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Role of the knowledge management in modern higher education – the e-learning

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The knowledge-based society of the 21st century makes the knowledge production the most significant sector. While the production of knowledge itself expands, it leaves its traditional fields of production in part and, at the same time, it establishes a tight connection with them and with the fields of their actual adaptation, it gradually becomes direct practice.
The need for a lifetime education is connected to the previous phenomena, which need means the basis of a carrier and long term success for the individual and is a fundamental condition for knowledge production for the organization. All these events require the complete renewal of learning models and methods, the field of education is to become practice-oriented and the adaptation of e-learning systems as well as distance education supported by computer technology. In their present study, the authors publish their experience gathered during e-learning developments.

Knowledge management and higher education

In these days the expression 'knowledge management' is perhaps the most commonly used term in management literature. Although it is interesting that the management of knowledge and the role of knowledge workers in connection with higher education are mentioned relatively less, though the system of higher education is precisely the place where not only the potentially future knowledge workers are trained but also the place where they are present as professors.[i] Whereas it is commonly known that in the society of knowledge, knowledge is a significant resource, while in its creation the so called knowledge workers[8] play the main role, therefore the endeavour is justified: so that the knowledge management and its range of means, the solutions of best practice already succesful in the world of business would be extended and utilized for the applications of a modern higher education. Taking into consideration that this issue is fundamental for the present higher education, let us take a closer look at what we call knowledge

[i] According to Sveiby's definition, the role of the knowledge workers is to turn information into knowledge by using their competence, pieces of information and other special knowledge services.[14]

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management. According to Davenport[7] the knowledge management is a kind of business model, which utilizes the knowledge as the asset of the organization to reach competitive edge. On the other hand it is also a management tool which promotes the evaluation, the utilization, the creation, the expansion, the protection, the division and application of the intellectual capital of the organization from an integrated approach. It is not difficult to accept that this definition connected to the world of business can be very well associated with that very up-to-date concept of higher education, according to which knowledge is considered a product whereas the university student is considered a client.

Let us take a look at how universities (especially the universities of the 10 new EU countries as well as those of the candidate countries) can meet these requirements, what shift of approach or change in their functions challenge them. Two things for certain: their integration and their role in the regions, as well as their potentially existing applied service of knowledge mixed with the knowledge of others on the market; on the other hand with the utilization of the knowledge property of the universities, or the better preparation of the knowledge-society's participants.

Let us take a look at these latter ones in detail.

Universities as knowledge bases

The knowledge-base role of universities and other higher education institutes and their related increased responsibilities become opportune through the following factors:

– The knowledge-based society of the 21st century make the "knowledge production", which is the main profile of the higher education institutes, the most significant sector. While the production of knowledge itself expands, it leaves its fields of production in part and at the same time it establishes a tight connection with them and with the fields of their actual adaptation as well as with their possibilities it gradually becomes direct practice, too.[ii]
– The need for a lifetime education is connected to the previous phenomena, which need means the basis of a carrier and long term success for the individual[11] and is a fundamental condition for knowledge production for the organization.[5] However

[ii] It is not by chance that in the most developed country of the world, that is, in the USA the so called regional knowledge centres – existing for several years now – usually evolved in close proximity to the most prestigious universities (among many other factors). However, from another point of view – according to certain experts – the industrial centres of the future are more likely to look just like vast complex research centres, since labour force tends to become more and more qualified, the financial dimensions of products and services shrink, yet the "built in" mass of knowledge is constantly complemented with new solutions along with the increase of the rate of the added value. (see e.g. Refs 4, 14, etc.)

this latter one requires the expansion of the methodology of education with practice-oriented, IT user approaches that can provide distance education.

