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PROJECT BASED LEARNING ON MULTI -TOUCH SYSTEMS

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***Abstract**: Combining eLearning as a training and teaching didactic technology with project-based learning as a method and using a multi-touch platform as a workspace, I define „project based eLearning" whose virtues are or not to be proven.*

The application of this concept in military training (both in academia and upper secondary military schools) may accelerate the information coverage time by students and it can especially get the students „closer" to the real situation even from the period during training.

***Keywords:** eLearning, project based learning, competences, multi-touch, didactic, cognitive gain*

I. THE NEED OF CHANGE

Education, training and instruction, as complex social entities and engines of development in any society, with all range of forms – formal, continuous, vocational, conjunctural – has benefited, however naturally, from the support of technological evolution at any historical moment. It is also interestingly how, nowadays, education and technology have exponentially boosted one another into a spiral whose central node cannot be defined, although its branch is clearly outlined by divergence. Where do we turn to within the Knowledge Society?

It is known, however, that learning paradigms are continuously changing, an almost transparent dynamic that, unfortunately, is only intended to describe what has already happened. What was the influence of the invention of paper on educational systems, movies or computers? We can define measuring parameters, we can define metrics of progress, obviously considering all this as evolutionary forms.

Research on the use of multi-touch, multi-sensorial systems in continuous or formal training and teaching, by redefining the curricular fundamental forms – the shift from an education based on a vertical curriculum to a skills training through trans-curricular project-based learning using multi-touch systems – represents a large scientific approach and is also very bold. The history of technology use, always considered new at the time and sometimes regarded with reticence in education and training, gives though an encouraging signal in terms of multi-touch technologies.

According to the „Education and Research for the Knowledge Society" Strategy, „the current research in learning sciences as well as the beneficiaries of the education system support curriculum centring on skills, not on information" meaning on „blocks of knowledge, skills and attitudes that optimize problem solving"; the way of applying the trans-disciplinary curriculum by teaching projects proposed through the present paper embraces this goal. It does this through the fact that the project method is a learning and evaluation strategy focused on the deliberate researching effort, on seeking and finding answers and on problem solving. This approach will give all target group categories throughout life learning skills, digital competences, including axiological or value skills, necessary for active and responsible participation in society – key competences required by „Education and Research for the Knowledge Society" Strategy.

1.1 Scientific premises

Information and communication technology is a major support for the transformation of education and training systems from the vertical model of knowledge accumulation to the vertical and collaborative model of skills development.

Modern technologies are a complementary support for the efficiency growth of the educational act, and not an alternative option. They act as a catalyst between the cognitive and affective objects of the formative process.

Project-based training, with or without support from the multi-touch technology, is much more efficient than the classic model, but in the same time, it is much more oriented towards the higher levels of the formal educational system. Moreover, it is a very good model for the military domain, increasing the cohesion and teamwork through the complementarities of individual knowledge and skills synergistically oriented towards a unique goal.

II. EDUCATION AND TECHNOLOGY

Let's start with a basic question: What makes a designer or an innovator different form a person who has a big idea?

In the exponential dynamics of technological evolution, the answer is how long we are willing to wait for an idea „to popup". The designer or the innovator creates over time relying on what that unique, genius idea has revelled. That's why we can say there is room for everybody. Things are the same with the pedagogical design of eLearning projects. And that's because the necessary time to define the predominant type of intelligence of every student or pupil, according to Gardner's theory on multiple intelligences, to define a special, unique and unrepeatable personal learning sequence would overcome the utility of such an approach.

Therefore, the designer must be consensual and must cover a large range of personality types that will make use of it.

So, how do I do it? Allow me not to know, for now, the answer to this question, for if there would be a bibliography, or if there would be a simple answer, the project would become redundant. Then I recommend "The order of magnitude" as rule, which is read as follows: When one thing changes any of its significant dimensions by one increment, than that thing no longer may be considered the same[1].

An exaggerated conclusion would be that we are starting a new way to educate.

However I do not rush to such a conclusion; before having the blackboard, we had slate boards. We haven't changed the pedagogical concept or the formative one by using paper instead of board. The project is still didactic. Slate, wooden board or painted glass, paper, chip (also a kind of slate if we think that it is calcium carbonate and silica) all use the same "operating system", reusable for millennia, with only one update every few centuries, the same interface. Technologically speaking there is no innovation here, other than the fabrication technology.

Still, a comparison between the impact of paper (around the year 1860 it began to be used in the educational process) and the impact of the computer and the internet should be taken into consideration.

