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► To cite this version:

Pasi Mattila, Jukka Miettunen. Motivating learning in mobile and game-based environments - Experiences in everyday classroom work - The path to the School of the Future. Michael E. Auer. Conference ICL2007, September 26 -28, 2007, 2007, Villach, Austria. Kassel University Press, 10 p., 2007. <hal-00257152>

HAL Id: hal-00257152

<https://telearn.archives-ouvertes.fr/hal-00257152>

Submitted on 18 Feb 2008

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Motivating learning in mobile and game-based environments

Experiences in everyday classroom work

The path to the School of the Future

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Key words: *m-learning, game-based learning, inquiry learning, school of the future, 21st century learning*

Abstract:

The world around us has changed. The pedagogy of the classroom has stayed more or less the same for decades, offering a stark contrast to the rate of change in other fields. Inspiration for change can be found in the veritable passion for new technologies, such as mobile devices and game technology, displayed by younger generations. The real challenge is to import these technological advancements into the classroom and, furthermore, educating teachers about the possibilities they hold. We have researched the core pedagogy of classroom learning and mobile learning for the last years. In this paper, we describe the School of the Future program and its goals and also what is the role of mobile and game-based environments. We will argue that classroom pedagogy must change in order to respond to modern requirements and those of the future.

1 The Background. Towards to the School of Future.

Between 2008 and 2010, the City of Oulu in northern Finland (www.ouka.fi/english) will give birth to an entire new section of town called Ritaharju. The area and its 7500 inhabitants will be situated in the immediate vicinity of the university and a concentration of technology companies. The school and activity center in the center of Ritaharju will supply the residents with school, day care and library services, catering for young and old alike.

The School of Ritaharju has been designed to function as a smart school -- a school of the future -- and it will aid other schools in the city and the entire country to develop educational technologies, teaching practices and contribute to modern school development and construction. The practices gleaned from the experience can be scaled to fit the needs of schools around the globe.

The school has been chosen to participate in the international School of the Future network alongside 12 other schools worldwide. The aim of the network is creating a learning environment that meets the challenges faced by 21st century learners and prepares them for the future. (<http://www.microsoft.com/education/innovativeschools.mspx>)

The path to the School of Future consists of the pre-work done; MOOP-mobile learning experiences, experiences of the game-based environments combining it to the work with Ritaharju school planning.

2 Ritaharju School of the Future – the heart of the community

2.1 Ritaharju community

The Ritaharju area and the community are a living combination of five key factors:

- (1) The people -- the residents of the community and their sense of community spirit
- (2) Unique cooperation between local residents and authorities, university and research institutes and enterprises
- (3) Infrastructure with ubiquitous information technology
- (4) A multipurpose building with a school and an activity center -- the heart of the village, open to everyone, in use at all times
- (5) Activities that bring the residents together to interact with each other and help them make a difference

The modern and dynamic activity center will contain many innovations such as the classroom of the future, projected spaces, and a smart gym. New concepts of teaching and administration will support 21st century teaching and learning. By directing attention to liveability, personal interaction and the well-being of the school's inhabitants, pre-emptive measures can be taken to promote the welfare of the staff and aid troubled students. After its completion, the model for the school of the future will be scalable nationally and internationally.

2.2 Supporting sub-projects and Smart Schools

The following sub-projects supporting the building efforts of the activity center and the school will begin in the fall of 2007: Rita-Life community application, classroom of the future and projected spaces, smart gym, development of digital learning materials, training programs for the staff of the activity center, efforts to enhance well-being in the school environment, community programs, and ecological sustainable development programs. The detailed development of the building based on the winning design of the architectural competition, Wigwam, will commence in October 2007. It is important that development efforts take into consideration that the building will be put to use to cater for the needs of the entire community.

Ten Smart Schools were selected in the spring of 2007 as the sites of pilot projects for the Ritaharju School. The best practices will be evaluated and refined before they are transferred to the working community of the activity center and school. Smart Schools will determine the values and common goals that will inform the formulation of the required skills of the student the 21st century.