– Whereas it is certainly a fact that the modern utilization of university knowledge can become a new valuable asset not only in the relations with market clients, but the feedback potentially coming from these relations can be applied for the enrichment of university education and for the direct "integration" of the cutting-edge knowledge as well. (This is of outstanding importance because the existing knowledge becomes soon outdated therefore the permanent reformation of the university knowledge bases as well as the the constant training of the individual are fundamental along with following the latest results while both have to be dealt with on society level.) So because of the co-operation with strategic partners:
  - the development of the subject material of syllabus structures at BSc level can approximate the real labour force market needs;
  - tutor systems can be built which would serve the development of students' talents and problem solving skills;
  - the competence-based adult education programmes (complemented with the concept of lifetime education) that meet the needs of the consultant bodies, chambers (and other lobby groups) and the business sector of the region can be launched with better chances – especially the e-learning systems developed within the confines of distance education;
  - the ways and means and knowledge management systems of university education can be expanded with the help of strategic partners with the most cutting-edge technologies, solutions and IT equipment – given by their nature of business.

It seems that on a social and regional level everything implies a closer co-operation for the universities with market leaders and other entities, with emphasis on the fields of knowledge integration, management of knowledge bases and distribution of knowledge. Within this phenomena the distribution of knowledge is given outstanding importance, which along with the need for lifetime education – because of the rapidly evolving knowledge that quickly becomes obsolete – mean a completely new role-dimension for the universities working still mostly in the traditional manner. No doubt that in this new role-dimension the networks – cooperating with the university innovation centres –, the knowledge production and distribution in a broader and tighter context and the e-learning system supporting them have fundamental importance. However, one has to consider and utilize the experience – unfortunately many negative ones – of developed countries (and this can be a useful warning for the universities of the ten new EU member countries who have relatively less experience in establishing an e-learning

system yet they have high hopes for them).[iii] Anyway, it is crucial to reconsider the conclusion drawn from the experience of the past – especially from the failures. Would it be true that the e-learning systems really do not have a real future, or a completely new approach is required towards the concept of learning, absolutely different from the approaches of the past and the essence of knowledge has to be reinterpreted as well. If the answer is positive, how and in what way should it be done? It seems that the pieces of experience imply the conclusion that in order to an adequate answer to be born for the teaching and learning problems that meet the permanent innovative requirements of our time, the re-interpretation of knowledge and new models are needed, in which models the adequate establishing and management of e-learning systems are to be elaborated. First of all the basic pieces of information and the reinterpretation of their role in the process of learning,[iv] and there is also the concept of learning understood as a permanent process where learning develops as some sort of transformation.[v] Therefore e-learning certainly has its place in the renewal of knowledge of both the individual and that of society, the things that must be clarified are the where, the how and the way. Perhaps the best way to see why it would be necessary for teaching and learning to be built upon a model of different logic – if the method otherwise perceived as efficient (the e-learning) is intended to be applied in an effective way – is to examine the conclusions drawn from the "dying" e-learning systems. (Otherwise it is not difficult to accept that in spite of the existing failures it is worth starting over and over again to find the suitable e-learning solutions, because – these days it is already clearly seen - this will be the road to take for the renewal of knowledge types of short expiry that is able to by-pass geographical distance as an indispensable knowledge-transfer.)

According to our judgement and experience the fundamental factor of and the key to a successful e-learning system is, to clearly see and divide the educational phases built on one another during the design of its modules.[10] (These modules are indispensable for

[iii] Jorgen Bang's essay on e-learning is a very interesting and instructive piece of work on this matter. It studies different sets of international experience, which leads to the conclusion that in spite of the enormous financial investments, the so called virtual universities – in most cases it is about the USA or the most developed European initiatives – they did not live up to the hopes of the creators. It is so till such extent that most of them went down. http://elearningeuropa.info/index.php?page=doc&doc_id=7778&doclng=12&menuzone=0&focus=1

[iv] It has to be accepted that in our era knowledge lost its one-dimensional character (the value of which was measured at the universities – in the classic sense – by examining the amount and level of acquisition of knowledge).

[v] This latter one can happen on either level (society, organization, group) the individual is always in the center. Therefore, it is fundamental to accept the fact, which derived from the spirit of our present time as a thesis that nowdays learning does not depend on age, place or time, but it is part of such a permanent and innovative transformation process to which the individual can join anytime, anywhere. Its constant evolution, the lifetime education is an essential part of that "destructive creation"[6] without which the greatest problems of our time cannot be solved.

us so that we could offer a curriculum matching to the needs and preparedness of the targeted group of students, which results in the learning effeciency we had intended to reach with the invested development. Let us take a look at a simple model to have clearer view on the topic.

