our works and allow as much as possible to enter the world of public education in order to raise interest of future students and mentor teachers in using innovative technology for educational purposes [2].

The scope of the journal does not allow us to elaborate on all of these topics above, so we shall describe the elements in No. 3 & 4. We use design-based research, which assumes that context affects learning, offering a methodological tool kit to systematically and iteratively test and improve a designed learning environment and to generate theory alongside in form of design principles [3]. Considering the characteristics and affordances of virtual worlds, an adaptation was proposed to be used for virtual world research projects [4], iterating cycles of implementations-findings-implementations, in our case asking research questions:

- How much previous knowledge do users have about the used technology?
- How is the users' level of engagement during collaboration?
- How do users solve the project-related activities they assigned themselves?
- How is the users' motivation during collaboration?
- How do the consultant-student interactions affect the collaborative process?
- How do the students-student interactions affect the collaborative process?
- How were the collaborative activities performed?
- How is the social process emerging within the virtual world?
- What are the different social roles that users take during activities?
- How do the virtual world resources (physical, instructional, interaction based, etc.) scaffold learning and collaboration?
- How has the virtual world diffused to other consultants and museum personal?

We plan to monitor activities of participants on several levels: analysing log files within OpenQwaq using data-mining and similar analysis is needed on the web access of the portal platform (as activities within the same area can be pursued from either platform). We plan to use Google Analytics with individual variables to investigate users' activities. After the end of the project, users shall fill out a questionnaire, which contain open and closed questions (using a 5 level Likert scale) about their collaborative impressions in mixed environment. We intend to make improvements to our mixed environment after analyzing feedback and monitoring data. After that we plan to evaluate the efficacy of our collaborative environment using the Four Dimensional Framework (Learner specifics, Pedagogy, Representation, Context) [5] and analyze findings in comparison to those found in similar set-ups using Second Life [6].

Our paper describes our efforts and results towards the next phase of our design-based research in producing the workshop platform. Firstly, we review literature on different possibilities for using virtual worlds effectively in higher education, narrowing the spectrum towards the requirements needed for interactive media design and development. Secondly, we describe our design considerations when choosing a virtual platform, taking into consideration the design efforts, social learning theory, our reasoning for choosing OpenQwaq. Thirdly, we describe our efforts in bridging Art and Computer Science projects, successes and failures, to conclude with lessons learned. Fourthly, we investigate internal shortcomings in form of a survey in order to analyse communication skills of Computer Science students in order to be able to design a next generation of virtual platform to embrace the triple of Art, Computer Science, and Museum industry as a workshop for sustainable production.

## 2. Virtual Worlds in Higher Education – Narrowing the Spectrum

Educational use of MUDs (Multi-user Dimensions/Dungeons) and MOOs (Multi-Object-oriented MUDs) go back to the early 90's, while MMORPGs (Massively Multiplayer Games) appeared about a decade later, like Second Life (<http://secondlife.com/> 2003 by Linden Lab), which soon grew into the largest 3D community, that was exploited for educational use [5]. As time progressed, researchers identified potential problems when using Second Life in education, including issues with the Second Life software and hardware requirements, a steep learning curve, and the possibility of students becoming exposed to distractions or inappropriate content, nevertheless it's use and potential for learning did not cease. Potential uses of Second Life include role-play, game and simulation creation, implementation within distance education programs, and the ability to encourage student-centred learning activities [7].

Generally, research on virtual worlds is more and more increasing and results indicate that virtual worlds are mainly used for the simulation of space, used in different ways depending on discipline and temporal scope, they are increasingly being used in blended learning contexts and due to their most significant communication possibilities, language learning is one of its most popular and successful topic in education [8]. The use of Second Life in higher education has always lead to an impasse between the advocates and the critics [9]. There is still a great deal to learn about how Second Life can benefit higher education. As is common among new technologies, it still appears to be in a largely experimental phase, which might never end [10]. The findings suggest that the 3D virtual world environments produces both positive (through telepresence, a specific aspect of flow, as well as enjoyment) and negative effects (due to distraction–conflict theory in which attentional conflicts faced by users of a highly interactive and rich medium result in distractions) on brand equity when compared to 2D environments [11]. From the student's perspective (and even despite technical difficulties), they commented positively, but did not prefer it over traditional ways of group-work (not feeling the sense of formality) and most of them perceived Second Life as an entertainment environment and preferred the more familiar web-based technologies such as Blackboard for group-work [12].

SLOODLE (Linked Object Oriented Dynamic Learning Environment) appearing in 2006 soon linked with the most popular open-source LMS (Learning Management System) Moodle (Modular Object-Oriented Dynamic Learning Environment) producing a braid for higher education that incorporated most of the crucial educational requirements formalised [13]. The Association of Virtual Worlds presents over 375 virtual worlds including their web addresses and brief descriptions for all ages and purposes: MMORPGs, social networks, mobile applications and

custom worlds [14]. They also listed over 150 solutions which are used by businesses and organisations to launch and extend their brands as well as for meetings, recruiting, and training [15].

As we are mainly interested in involving our computer science students to take part on-line in interdisciplinary production workshops, we are not so much interested in virtual environments for their social nature, but rather interested in task oriented virtual environments that not just could be used for small collaborative meeting and networking, but also for sharing documents & knowledge, productivity tools for co-creating, visualizing and presenting ideas & projects, as well as consulting. Besides, we wish to make sure that our projects do not pause a financial burden on us, thus we have to filter all commercial products and stay with open-source versions, which rather limits the spectrum, yet, some good benchmarking could be found by ProViWo project on Alto University site [16]

### **3. Design Considerations for Choosing a Virtual Platform**

#### **3.1. Design Effort Considered**

Despite the fact that virtual worlds are often used effectively in education, in some cases there may be problems which can go to the expense of effective learning [17]. At the planning stage, one has to answer several questions in order to determine how much effort is necessary to put into the design process to come up with an efficient solution worth the effort? It is well worth to look into the investigation of design effort to stage the particular collaboration vs. 3D added value affecting the quality of learning outcomes based on the classification of collaboration and learning pattern. The diversity of efficiency in learning outcomes for designing different types of collaborations could be traced through the mapping of patterns [18]. Our choice was on the Quick win design having 3D experience as natural solution with seamless patterns, where simple elements (different file types and video/slides) can be presented, users can have interaction with them and with each other and the 3D added value requires only low design efforts.