Keeping the same proportions, let's make an exercise of imagination. How can I transfer the impact of pedagogical technologies (their dynamics) on the educational systems to the urban, social life from outside the school boundaries?

What if the real estate industry would be as cheap as a student's access to high speed internet?

What kind of cars would be driven if the automobile industry would have had the same dynamics as the industry of pedagogical technologies?

...and the list of question may go on.

There is a big confusion around multi-touch technologies, and despite their 25 years long history, very little concrete information or experiences were made on this technology.

[1] Bill Buxton, main reasearcher at Microsoft

However, you should compare the complexity of this device with that of a mouse. It took 30 years from the invention of the mouse in 1965 to its large scale utilization after the launch of Windows 95. I don't think we will wait another 30 years for using multi-touch technologies for teaching, training, education.

Turning back to the pedagogical aspects, perhaps the major impact will be given by the dualism between discrete and continuous. How willing are we (curricular designers, instructional designers, pedagogical experts, teaching practitioners) to give up to the discrete formalism that we are used to, to the operational objectives which are mapped over the curricular elements in a way that is both perceivable and measurable, and beam ourselves up, in exchange, to a new level of reasoning in the continuum of the complex reality where the final objectives is gaining new competencies?

A „project based" approach on the multi-touch systems gives us no limits in defining the degrees of freedom for the cognitive system. The wealth of interaction is strongly related to the wealth/number of degrees of freedom and it particularly pursues the degrees of freedom, supported by technology.

2.1 Multi-touch technology

The multi-touch technology is based on a dual image projection system superimposed over the image perception. A relationship between transmitter and receiver which allows the alteration of an image projected on a screen by "reading" the action with a video camera of a specified type.

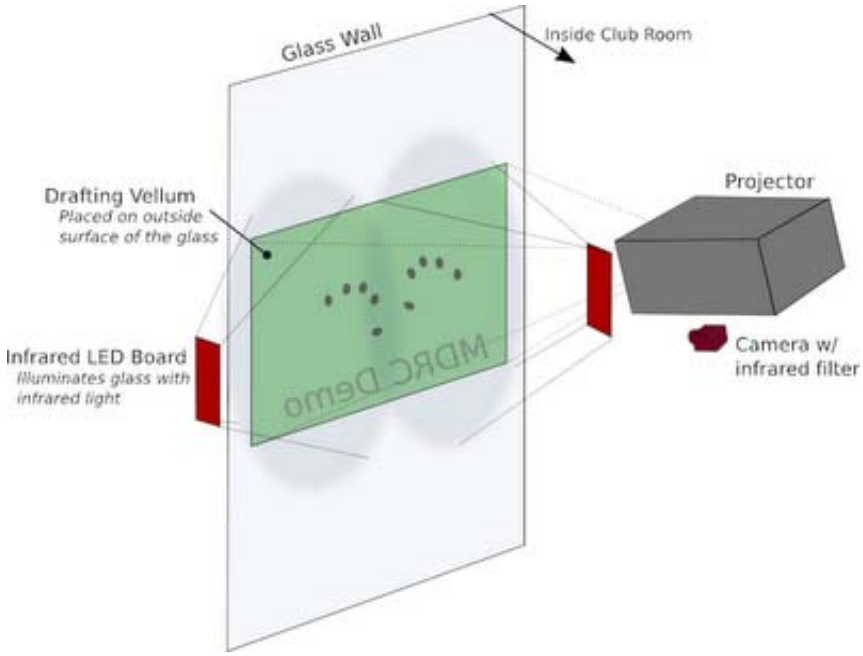


Figure 1. The basic scheme of a multi-touch device

For the two most familiar technologies, MS Surface and SMART Table, we have a classic, common projector which uses an image from a computer, the image having been produced with a computer software. The infrared camera perceives the hand motion and operates within the software similar to a mouse, giving the illusion of "alteration", "modification" of forms.