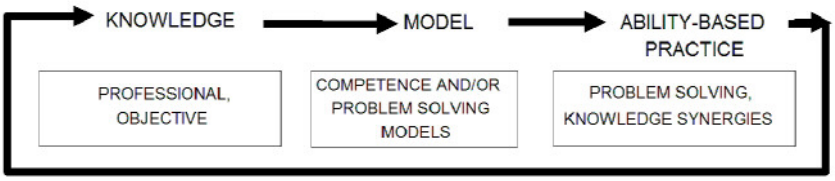

Figure 1. The model of knowledge acquisition

The Figure 1 presents that the modern teaching and knowledge acquisition are to include not only for the so called explicit (knowledge-based) knowledge transmission, but also for the so called tacit (hidden, problem solving) knowledge transmission – at least on the level of the basic problem solving processes. All this mentioned here are of great importance in the modern learning model because since the knowledge becomes obsolete in a rather short period of time, the ways of utilization are expedient to be supported with model-like practice, as experience shows us that in this way the individual with a little routine in problem solving has better chances in understanding the evolving situation, finding the suitable solution and making the right decision in a difficult position. (It is not by chance that in flight training simulation has been applied for a long time.)

The model can be adopted as the new learning model, too. Because according to the evolution-spiral of Hegel's dialectics upwards, based on the process of lifetime education, knowledge can be built in and activated if we interpret it in the context of Hegel's evolution-model it can be clearly seen that this acquisition-model is not a single one but always targets a higher and higher level. However, we think that the model takes us close to the fundamental dilemmas of the e-learning education systems. First of all it has to be clarified what sort of logic should be applied in e-learning curriculums, whether it should be based on knowledge acquisition or problem solving or a third logic mixed from the previous two? This is quite a dilemma! On one hand, knowledge acquisition (either based on deductive or inductive logic) – if it intends to remain efficient – goes by linear logic. (It is not by chance if an e-learning curriculum follows mainly knowledge-based logic, sooner or later the student – in defiance of the expensive on-line solution – will download the curriculum and will use it like a book during knowledge acquisition.) On the other

hand, the logic of problem solving is certainly not of linear type. If we want to get closer to understanding itself, we have to apply the method of modelling. But if we want to practice problem-solving – in the interest of the acquisition of actual competence – we have two possibilities: we practice in real situations on the "field" or under some way simulated circumstances in a model-like situation.

On the basis of those mentioned above it seems quite obvious that just because of the maximal utilization of modern computer and multimedia possibilities in the acquisition process, it is not worth going by the logic based on knowledge acquisition. The reason for that is that in many cases it is not only impossible to utilize all the advantages of the modern equipment and methodology but also it is many times unnecessary or in some cases even disturbing. This, of course, does not mean that e-learning curriculum should not contain any data-like information, but its positioning and amount have to serve the interest of better understanding and a more efficient acquisition to solve the given problem. (So this means that we can offer knowledge for example in case of technological transfer or higher education training. Yet they do not have to be processed with ultraexpensive technical ways, but a simply downloadable book-like – usable like an appendix – description can be appropriate for the purpose as well.) The models will be offered in the problem solving phase of acquisition, for the demonstration and operation of which – if necessary – multimedia solutions can be adopted, of course depending on the nature of the simulated problem. Then in the end, such interfering model-solutions should be practiced that can present the importance and significance of the interfering and/or solution to the student doing the acquisition (for example going through the model of a chemical process as a result of his/her correct or incorrect actions, the student could experience the consequences of those actions immediately, for example an explosion, if that is the case, etc.).