#### **3.2. Social Learning Theory considered**

Smith and Berge analyzed [19] whether the three key components of Bandura's [20] social learning theory (observational learning, imitation, and behaviour modelling) manifest within Second Life, being the most popular for use in higher education.

Newcomers always start with lurking, observing the behaviours of others' online, users can experience the tools that others have used, instructors can observe other instructors, and students can learn the acceptable behaviour of other students. Though there are some rules that need to be stated, one can learn fairly easily what can or cannot be done in-world by observing the behaviour of others.

Imitation and behaviour modelling – which comes after experiencing positive behaviour at the first stage of observation – is one of the main features of Second Life, as configuring and dressing up avatars is a basic element in-world, it is designed for role-play and there are plenty of sites and environments where different behaviours could be observed and imitated. Of course this could be a virtue on one side (encountering verity) and a flaw (picking up on the dark side)

at the same time. Being a world of continuously inhabited terrain one can gain plentiful experiences and get distracted at the same time, not to mention the unfortunate possibility of becoming addicted. Once becoming expert in use and experiencing the Flow [21] performing of in-world activities, learning and collaboration does not mean a burden to intentions. However, a learner as a newcomer needs to invest some time before managing the tasks that are required in the educational process.

An important concept of observation and modelling is directed towards attitudes and emotional reactions, which is an important factor in learning and collaboration. Second Life, however does not manifest to this need, as emotions and reactions can only be transmitted using the built-in symbolism that can be controlled by the user, but that does not reflect true emotions. These features help expression in role play, but does not provide feed-back needed in human-to-human interactions, which are the natural virtues of communication in real world.

### **3.3. Our Choice for OpenQwaq with reasoning**

Our choice for OpenQwaq as collaborative environment for common project work was made according to the following analysis:

- Second Life needs quite a budget to set-up, maintain and update with resources needed to establish a sound pedagogic environment for the types of interactions required for the success of our project.
- OpenSim is much more cost effective, however it needs dedicated hardware, professional set-up, administration and maintenance, as well as designers and programmers to build resources in-world. But at the Faculty of Informatics, seeking the proper hardware is not problematic and neither is administration of the complete set-up. Building resources in-world is an interesting activity that could also distract attention from the task of collaboration on projects.
- OpenQwaq needs also hardware and set-up (much more than OpenSim, as it was released on May 2011 and does not have a robust developers' community as background support). The platform can also be used as a file server allowing collaborative work on a client 2D portal or by entering the 3D world, getting immersed in the full environment, the same resources could be found and 'touched' for interactions [Figure 1]. One can develop as many rooms as needed per teams with just a matter of duplication, which could then be configured for each group. It has most of the interactive features that the other two provides: text chat, voice over IP, teleporting, interactive panels, ...etc and soon video streaming will be integrated too. Besides, the interactive features accessible on panels provide much higher level of interaction which is a virtue in collaboration. Although avatars cannot be configured the video signal can be projected onto the face of the avatar (when video streaming is integrated), providing feedback on emotional reactions, which is not possible in the above two worlds.

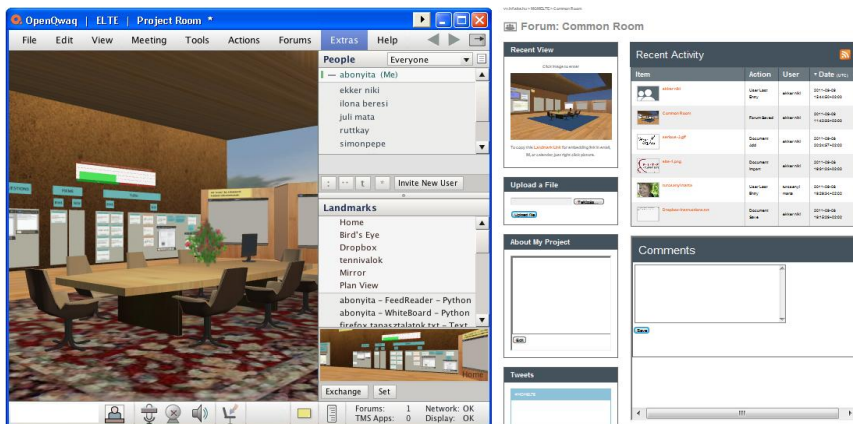


Figure 1: OpenQwaq – Common Room (left - 3D, right – portal form).

Unavailability of some features existing in the other two virtual world are virtues:

- Avatars cannot be fully configured, which was one of the most favourite activity for users in Second Life, however this could be also a distraction when collaboration in the main issue and this extra task of creating new forms of avatars could be a separate project theme for 3D modelling classes.
- Building in-world is not possible (only pre-built items can be added), however this is a virtue, since students are not distracted in this direction.
- It is not open, so only those worlds can be visited for which one has authority to enter. This could hinder the Flow to emerge so quickly in users, however there is less to master since it is a more restricted world and one can concentrate more on the collaboration over the assigned task. The design of the working area can be built to allow some leisure time activities as well and an exhibition area, where the works of previous projects could be experienced and social processes invoked.