3 Previous experiences. Helping the process for the School Of the Future

3.1 Mobile learning – MOOP project

Interest and enthusiasm in the SOF project did not emerge out of thin air in the Department of Education in Oulu. The endeavors around the project are informed and influenced by the positive experiences from the city's highly innovative projects centered on mobile technology. In what follows, we will discuss briefly some of the pedagogical principles of the Department, previous projects, and an upcoming project developed for SOF.

We see learning as a process of inquiry during which a student outlines his or her thoughts on a given topic and collects information and observations from his or her surroundings accordingly, reporting the findings as they surface. The MOOP project was designed along these lines utilizing mobile and web based learning environments and based on a model of learning that emphasizes research, information management, and creative problem solving as ways of structuring and acquiring knowledge. Tangible results in the use of mobile devices in teaching and learning have encouraged us to continue the development of alternative learning environments for the school of the future. During this development work, it has also been possible to test out new ideas in various teaching situations and filter them through different pedagogical models.



Figure 1. Learning through research (Hakkarainen et al, 1999)

One tool of note is the mobile terminal. With the added benefit of the camera phone, this device goes where the student goes and its familiarity motivates the child. The MOOP project was integrated into an elementary school curriculum for three years. The camera phones were used in normal teaching situations whenever it was purposeful and practical. The groups using the devices ranged from kindergarten to young people in high school age, but adults got to test them in action as well. The kindergarten children observed and recorded their daily routines and posted them on a network where their parents and especially grandparents living out of town could view and comment on them, allowing them to participate in the child's daily life and rearing. All parties perceived these activities as meaningful and important. In elementary school groups, lots of tasks involved locating points on an obstacle course where students performed learning assignments in the vicinity of their school and homes. The assignments were centered on a given problem. Information concerning location was used to gather additional knowledge related to the observations and to guide the movements of the groups. Tasks like these are suitable for children from age 11 to 14 and support a learning process that emphasizes independent research. The mobile phones given to each of the students were discovered to be a natural extension to the learning process. Groups with older students used

the devices to gather information of the surrounding area and used the data to help instruct younger students or to build databases of nearby services.