In this "dialogue"-like structure tests can be used very effectively, furthermore the discourse and acquisition control with the tutor as well as the complex study written with the tutor's support are very useful, too, of which I would like to present some representative solutions. With the help of the relevant examples we aim to present that the more one succeeds in leaving the traditional model-solutions behind, the more it is about "deep down inside". The background content of the present work is to built up such a system of models that would stimulate the problem solving thinking according to the professional hierarchical levels of the competence-system in question, complemented with further solutions (for example IT solutions for experimental interventions performed on model-cases, developments complemented with e-assessment techniques), and that the acquisition of the latest scientific results of the given field cannot be done within the confines of traditional learning models.

The examples mentioned (since the experimental e-learning expansion is conducted at the Zrínyi Miklós National Defense University – ZMNDU) are from the field of military science. But with the help of the appropriate analogies it is not difficult to accept that with the utilization and profiting of the specifics of each test-type, any subject, type of competence or system of competence from any kind of field can be processed this way.

Now let us examine some relevant examples in connection with certain test types.

Knowledge based e-tutoring

The e-pretest

The students participating in e-learning or distance learning course themselves can organize their learning and can hold intercourse with the tutor of the curriculum through the Internet. After taking over the curriculum and related CD and guide, students have to apply an *e-pretest* to the tutor in a prescribed e-mail format. For example, see an application e-pretest[vi] like application form of multimedia curriculum of authors *Research and Development in Military Technology*:[10]

The application e-mail contains:

- the applicant's personal data;
- the applicant's availability data;
- the planned user name and password for the application to the senior master (tutor);
- in relation to the multimedia curriculum
  - hardware and software required for its application;
  - level of knowledge needed for learning it;
- other data the student intends to inform the tutor.

The tutor informs by e-mail the applicant about acceptance of the application and the information necessary to register at the Intranet system of the University. Then, the applicant in accordance with his individual plan begins the process of learning during which he can use services of the Learning Management System of the University through the Internet – as regular and correspondence students do.

[vi] See: http://www.drseres.com/elearning/files/tavoktatas/jelentkezes_eng.htm

Conventional e-tests[vii]

After completion of a topic (chapter, case study) of an e-learning course the student can and/or must check his encyclopedic knowledge by e-test.

Usually e-tests are quiz-type. The simplest e-test is the "True-False" type.

The "4 by 1"-type is a little bit more difficult. The "*5 by 7*"-type and the "pull-to-place" type e-tests allow of checking more sophisticated relations.

Knowledge based e-tests[viii]

The quiz-type e-tests are not enough effective for checking complex relationships of curriculum in higher education in most cases. That's why we present some e-test examples from English version of author's multimedia curriculum.[10]

First example is a self-test for checking *visual memory* of e-students. There are six types of military system in the Chapter 1 of the curriculum. Figure 2 presents schematic outline of these models. Student chooses one of them (Figure 3), then he/she selects the adequate model. If selection is correct, whole model appears with claps, if selection is incorrect, selected model appears with whistle.[ix]

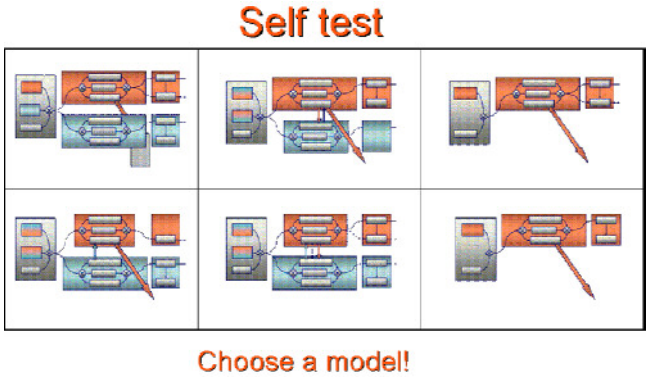

Figure 2. Schematic outline of a self-test for checking visual memory of e-students

Second example is a self-test for checking *lexical memory* of e-students. Chapter 3 of curriculum presents the Research and Technology Organization of NATO. Figure 4 presents R&T organization of NATO in Hungarian and in English. The e-test in Figure 5 allows checking how students remember Name and Tasks each of organization.