## 4. Bridging Arts and Computers Science Projects

### 4.1. Common Project on Developing Serious Games

Moholy-Nagy University of Art and Design (MOME <http://www.mome.hu/>) is a small, traditional art and design university, with students excelling in visual design and creativity in different disciplines, including Media Design, Eötvös Loránd University (ELTE <http://www.elte.hu/>) is a big old general university, with several Faculties, including Informatics. MOME's Creative Technology Lab and ELTE T@T lab has a strong motivation to join forces, due to the fact that the former's profile is media design while that of the later is media programming, thus the two produce a braid supplementing each other to produce creative edutainment and museum technologies. The MOMELTE project (co-operative project between MOME and ELTE universities) was launched to build Serious Games in form of a competition. The MOMELTE portal (<http://tet.inf.elte.hu/momelte/>) provides links to comprehensive descriptions of the project itself

and the technology used. Some predefined courses at both universities set their aims to take part in this project specifically, where requirements for entering the competition were:

- The serious game should have connection to some form of formal or informal learning, indoors or outdoors of museum area or any other specified location, including virtual spaces, motivating the learners' involvement.
- At least one of the following three technologies has to be involved: multi-touch or other gestures, augmented reality, locative mobile technology.
- Work has to be done in groups, containing at least one student from MOME and at least one student from ELTE and a consultant from either university.
- Work process has to be traceable within the virtual collaborative platform.

**Background for work:** At MOME the Creative Technology lab offered premises and technology for experimentation, while at ELTE T@T Lab offered premises, technology and equipped the large student area with various technologies to experience while enjoying leisure time. Both universities offered several courses, which would specifically help students with progress in achievements. MOME has a specific course in which common projects are built with specific museums, thus a critical number of museums are involved from the beginning.

#### 4.2. The Setup for bridging

Probably the most difficult part of the co-operation is synchronizing communication and monitoring collaboration:

- Having different technological backgrounds and use of tools, students need to be introduced to technology through their own experiences in order to raise attention to new developments allowing emergence of innovative ideas.
- Informatics students are highly disciplined and use different technologies for sharing files, but are less communicative. On the other hand, art students are more philosophical and refer mainly to Raison D'être
- The timing of different courses cannot be synchronized, so real-time meeting is quite difficult to achieve.

We have already tried several approaches in using collaborative technology (*like Google Sites <http://sites.google.com/>, BSCW <http://public.bscw.de/>*), but none were really working, especially due to our persistent requirement to log actions of collaboration in order to be able to monitor events from both sides, whether the projects are progressing in a good pace. Thus, students used their own Learning Management Systems within their own university courses that they were already accustomed to and we set up an OpenQwaq platform for collaboration in MOMELTE project and for one specific project theme we set up an OpenSim server to allow development of a virtual campus for the future.

#### 4.3. Introducing Step-wise Immersion

We have devised a new methodology for immersing our students into mixed realities step-wise, by experiencing technology and museum environments, being precise and concise, respecting deadlines, using social media, getting to know collaborative technologies, developing an inventory of common vocabulary for discussions, being able to find own added values to supplement each other in projects, documenting feedbacks and steps taken, getting more and more immersed

in virtual reality by shifting collaboration towards this area and developing experiences that could lead to innovation of ideas useable in museum context [22]. Thus the user experience during an emerging co-operation could lead to innovative design ideas and technological awareness in choosing proper tools to accomplish goals. The same applies to museums, which are the least aware of the demanding changes of time and are reluctant to ask for help from both sides, but are uneasy at becoming technology users. Nevertheless, we left the developed Google Sites area as an alternative workspace for those finding it difficult to use the newly developed environment with more immersive features. These project participants are provided with basic, less advanced collaborative tools: area for definition of project and access to participants, file area (to exchange project files), memo area (to document meetings and agreements), discussion area (for asynchronous conversation).

#### 4.4. Step-wise Immersion – the steps to be taken

1. Face-to-face meeting at launch of project (Prezi: <http://bit.ly/KXnLBF>).
2. Read incoming project ideas in form of Tweets coming into @MOMELTE and the web page blog for news on the project and checking out the calendar.
3. Composing project ideas, saving it in PDF and uploading it to a public area.
4. Sending out a Tweets with own project idea including: name of the project, Keyhole Markup Language (KML) positioning in town, link of a relevant picture and link of the PDF file introducing the project.
5. Venues of the project ideas could be located in two ways: if one has smart phone, then launching *Junaio* (<http://www.junaio.com/>) application and allocating MOMELTE channel, or if one has access only to desktop applications, then the Junaio developer page allows the search for channels and shows all Points Of Interests (POI) after searching for e.g. Budapest.
6. Search for partners by Tweeting using #MOMELTE as hashtag.
7. Attend face-t-face project introduction event, introducing group projects.
8. Ask for an account on OpenQwaq client 2D file server.
9. Ask for Forum area on 3D platform for co-operation.

#### 4.5. The User Experience

1. It is important for all participants to get to know the project in details and be able to identify major participants to make contact in real life. The event is recorded, so it could be streamed any time for those, who could not attend. Real connections and visual illustrations are of high importance at the start of any project, encouraging direct communication between partners.
2. Twitter is being introduced on a reader level, to experience how ideas could be published and read instantly using this technology. The need and relevance of concise messages could also be experienced, raising attention of students to project ideas to participate, which needs registration on Twitter to to send own ideas and feedback.
3. Students are already used to submitting work in PDF-s, however they have to make sure that they are placing it into a publicly available storage area, which can provide an accessible link to anyone.