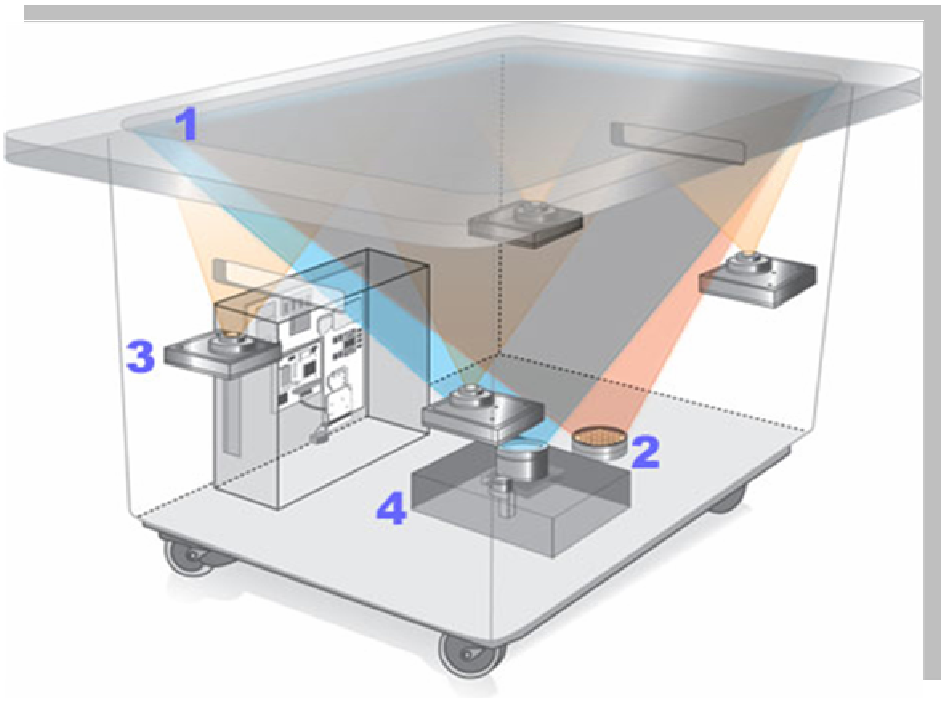


Figure 2– The architecture of a multi-touch work table

1. Work screen: An acrylic surface with diffuse illumination. The processing of multiple inputs from multiple users is performed by an infrared camera (2). Recognition of actions or objects is performed either through decoding domino-like tags (superimposed on an imaginary grid), or by identifying and comparing forms with existing ones in a pre-defined database.

2. Infrared camera. It operates close to the infrared spectrum using the light source of a LED within a wavelength band of 850-nano meters. When an object (or the user's hand) touches the screen, the light is reflected to a system of mirrors and is captured by a cluster of miniature cameras with a resolution of 1280 x 960 pixels.

3. Central Unit. The computer is a common type. The usual specifications are: Core 2 Duo Processor, 2GB RAM and a 256MB graphic card. It has wireless communication and ports that use WiFi and Bluetooth antenna (future versions will incorporate RFID technology or "Near Field Communications"). The operating system is a modified version of Microsoft Vista.

4. Projector: the multi-touch tables use classical DLP/HDTVS projectors. It works in visible light at a resolution of 1024 x 768 pixels and is usually miniaturized.

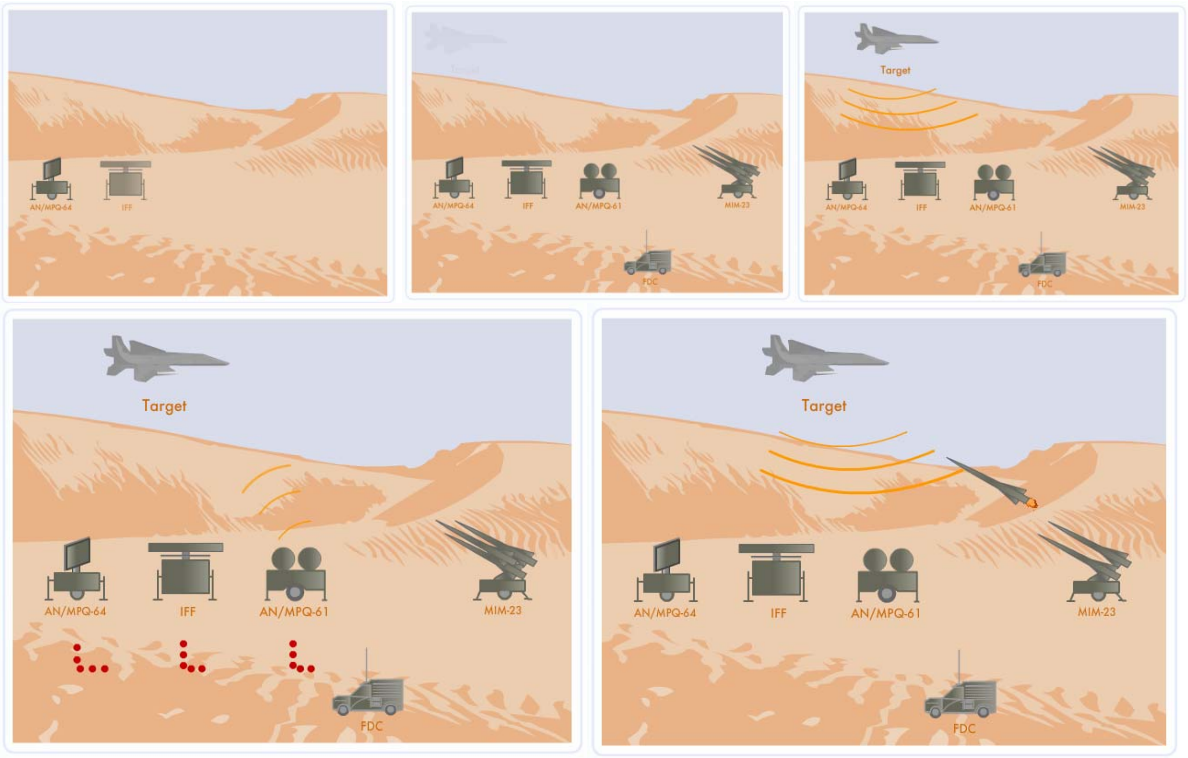
In terms of applications that may be developed with such technologies, the difficult part is the pedagogical script, and not the programming language or languages. The programming languages are the classic, standardized ones which are compatible with Microsoft OS: HTML, Dhml, Java, Java 3D, Flash, Cult 3D, etc..