[vii] You can see some examples in author's portal E-TEACHER: http://www.drseres.com/elearning/eteszt
[viii] You can see some examples in author's portal E-TEACHER: http://www.drseres.com/elearning/teszt
[ix] You can try this e-test: http://www.drseres.com/shahin/selftest.pps

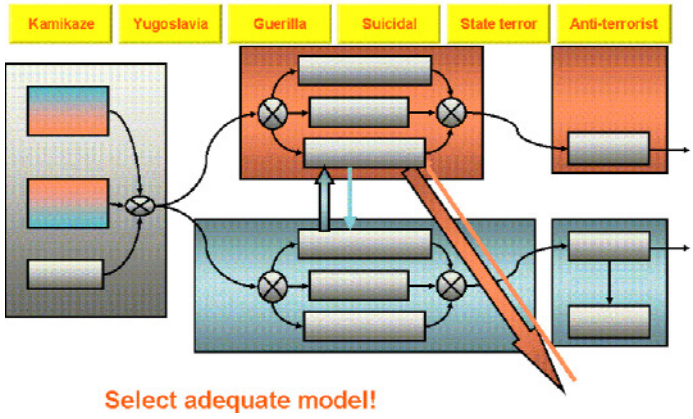

Figure 3. The choosen model

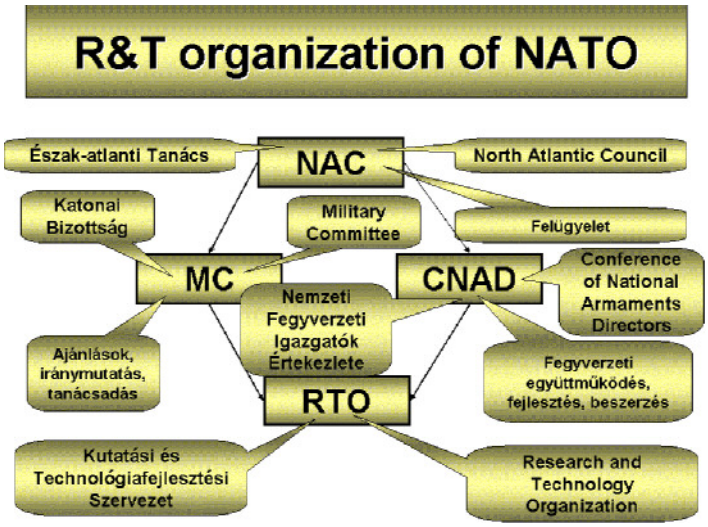

Figure 4. Presentation of R&T Organization of NATO

Third example is a self-test for checking *logical memory* of students. Chapter 4 of curriculum presents the Quality Assurance of NATO. Figure 6 presents life cycle of military products. The e-test in Figure 7 allows checking how students remember *logical order* of life cycle.