4. Sending out concise messages is of crucial importance, thus great discipline is needed at this point. A well defined profile should illustrate the institutional background and profile of the user. A detailed description is provided on using Twitter and helping to produce the required shortened links of picture and PDFs as well as allocation of KML for positioning. This provides a good background for several locative technologies. Students or consultants from either universities and well as museum contacts can all initiate emerging projects this way and get to master the technology as well.
5. Locative technology could also be mastered at a next level using smart phones and Junaio technology. This could facilitate participants to search for the proposed venues and examine the environment where the specific projects are to be launched to provide adequate background knowledge for the aims. But, if someone does not have a smart phone, the Junaio developers' web page also allows the access for the same information online, it just needs a separate step to go out and check the location on spot.
6. Tweeting in search for partners needs a more immersed practice in this technology, providing a form of immediate communication in project work.
7. Choosing a consultant is for practical reasons, making sure that everyone will have a helper and could get credit for project work. Besides, this also forces the university staff to get immersed themselves ☺
8. Project presentation session provides all project groups to introduce themselves in 5 minutes each and give ground to feedback and encouragement as well as orientation or attraction of further partners.
9. OpenQwaq file server works as a web-based collaborative file sharing and discussion area, where one can find: the short project description with access to participants and links to the most important files of the project, group Tweets that contain the #group-name hashtags, file uploading/downloading for memos and project materials, and a discussion area. (This basically has the same structure as the alternative working area on Google Sites portal.) Museum curators would most probably use this level for contact throughout the project, but might be motivated (if brave enough) to go further one step.
10. The VV environment provides a visually appealing 3D immersive space [Fig 3.] in which one can recognize the above (No 9.) elements situated in the left side/corner, where all the Tweets, project descriptions could also be found and high levels of interaction is allowed on these objects as well as Voice over IP (VOIP). Students can share their emerging work online, while their collaboration can be monitored from either side. Students are obliged to take at least one action per week to show their progress, either online in OpenQwaq or in form of Tweets, piped in-world. Student collaboration requires discipline as all objects scattered shall be removed and only those that are placed on shelves would be backed up on a daily bases.



Figure 3: OpenQwaq – project room template for MOMELTE project.

#### 4.6. Development of the Step-wise Immersive Environment

*Google Sites* (<http://sites.google.com/>): provides informative web pages with a counter indicating the number of days left till the final deadline.

*Twitter* (<http://twitter.com/>): provides immediate communication of disciplined content which can be filtered and piped into further applications as RSS feed.

File stores: *Google docs* (<http://docs.google.com>), *Microsoft Live* (<https://login.live.com/>), *DropBox* (<http://www.dropbox.com/>), or any other services on campus could be used to upload PDF files.

*KML* ([http://hu.wikipedia.org/wiki/Keyhole\\_Markup\\_Language](http://hu.wikipedia.org/wiki/Keyhole_Markup_Language)): *Google Maps* (<http://maps.google.com/>) or *Bing Maps* (<http://www.bing.com/maps/>), *Wikipedia*, Twitter's own place locator to obtain KML positioning of an institute.

Pictures: *Flickr* (<http://www.flickr.com/>), Twitter's own predefined services, or any other service could be used to upload pictures taken.

Short links: *Bit.ly* (<https://bitly.com/>) or *Twitter's* own service to shorten URL-s.

*Junaio* (<http://www.junaio.com/>): is a free application for iPhone and Android. The developer account allows creation of channels, where a locally hosted Apache server (<http://www.apache.org/>) or *Hoppala* (<http://augmentation.hoppala.eu/>) free service can host POIs. Tweets of required data are piped into POI structures. *Junaio* (<http://dev.junaio.com/map/index/channel/95028/latitude/47.161160/longitude/19.504960/stream/false>) allows an overall view of all POIs on desktop and on smart phones.

*OpenQwaq file server* (<http://vv.inf.elte.hu/>): is actually the 2D web access of an *OpenQwaq* (<http://code.google.com/p/openqwaq/>) server that has been installed for this project. All project groups are provided with a subdirectory and we have developed an extension for this access to accommodate a project description, Tweet gadget and Forum for discussion (on group level and individual files) using iFrames.

*3D OpenQwaq*: is the 3D immersive OpenQwaq access for collaborative workspace. We have created a Common Area for project participants to gather and brainstorm. All incoming project ideas are piped in-world and land on the Brainstorming wall, Tweets are piped on a communication board and Topic cards provide brainstorming and feedback as well as sticky notes allow spontaneous reactions. Text chat and VOIP (soon video streaming too) is also facilitated. Several working areas provide interactive boards to share presentations, program codes and documents that could be edited online collaboratively. There is also a Gallery for social activities displaying products of former projects. Each project group is provided with a separate room for collaboration, including a communication board with group tweets being piped in-world, white boards and all the above interactive collaboration functionality that is also available in the Common Area. Each project room also has outdoors for leisure activities. The rooms are built to illustrate a comfortable working environment, but students are encouraged to change and create new artefacts to increase their own comforts. We have also prepared user guides in Hungarian language to help users.

## 5. Results and lessons Learned

The final results and products of this workshop were quite remarkable, with the museums being very satisfied, getting some rather good models for their exhibits that could be further polished and finalised (some are on the road of final production):

- Augmented walk experiencing the works of famous artists in town for Petőfi Literature Museum.
- Simulation of pandemics and the path of food for the Semmelweis Museum for History of Medicine.
- Microsite for Kolibi Theatre.
- AR music book and Kinect music and motion game illustrating one of the most popular plays for children called Bors nany.
- AR video explanations on pictures of modern Art at Ludwig Museum.
- Creating a virtual exhibition area in OpenQwaq and OpenSim.