Basic education "model for knowledge building"
future information society skills

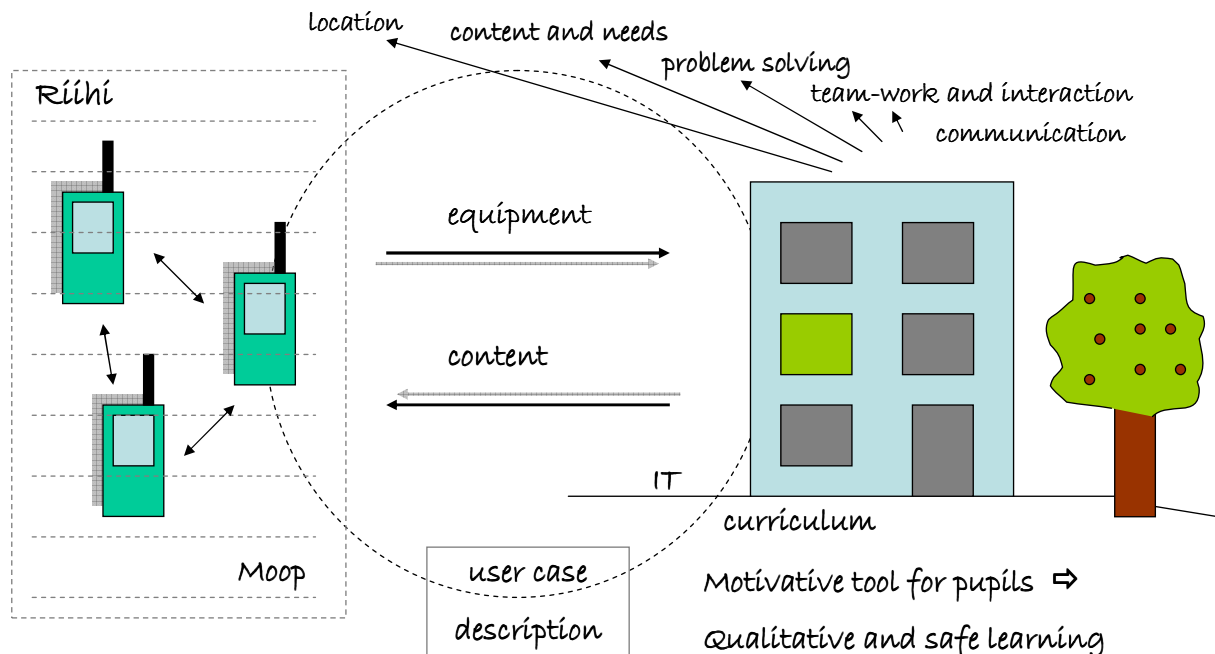


Figure 2. Innovating future services in education.

The MOOP project achieved good results and it generated a learning environment that has been adopted as one of the first applications for the school of the future to supplement the more traditional virtual environments already in use. The content of the MOOP project supports the notion of a prosumer. Traditional methods of information retrieval from the Net or other sources turn the learner into a consumer of information. When the students use their mobile devices and the MOOP application to record their own observations, observations which are useful for the individual student as well as the rest of the group, one can speak of an agent who is central to producing as well as consuming information, a prosumer. In this case, the prosumer produces useful observations for his or her own work and shares them with others, giving everyone the possibility to use these observations as they wish.

3.2 Game-Based Environments

The traditional notion of a learning environment has expanded to cover virtual spaces. Today, these virtual learning environments are often network-based and readily accessible to a certain group of students. Virtual meeting places are extremely popular among young people. Their very popularity can occasionally even present problems for everyday schoolwork. Thus, attempts to harness these new tools and environments for learning purposes are worth undertaking. These considerations have inspired the project that has produced a 3D virtual learning environment. The space itself and its virtual inhabitants are based on historical data. The players who enter this environment learn by interacting with the game world and other players.

The games designed for this space offer challenges the players try to solve as a team. They emphasize group work skills, group interaction, and cooperation in various conflict situations that have to be negotiated inside the virtual world. Historical information plays a key role in game play and thus the learning experience is integrated into the events of the games, making learning fun. The game concepts were produced in cooperation with the Department of Education of the City of Oulu and LudoCraft, the Game Design and Research Unit of the University of Oulu. The activities embedded in this virtual space offer a game-like environment that supplies the players with bits of information which carry the plot of the games and provide an interactive learning experience. The convergence of gaming and learning environments expounded through the description of these projects challenges traditional notions of teaching and learning, changes the way these concepts are viewed, and creates an alternative perspective to the distribution of information.

The core in developing and using the game and learning environment in teaching is Inquiry-based learning (IBL). IBL is a project-oriented learning model and pedagogic strategy based on constructivist and socio-constructivist theories of learning (Eick & Reed, 2002). This learning process by exploration of the natural or the constructed/social world leads the learner to questions and discoveries in the seeking of new understandings. With this pedagogic strategy, children learn science by doing it (Aubé & David, 2003). The main goal is conceptual change. A micro world implements constructivist instructional design models that lets the learner "play" within an artificial or real environment and learn by building things. The purpose is to give students the resources to build and refine their own knowledge.

Young media consumers want to be active participants in rather than passive observers of information. This is particularly apparent in their use of the Internet – they are at home in networks and virtual environments. Previously, the Net was conceived merely a source of information, but today the social and communal nature of virtual network environments is recognized. Information is actively constructed online through the exchange of opinions and images. Furthermore, users want to be able to influence their virtual environment and not only act as consumers but as producers of information as well. In the learning environments of the future users will be able to manipulate content to suit their present needs. These developments, in turn, will present challenges to individual schools as well as pedagogy in general.