Figure 5. A self-test for checking lexical memory of e-students

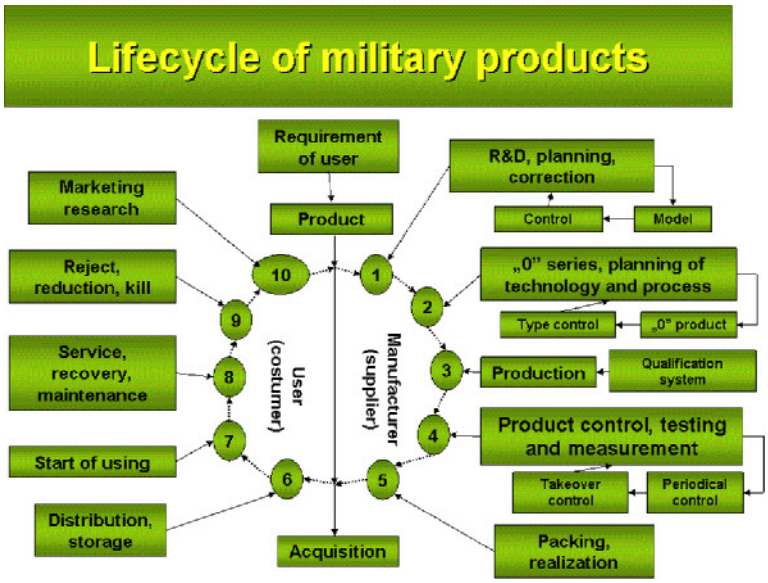

Figure 6. Presentation of life cycle of military products

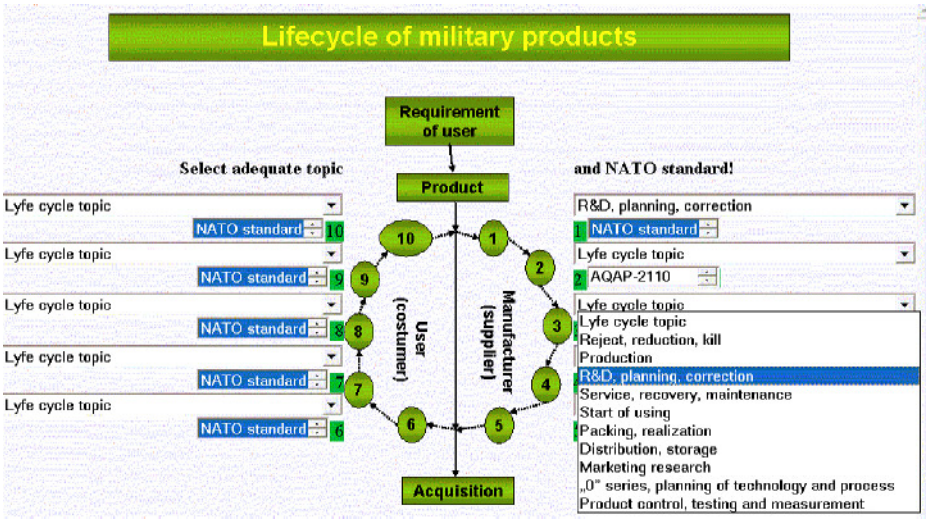

Figure 7. A self-test for checking logical memory of e-students

The e-tests online

Usually e-tests are used off-line for self checking of e-students. But e-tests can be used for checking of student's knowledge on-line too under e-teacher's control with special software. For example we present an on-line e-test from author's curriculum with SynchronEyes program.[x]

An e-class of e-students and their e-teacher are connected to a workgroup in the e-classroom by way of university's intranet or internet (Figure 8).

SynchronEyes program enables sending e-test to all of e-students simultaneously. After a limited time, e-teacher can control and evaluate answer of all students on own display (Figure 9).

[x] See: SynchronEyes™ classroom management software, http://www2.smarttech.com/st/en-US/Products/SynchronEyes+Classroom+Management+Software/