However the process itself was rather painful, as we had to realise that though teachers at MOME in theory promote the use of social networks and high tech environments, they are not so fluent with these innovative artefacts and thus are not able to support their students with their use. Even though we have offered our help on spot to MOME at every step, they were so preoccupied with project development, that they could not find time to accept our help. After all our invested efforts, we have to frankly admit, that our fine-tuned *Step-wise Immersion* process ended up as *step-wise Murphy* process (what can go wrong – goes wrong):

- ELTE students were registered to Twitter, awaiting ideas and discussions, however MOME teachers seemed to have problems understanding Twitter features and finally gave up with enforcing it onto their students – thus teachers at both sides Tweeted only and had to arrange themselves the teaming of projects.
- ELTE teachers made sure to find partners for most of the projects initiated by MOME, however MOME teachers did not find it important to do like-wise as their policy is endorsing the creativity of their own students – thus only projects initiated by MOME were supported, which (even though completed successfully) did not have the zest of innovation, which would have been the aim of ELTE in order to write good publications about results.
- Face-to-face meetings for project teams were extremely difficult to arrange, thus the projects' launch timing had to be prolonged by two-three weeks due to unsynchronised holiday intervals at both universities.
- Due to an unforeseen bug in OpenQwaq (related to the use of central-European characters) system access was paralysed for days, even though we spent incredible effort in solving the problem, but found no support or similar problems in the community portal and could only solve it with delay – thus MOME was discouraged at using the OpenQwaq client to access the 2D file server and we had to set up quickly the alternative Google Sites working area on MOMELTE portal, where each project group had their own area for discussion, blogging, forum and file exchange.
- Even though we tested the 3D OpenQwaq virtual platform with MOME before launching the project, MOME teachers were using their own laptops at test time and had a good impression on its use, however when using their Mac lab at project time, they realised that OpenQwaq had several problems running on their computers (ELTE had no problems as our Mac lab had brand new machines) – thus we urged only those student groups to use the 3D world, where everyone has equal access to the area. Slowly everyone shifted to the common Google Sites platform, not to spend extra time with the needed learning curve of the 3D environment.
- ELTE being technology oriented was quite aware of the necessary investment from the side of students and staff credit-load-wise, however MOME was inexperienced in this

respect and students started to complain about the extra load that was not rewarded in credits for their efforts – a successful increase in their credits was endorsed later on, but this has also discouraged some of the students at MOME.

However, we must state, that even though we had tons of problems to solve on the go, our efforts were rewarded by the end-products produced by students works, some of which even ending in conference papers, demos, and launched museum products. We could not perform our research, analytics, surveys as planned, but had to rethink our strategy and look at ourselves in a critical manner: would have we succeeded with this platform if the problems of technical knowledge, technical set-up and support were as good as at our own side? That is to say: what about our own students? Are they enough literate in social networks? Are they ready to collaborate on such platforms? How about their communication skills: are they good enough for multi-disciplinary project work? We decided to end our investigation by trying to answer these questions before composing our design principles that should conclude this first phase of design-based research.

## 6. In-house Investigation on On-line and Virtual Tools

We made a survey among our own students (N=342), attending courses on B.Sc. or M.Sc. level as program designer students within our Faculty of Informatics, asking them the following questions:

- Which social media sites do they use and with what frequency?
- During project work, which are the forms of communication, which they would prefer?
- What are their specific requirements towards environments that support project work?
- What is their self-esteem about their own communication skills and they had a chance would they wish to improve them?

We measured the frequency of social media use on a 5 scale Likert scale (1 = Never, ..., 5 = Very often). In the following [Table 1] we present results according to the mean values of frequency of use of social media sites in a descending order.

	Mean	Std. Deviation	Variance	Mode
1. Youtube	4,01	,835	,698	4
2. Facebook	3,89	1,259	1,584	5
3. Google+	1,76	1,030	1,061	1
4. Iwiw (Hungarian social network)	1,59	,690	,477	1
5. Twitter	1,43	,889	,791	1
6. Virtual, 3D environment	1,16	,493	,243	1
7. LinkedIn	1,14	,461	,213	1
8. Pinterest	1,03	,208	,043	1

Table 1: Frequency of social media use

We can see that Youtube and Facebook are the two most popular social media sites used by students. The mean frequency value for the rest of the sites is under 2. Investigating the use of the relatively new Pinterest community site we found that students were not so much interested (maybe did not even know about it) and expressed as reason for not using such services frequently, that they “prefer to use those community sites, where they could keep contact with most of their acquaintances”. This could be partly one of the reasons why the use of Google+ is not so popular. It seems that until the number of acquaintances in the community does not reach a critical number, active use is not typical. It is also quite evident from the answers, that the use of 3D virtual environments is not at all characteristic; they do not have prior knowledge of such.

We also made a survey on the use of different communication services, using the Likert scale (1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Very often). We present the results [see Table 2] according to the decrease of use of specific services.

It can be seen, that among the synchronous communication forms chat is the most popular (3,77), followed by voice call (2,69), and video call (2,29). As for the asynchronous communication forms, reading forums is the most popular (3,51), and the least popular is writing blogs. Among the students who filled out the surveys, just 3%-a declared themselves to be frequent bloggers, thus it seems that this form of self-expression is negligible among participants.

Service	Mean	Std. Deviation	Variance	Mode
1. Instant messaging	3,77	1,153	1,330	5
2. Reading forum posts	3,51	,974	,949	3
3. Liking Other People's Posts on social networks	2,82	1,088	1,183	3
4. Commenting Other People's Posts on social networks	2,73	1,068	1,141	3
5. Voice calls over the internet	2,69	1,296	1,681	3
6. Sharing activities/news on social networks	2,64	1,101	1,211	3
7. Writing forum posts	2,41	1,009	1,017	2
8. Commenting forum posts (not anonymously)	2,34	1,011	1,021	2
9. Video calls over the internet	2,29	1,219	1,485	1
10. Commenting forum posts (anonymously)	1,73	,858	,737	1
11. Writing a blog post	1,54	,848	,718	1

Table 2: Frequency of communication services use

We also asked students which forms of communication would they prefer within a collaborative project work. We present the results below [see Table 2], listing the forms according to the mean value of preference in a descending. The values of the Likert scale are ( 1 = Very improbable, 2 = Probably Not, 3 = Possibly, 4 = Probably, 5 = Very Probably). The survey also allowed a free form to comment on students' favourite types of communication.