The following example illustrates an application that allows “the organization” of the solar system.

Figure 3-Educational application on a multi-touch system. Building the Solar System

A teaching sequence illustrating military equipment used in radar identification of targets is the next step in strategic organization through a multi-touch simulation.

Figure 4-Military equipment in a sequence of educational software



The images above represent a simulation sequence of the HAWK XXI system and underlines the importance of the AN/MPQ-64 equipment during a countermeasure set up.

III. HOW IT WILL BE

The scientific revolution has only begun. It is said that it will have the potential to define a new era of innovation based on science, and therefore will outshine the last half of a century of innovation based on technology. Should this be the case, a new wave of Social, Technological and Economic growth will cover those countries whose national security strategy will include elements of support and sustainable development of the educational system within or our of globalisation.

The important challenges for governments, educators and scientific research communities must be linked to the technology transfer and to the development of new within- and cross-community communicational architectures.

Government institutions will need stability in the strategic educational projections, appropriate financing instruments and viable coordination mechanisms should they wish to have opportunities for progress.

In order to effectively support the scientific research communities and the educational communities, it is necessary to define new methods and tools for active strategy.

These tools must include, non-exclusively, metadata libraries, viable and coherent coding systems for facts and information through adequate semantic categories.

The construction of analysis and coordination flows for collaborative projects is likely to represent the viable way of defining, managing and implementing large projects. With the amendment that any such grand collaborative project coordinated among several entities must identify, define and solve security, confidentiality and copyright issues.

Although it is hard to imagine an entity that establishes a certain strategy that is inferior to a governmental decision-making structure, leadership must be assumed (the Spiru Haret example from Romania's history is not singular).

The strategic leader must assume both roles: teacher and mentor. As Noel Tichy2 reminds us, great leaders are great teachers. „They have that treachery point of view and a great capacity to invest in creating other leaders". These skills create, in fact, the educational basis of a strategist.

On the other hand, „project-based learning" is a relatively old3 teaching method in universal culture, but is difficult to put in practice due to ergonomic reasons. Even so, I put forward the necessity of defining certain standards by which this will be subject to at least one primary goal: systematic teaching method that engages students in learning and applying knowledge as well as in acquiring skills through a complex, structured and systematic didactic project that comprises events and tasks relevant to the real world. This attempt of defining can be completed if I add that project-based learning can have various forms: from small projects over a short time span, that can last for several days, with a single subject to projects expanded on a longer time span (e.g.: one academic year), interdisciplinary and involving a wider community.

At the same time, information technology has a higher degree of development than teaching. Therefore, multi-touch devices are already used in marketing, advertising and media. These hardware devices offer the possibility of a wide interaction with information, an interaction of a complex type, multi-sensorial, using both hands and having the possibility to work with both real and virtual entities, getting very close to what we call virtual reality.

Combining eLearning as a training and teaching didactic technology with project-based learning as a method and using a multi-touch platform as a workspace, I define „project based eLearning" whose virtues are or not to be proven.

The application of this concept in military training (both in academia and upper secondary military schools) may accelerate the information coverage time by students and it can especially get the students „closer" to the real situation even from the period during training.

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