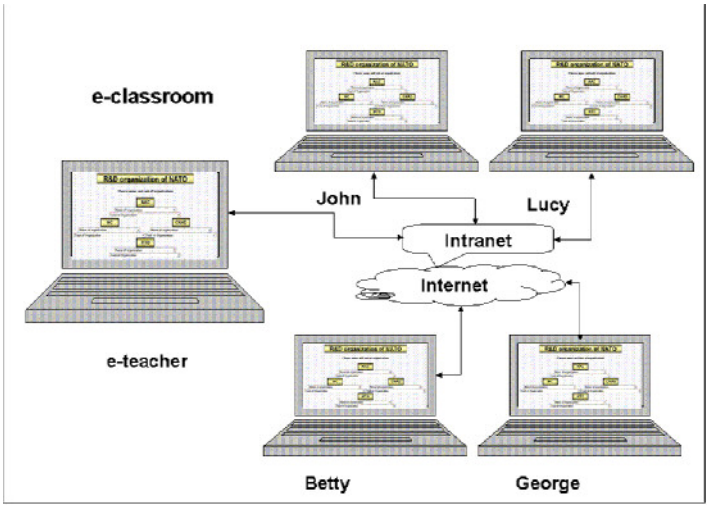

Figure 8. An e-classroom

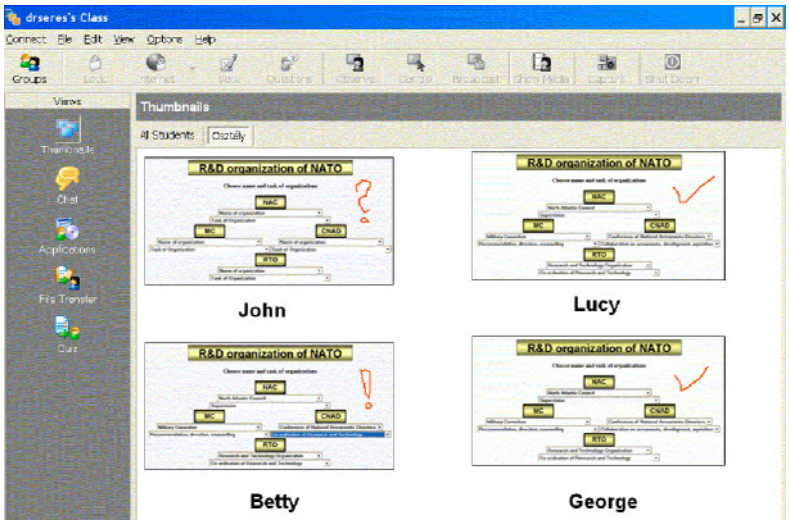

Figure 9. Display of e-teacher for checking of on-line answers

The e-tasks

To close a given topic of the multimedia curriculum *Research and Development in Military Technology* e-students can check on-line and/or off-line necessary encyclopedic knowledge. They solve the e-tests before elaborating prescribed e-task adequate to their training level.[xi]

Elaborated task must be sent to the e-tutor by e-mail, who after evaluation informs the e-student by e-mail about the result.

When all the prescribed tasks gained positive evaluation, the e-tutor allows the student to apply for examination via e-mail.

Having admission to examination the e-student elaborates the course-task adequate to his level and sends it to the address of the tutor.

The comprehensive course-task will be evaluated during the examination.

The robot-tutor

One of the most democratic forms of knowledge transfer is e-learning. But there is a contradiction – especially if the e-student and the e-tutor are located in different time zones. The contradiction lies between the right of e-student for help at any time and the right of e-tutor for lawful working hours. For this reason robot-tutors with artificial intelligence can play a really important role in e-learning process. Questions of e-student can be answered by robot tutor at any time.

An experimental robot-tutor has been developed for a lecture[xii] of author's multimedia curriculum on the base of Nela assistant robot[xiii] designed by Technical Director of Robot-Hosting firm Shahin Maghsoudi.[xiv]

This robot-tutor (Figure 10) can give verbal answer for 9 questions connected to the lecture.[xv]

[xi] For example, see Figure 7 of author's publication in 2006 (Vol. 5, Issue 1, p. 100) of AARMS "Let's learn easily and quickly – lifelong" http://www.zmne.hu/aarms/docs/Volume5/Issue1/pdf/10gonc.pdf
[xii] http://www.drseres.com/shahin/system.pps
[xiii] http://222.154.227.228:51000/htdocs/nela02.html
[xiv] http://robot-hosting.com/html/n-people.html#SM
[xv] http://www.drseres.com/shahin/

Figure 10. An experimental robot-tutor

Summary

In the summary we would like to point out that the e-learning solutions – especially the lifetime education-systems (elaborated within the confines of distance education) of adult education types and the systems that achieve the permanent knowledge transfer render possible and make realize such new forms of learning and teaching, which make the independent and individual learning, the so called active (problem solving) way of learning a process that is realized in a way never seen before (independently from geographical or time limitations). It is also very important that these innovative solutions and possibilities become accessable for more and more people by the ambience and by the IT solutions developed by the society of knowledge. On the other hand – from the value-production point of view – the knowledge integration and utilization are elevated on such a level, the complete perspectives of which are unfolding just now.

Our experiments connected to knowledge management, knowledge integration and knowledge distribution possibly utilized in higher education, as well as our attempts of sharing the relevant results are only a few small steps on this long road.

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