Even though it is clear from [Table 3], that students prefer face-to-face communication in project work, we are aware from previous project set-ups that it is rather difficult to find a common time and place for meetings, due to the fact that students taking part in our internal projects

(attending courses within our own Faculty) have so different time schedules for courses and other activities. Thus it would be rather impossible to arrange a common meeting for those working in different institutes and fields. Thus, in order to arrange regular communication, we definitely have to make use of innovative synchronous communication tools, like voice or video conferencing. It might well be, that some of the participants could not take part even in this way, so it is necessary to provide recordings of such sessions to be viewed or heard later and also to prepare reminders in form of text.

	Mean	Std. Deviation	Variance	Mode
Personal meeting with the group's members	4,51	,776	,603	5
Contacting by email	3,87	1,001	1,002	4
Contacting by chat	3,70	1,075	1,157	4
Contacting by online voice calls over the internet	3,68	1,183	1,399	4
File sharing (e.g. Dropbox)	3,55	1,157	1,339	4
Collaborative document editing (e.g. Wiki, Google Docs)	3,49	1,161	1,347	4
Contacting by Closed social network	3,49	1,093	1,195	4
Contacting by telephone/mobile phone	3,32	1,111	1,235	4
Contacting by online video calls over the internet	3,21	1,283	1,646	4
Contacting by Open social network	2,50	1,143	1,306	3*
Contacting by a virtual, 3D environment	2,18	1,321	1,746	1

\* Multiple modes exist. The smallest value is shown.

Table 3: Preferred communication forms

It is also evident that emails are the next most popular forms of communication from among our students. However we see this form of communication to be very critical in case of project development and monitoring, as we are not able to trace students' work. A solution could be to provide internal mailing within the collaborative platform, and allow participants to use only this traceable form during project work. Thus, analysis of log files could provide us information to determine the frequency of activities and the level of contribution of individual students.

After emails, chat is the most popular among students. From free form comments, we could see that it is an important factor among "chat fans" that they could do so independently and in parallel with several acquaintances at the same time. Many students indicated, that Facebook is their chosen main communication platform, because this provides them the fastest form of communication, supporting both message and chat function, while they can access most of their acquaintances. At the same time, a lot of students expressed their dissatisfaction with the huge amount of junk information Facebook being too noisy channel at the same time.

Those who indicated video conferencing to be their favourite form of communication expressed the parallel transfer of gestures and mimics as an important factor, making information transfer to be less misunderstandable (which could be so in case of lack of emoticons in chat services). At the same time, we can also see that a part of the students find video conferencing

inconvenient, as they “prefer to hide behind a nick name, not to reveal gender, colour, and only allow the transfer of thoughts”.

There were students who declared forums to be the most perfect form of communication, highlighting the fact (in contradiction to chat) that it is not necessary to answer immediately, but they could think more deeply before having to give an answer and could also refer to previous posts of others (that could be followed in a more structured form than in case of emails) to take into consideration the opinion of others before composing that of their own.

The survey also allowed students to rate their communication skills on a 5 scale Likert scale. We were also interested to know, whether they were ready to take a free course at our faculty on developing their own communication skills.

Most of the students considered themselves having good communication skills (4 on the scale), while the mean value turned out to be 3,68. The motivation in taking part on communication training indicated a mean value of 3,35. Nevertheless, the survey indicated that there is a slightly positive correlation between those who wish to participate on communication training and the level of their declared abilities, that is: those who are willing to be involved in communication training are mainly those who believe they have good communication skills. It might well be that those who declared themselves to have poor communication skills do not even find this skill to be so important, as they are not even willing to participate in such training, even though it seems they do need it the most.

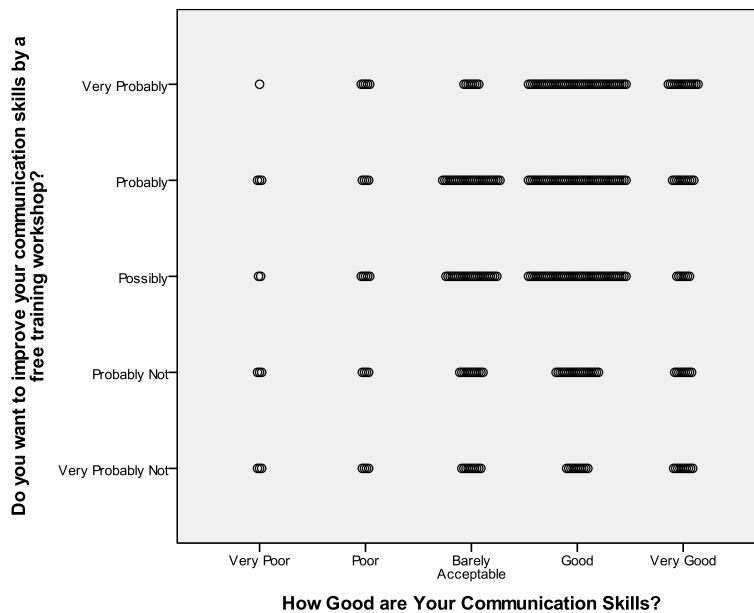


Figure 4: Scatter Plot of Communication skills vs communication skills development

It is thus highly recommended that before entering multidisciplinary project work, we should survey students not only on their level of technical skills, but also their communication skills.

The answers from students raised our attention to the need for use of VCS (Version Control System) integrated within our communication platform (especially important for programmers, but not outside of the general platform).

During our previous longitudinal studies within an integrated course involving program designer and informatics teachers learning about “Designing multimedia materials” to develop artefacts in groups of four as project work we analysed student’s behaviour and attitude in an online learning environment and examined the learning styles of students on different scales. Our previous findings have some relation to those experienced in this project [23]

- Though learning styles are highly debated, we were able to show some typical traces of similarities in program designers and informatics teachers.
- At the same time there should also be a slight difference between the two with respect to communication skills, as project communication proved to be problematic if only programmer students took part in the course.