Games and play are natural activities and part of everyday life. Before the advent of mobile and wireless technologies games were tied to specific occasions and locations. Today, games are capable of producing a forum where people can establish and uphold relationships with others. The societal role of games is transforming gaming from a mere pleasure-seeking activity into an incremental part of modern society, especially in youth culture.

People use games as a means of expression. Gaming is a phenomenon that touches nearly everyone. Games and game environments provide a space wherein one can solve problems, interact with others, and build social networks. They also present opportunities for exploring and developing one's emotional life. Furthermore, as shown by Gee (2003, p. 205), games operate with solid principles of learning that are better than those in many of our skill-and-drill, back-to-basics, test-them-until-they-drop schools. Games are often multilayered and can contain a vast variety of activities, address any number of interests, and provide countless possibilities for human interaction. In the future, it is crucial to develop genuinely innovative educational games for large audiences in order to counterbalance the mass of violent games on the market. As such, games will have an increasingly important part to play as learning environments and methods of teaching (cf. Lim et al. 2006).

How to use Games to Construct Meaningful and Motivating Learning Situations? Earlier research has suggested that games can have a positive impact on learning, since they support intrinsic motivation, and give opportunities for imitation and learning by providing feedback, fantasy, and challenges (Rieber 1996). The purpose of play is to practice everyday skills. In order to motivate the player, a game must have a goal. This goal produces a challenge for the player and motivates him or her to develop the skills that are required to reach it. Digital games fulfil the central requirements of purposeful play (Ermi et al. 2004). Learning need not be the explicit objective of play, but any given game requires some learning to take place. The charm of play and the popularity of digital games inevitably lead to the question: Can gaming be used in teaching? Through games, children are often prepared to go to great lengths in order to achieve their goals.

Playing games develops one's style of thinking towards an experimental, game-like approach to problem solving. The activities that take place within a game are circumscribed by a set of rules that have been agreed upon beforehand (Salen and Zimmerman 2004). In addition, the game acts as a learning space in which the learner is able to take risks where real-world consequences are lowered (Gee 2003, p. 62).

Online games and various virtual game environments are steadily gaining in popularity. Gaming is as much a hobby as reading books, but often this is not recognized by parents. Children are especially attracted to action and adventure games. Furthermore, children more often than not resort to their circle of friends in their choice of games and thus gaming is at the outset a social affair. Young students view games as meaningful and motivating environments that enable them to exercise their faculties, actively explore various subjects, meet with friends, and create and uphold relationships with others. In contrast, most parents and educators view games as entertainment.

In 2005, the City of Oulu celebrated its 400th birthday. The very same year, the city hosted an event known as the Festival of Schools and welcomed 12,000 school children and teachers from all over the country to participate in activities associated with the event. One the largest workshop at the Festival was dedicated to communication and media skills and the workshop needed something new and exciting to attract students. This need was met by designing an educational 3D gaming environment.

The virtual game environment emphasizes group interaction and cooperative skills, testing these skills in various challenging conflict situations that have to be resolved through teamwork. The game itself is a multiplayer game designed for up to 30 simultaneous players. It should be noted that the objective of the designers was to avoid the inclusion of any violent or destructive elements in order to ensure the applicability of the game for educational aims and younger players.

The environment is a faithful representation of the area surrounding the Castle of Oulu in 1651. The model is based on historical documents and drawings from that period. Some fictional elements were added to enhance game play.

The moderator sets up the game on the server according to the age and number of participants, assigns a preferred duration for the game, and adjusts the difficulty level. Each player is assigned a name, a character, and a specific mission. The assigned characters are based on typical professions and social classes of the period such as peasant, clergyman, merchant, or soldier. A typical mission statement reads: "You are a shopkeeper and your job is to buy and

trade as much merchandise as you can. In addition, you have to contribute to the mayoral campaign of the merchant Anders Mattson by acquiring votes." The other players receive similar tasks associated with various professions. Some of the players act as henchmen, creating discord and thus adding suspense to the game. The players score points according to their performance on a given mission. The teacher, acting as moderator, can assume the likeness of a bird or a dog in order to move freely in the environment as an observer.