Thus, we have to integrate all our findings into new design principles as a conclusion of this research in order to be able to take the next step to set-up a new platform for multidisciplinary workshop.

## 7. Design principles

We thus come to the point of formulating our next design principles:

- Since our main aim is to design and develop innovative artefacts, that not only qualify as a museum installation, but could produce research publications, we have to make sure that our own project ideas are definitely incorporated in the next process of project work. Thus, we plan to make direct connections with museums and work out topics that suit both partners beforehand.
- No matter how our project partners declare their knowledge and skills with use of technology and social media, we have to make sure that it is actually up to our expectations and for this reason we have to endorse a starting phase for levelling the knowledge needed for fluent project communication. Thus, we plan to offer a few days course for teachers at Arts University and museum pedagogues at our university before the semester starts, so that they get acquainted with the proposed technology and feel comfortable using the whole platform system designed.
- We have to make sure at the beginning of the semester that we start with familiarising our own students with the social media tools needed and as much as possible and build into the communication platform those that could be avoided to access from outside.
- We also have to make sure in the very beginning that we identify difficulties in communication skills among our students and make sure to build in some training elements within our courses to develop these skills as well.
- We have to choose a 2D platform for basic communication and force only those project participants into 3D platforms who are specifically entitled to develop such as their project work. The basic platform, however must have all the necessary tools that help project work to emerge with ease and at the same time provide privacy for innovative developments: chat, forum, videoconferencing, file-share, versioning, white-board, desktop share.
- Allowing work to progress in closed circles with respect of each museum seems to be a requirement from the side of museums as they are not so keen in letting their ideas spread, the least to other museums.



- However, we shall definitely put more effort in networking our own internal workshop (integrating different courses) through OpenQwaq and try to investigate further its use in production of creative program artefacts. In the last semester we started to hold some consultation hours within the OpenQwaq platform, which we shall further spread in the next semester, thus making our students feel more comfortable and trying to find out how we could facilitate ease of use also for those who are not so technical minded.
- We have to make sure that project teams would meet regularly online (no matter which platform used) and create tools that would allow further scheduling and produce a gadget that could be inserted into any browser to show whether someone from the team is on-line (just under development).

## 8. Conclusion

Virtual worlds are highly used in Higher Education, though there is still lot to explore on their benefits within the learning process. Lots of different 3D worlds exist for diverse aims, Second Life being the most popular among them, however a careful consideration in design efforts, social learning theory and a specific need for a task oriented virtual environment – that not just could be used for small collaborative meeting and networking, but also for sharing documents & knowledge, productivity tools for co-creating, visualizing and presenting ideas & projects, as well as consulting – really narrows the scope.

OpenQwaq technology has been chosen as 3D platform, which was released only recently, so there is just an emerging community of developers, apart from the fact that its origin, *TelePlace* (<http://www.teleplace.com/>) service has been around for some time. So, we had to live with the hindrance of lack of community support, but still believe that there is much to explore within this virtual world in supporting task-based productive work joining multidisciplinary teams.

We made careful considerations in choosing not only the virtual world but also integrated additional technology to produce a platform where step-wise immersion could be attained in mixed reality in order to enable participants to experience and master the use of required technologies for further development of different artefacts with relation to requirements from museums.

By bringing together students of different background and exploiting the artistic, creative approach and the professional ICT knowledge and skills, novel applications came to life in the first phase of the project, however the totally new mode of working together and also striving to satisfy museum requirements has taken away considerable attention from technology requirements and urge to experience the 3D immersive feeling and pulled back even the braver ones to the more consolidated 2D platform.

Re-examining the skills of our own students we found, that even though they are technology minded and find no problems in this field, their use of social media is very limited and their communication skills need much to improve in order to let ourselves go into a next phase of multidisciplinary project research without feeling any guilt in a proper preparation from our own side. Our research, though a bit out of scope, has lead us to recognise some more important design consideration for an effective collaboration platform and priorities in creating primary partnerships. We do look forward to the next phase of our research starting in the coming school year.

## Acknowledgement

We hereby wish to acknowledge the work of Péter Simon is setting up the OpenQwaq world. The Project is supported by the European Union and co-financed by the European Social Fund (grant agreement no. TAMOP 4.2.1./B-09/1/KMR-2010-0003 & TAMOP 4.2.2./B-10/KMR-2010-0030).

## 9. References

1. Bower, M., *Redesigning a Web-Conferencing Environment to Scaffold Computing Students' Creative Design Processes*. in *Educational Technology & Society*, 14 (1), 27–42. 2011. also at [http://www.ifets.info/journals/14\\_1/4.pdf](http://www.ifets.info/journals/14_1/4.pdf) (accessed 05.28.2012)
2. Turcsányi-Szabó, M., *Aiming at Sustainable Innovation in Teacher Education – from Theory to Practice*, Informatics in Education, 2012, Vol. 11, No. 1, 115–130, Vilnius University, 2012.
3. Brown, A. L., *Design Experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings*. *Journal of the Learning Sciences*, 2(2), 141- 178, 1992.
4. Santos, A., *Using Design-Based Research for Virtual Worlds Research Projects* [online, 2011.03.09]. *Journal of Virtual Worlds Research: The Researcher's Toolbox*, Vol.3, No1. November 2010, retrieved from [http://www.jvwrresearch.org/page/volume\\_3\\_number\\_1\\_the\\_researchers\\_toolbox](http://www.jvwrresearch.org/page/volume_3_number_1_the_researchers_toolbox)
5. de Freitas, S., & Griffiths, M. (2008). *The convergence of gaming practices with other media forms: What potential for learning? A literature review*. *Learning, Media and Technology*, 33(1), 11-20.
6. de Freitas, S., Rebollo-Mendez, G., Liarokapis, F., Magoulas G. and Poulouvassilis, A., *Learning as immersive experiences: Using the four-dimensional framework for designing and evaluating immersive learning experiences in a virtual world*, *British Journal of Educational Technology*, Vol 41 No 1, 2010 pp. 69–85, retrieved from <http://www.soi.city.ac.uk/~fotis/publications/BJET2010.pdf>
7. Inman, C., Wright, V., Hartman, J., *Use of Second Life in K-12 and Higher Education: A Review of Research*, in *Journal of Interactive Online Learning*, Vol 9, No 1 Spring 2010, ISSN: 1541-4914 - also at [www.ncor.org/jiol](http://www.ncor.org/jiol) (accessed 05.28.2012)
8. Kim, S. H., Lee, J., Michael K. Thomas, M. K., *Between Purpose and Method: A Review of Educational Research on 3D Virtual Worlds*, *Journal of Virtual Worlds Research* Vol. 5, No. 1, 2012, also at <http://journals.tdl.org/jvwr/article/view/2151/5973> (accessed 05.28.2012)
9. Herold, D.K., *Second Life and Academia – Reframing the Debate between Supporters and Critics*, *Journal of Virtual Worlds Research* Vol. 5, No. 1, Volume 5, Number 1 Assembled May 2012, also at <http://journals.tdl.org/jvwr/article/view/6156/5976> (accessed 05.28.2012)
10. Bowers, K., Davis, D., Neely, J., *Framing Second Life for Use in Higher Education: An Analysis of EDUCAUSE Review and The Chronicle of Higher Education*, in *The Journal of Virtual Worlds and Education*, Vol 1. No.1. 2010 (pp 136-165) also at <http://www.jvwe.org/publications/jvwe-volume-one-number-one.pdf> (accessed 05.28.2012)
11. Nah, F., Eschenbrenner, B., and DeWester, D., *Enhancing Brand Equity Through Flow and Telepresence: A Comparison of 2D and 3D Virtual Worlds in MIS Quarterly*, Special Issue: New Ventures in Virtual Worlds, Volume 35, Number 3 (pp. 731-747) — September 2011 also at <http://misq.org/enhancing-brand-equity-through-flow-and-telepresence-a-comparison-of-2d-and-3d-virtual-worlds.html?SID=q2r3c0nikjcc5q2qtcnr9o3d66> (accessed 05.28.2012)
12. Alrayes, A., Sutcliffe, A., *Students' Attitudes in a Virtual Environment (Second Life)*, in *Journal of Virtual Worlds Research*, Volume 4, Number 1, Metaverse Assembled 2.0, July 2011. also at

<https://journals.tdl.org/jvwr/article/view/2107/5540> (accessed 05.28.2012)

13. Kemp, J., Livingstone, D., Bloomfield, P. R., *SLOODLE: Connecting VLE tools with emergent teaching practices in Second Life*, in *British Journal of Educational Technology*, Vol 40 No. 3, pp. 551-555, 2009.  
also at <http://onlinelibrary.wiley.com/doi/10.1111/j.1467-8535.2009.00938.x/abstract?userIsAuthenticated=false&deniedAccessCustomisedMessage=> (accessed 05.28.2012)
14. *Consumer Guide to Virtual Worlds*, The Association of Virtual Worlds, 2010. at <http://www.associationofvirtualworlds.com/publications/bluebook/> (accessed 05.28.2012)
15. *An Enterprise Guide to Virtual Worlds*, The Association of Virtual Worlds, 2010. at <http://www.associationofvirtualworlds.com/publications/the-green-book/> (accessed 05.28.2012)
16. *Benchmark of 3D virtual environments*, Professional Collaboration and Productivity in Virtual Worlds, 2012 at <https://blogs.aalto.fi/allthingsvirtual/files/2012/02/Report-3.pdf> (accessed 05.28.2012)
17. Turcsányi-Szabó, M., Csizi, L., Végh, L., *Virtual worlds in education – best practice, design and research considerations*, *Journal of Teaching Mathematics and Computer Science*, University of Debrecen (accepted – under publication), 2012.
18. A. Schmeil, M. L. Eppler, *Knowledge Sharing and Collaborative Learning in Second Life: A Classification of Virtual 3D Group Interaction Scripts*. *Journal of Universal Computer Science*. Vol. 14, No. 3, 2008.
19. Smith, M., Berge, Z.L., *Social Learning Theory in Second Life*, *MERLOT Journal of Online learning and Teaching* Vol. 5. No. 2, 439–445, 2009, retrieved from [http://jolt.merlot.org/vol5no2/berge\\_0609.pdf](http://jolt.merlot.org/vol5no2/berge_0609.pdf) (accessed 05.28.2012)
20. Bandura, A., *Social learning theory*. New York: General Learning Press, 1977.
21. Csikszentmihályi, M., *Flow: The Psychology of Optimal Experience*, New York: Harper and Row, 1990.
22. Turcsányi-Szabó, M., Simon, P., Abonyi-Tóth, A., Ekker, N., Ruttkay, Zs., *Augmenting Experiences – a Bridge Between Two Universities*, *Proceedings of ISMAR 2011*, 2011.
23. Béres, I., Magyar, T., Turcsányi-Szabó, M., *Towards a Personalised, Learning Style Based Collaborative Blended Learning Model with Individual Assessment*, in *Informatics in Education*, 2012, Vol. 11, No. 1, 1–28, Vilnius University 2012 also at [http://www.mii.lt/informatics\\_in\\_education/pdf/INFE195.pdf](http://www.mii.lt/informatics_in_education/pdf/INFE195.pdf) (accessed 05.28.2012)