The user interface of the game is simple and straightforward. Movement in the game environment is controlled by the arrow keys on the keyboard and the computer mouse. Exchanging items and other related actions take place using the function keys. The objective of the project was to investigate the educational use of a 3D gaming environment targeted for students 9 to 16 years old. Given the relatively short amount of time that was available for design and production, the game itself can be considered a success. Despite the fact that before the final field experiments the game had not been tested on large groups involving more than 10 players, the game environment was found to be stable and reliable.

Preliminary findings based on the oral and written feedback suggest that a game-like approach to historical materials is motivating for the students. As with the use of print or following learning material in multimedia form, assuming a character in a virtual world can act as a valuable supplement for the learning process.

New teaching programs often emphasize community, the importance of communication, and media skills. The game showed potential for the realization of precisely such objectives.



Figure 3. Bird's eye view of the area surrounding the Castle of Oulu

The positive feedback from Adventure in the Castle of Oulu inspired the team to conceive of a second educational game. Unlike in Adventure in the Castle of Oulu in which game play took place in a closed environment coordinated through client programs, the game's follower was designed to function on the Internet and contain the possibility of interfacing with other

learning environments and technologies such as mobile devices. The 3D game engine software created for the project was designed with future projects in mind.

The central idea behind Virtual Snellman is to create a virtual learning environment that contains a wealth of information about Snellman and his contemporaries, and to transport the player into their historical surroundings. The learning environment will also contain exciting game-elements such as various objectives and goals, role-playing and colourful characters, and an exciting plot. Students will be able to develop strategic thinking as well as problem solving and decision making skills. Furthermore, the learning environment will enable the student to be a part of a group and interact with his or her social network.



Figure 4. A street scene from Snellman's period and game environment

This Snellman-themed learning environment will be realized as a game in order to attract students. The purpose of the game will be to introduce the students to fascinating historical materials in an exciting way and thus make the learning experience a captivating one. A game-like environment will offer the player the opportunity to shape the learning experience to suit his or her interests. A game that emphasizes action will make the relationship between the individual player and the information imparted by the game an active process in which interaction and communal goals are raised above the gathering of factual knowledge.

The two case projects described in this paper approach the problematic area of educational games with a hands-on mentality. Since an educational game cannot deliver if either the educational content or the game itself fails, there is a need to combine the two domains into a seamless multidisciplinary effort. The two-year collaboration between pedagogical experts and game design researchers has provided us with a wealth of information – and critical questions – that can be used in future work. How to present information to young students in a meaningful and exciting way? How to bring books to life? Is it possible to deliver the same information using games?

This tool enables the simulation of real-life situations which can then be tackled inside the safety of virtual reality. Travelling through the environment can itself be considered a learning experience. Furthermore, the flexibility of the digital information supplied by the environment enables it to be exported into other applications and platforms, such as mobile devices, in the future. Virtual learning environments demand a fresh conception of information and teaching, but they also supply new possibilities for uniting learning in the real world and learning that occurs with the aid of computer networks.

Games present a difficult situation for teachers and parents. Due to the fast pace of modern culture, teachers and parents find it difficult to keep up with progress. Teachers and schools can no longer view themselves simply as distributors of information. The focus of education is shifting towards the task of understanding a computerized digital world that contains great amounts of noisy information. Active learning such as this produces a learning experience that the student will remember for a very long time. Learning, in this sense, consists to a large extent of adapting and processing information to suit a great variety of different contexts. Experience has shown that young students are drawn to game-like learning environments and find in them the necessary motivation to undertake the study of a given subject. Retrieving strategically placed bits of information produces a clear picture of the subject as a whole, provides an enjoyable gaming experience, and, most importantly, inspires learning.



Figure 5. Gamers in action

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