Multiple Intelligence Theory in Improving the Quality of Virtual Education

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1. Introduction

Virtual education is not a new phenomenon. Since the coding language for the World Wide Web was developed, government agencies, research centers, educational institutions, libraries, business corporations, and of course a great number of individuals has quicken to connect to the Internet. One of the results of this whopping wave in online communications was the prompt development of technology-based teaching and learning including education on the higher level.

Today universities and colleges are hurrying ahead to provide virtual learning courses, and a lot of institutions are making significant investments in new technologies for teaching.

There are a number of different definitions and views on the term of quality of virtual education. According to Barker (1999) the definition of quality in education includes the following components: the quality of learning materials, the availability of materials, support for students through well trained staff, a well managed system, monitoring and feedback mechanisms to improve the system. Stated more succinctly, quality education is education that produces an independent learner.

Quality of education and virtual education is often viewed as a number of separate independent units like in this definition. It is also often considered from different points of view, and most part of these points of view refers to technical and practical matters.

Current high level of technological development is significant and its influence on all aspects of our life can't be overestimated. Information technology is the main tool for development of educational approaches. Software development, interface design are some of the most significant aspects of virtual education courses creation. It all has to be used in sufficient way to bring reasonable results.

What exact influence does all this technology have on the effectiveness of education in colleges and universities? The amount of written material devoted to virtual education is comprehensive, and includes strategy papers, "how to" articles, and essays. Most of these

writings suggest that the learning outcomes of students using technology are similar to the learning outcomes of students who participate in conventional classroom learning.

The attitudes and satisfaction of students using virtual courses are also mostly characterized as generally positive.

But how is the quality of virtual education assessed? What are the findings of the research on the effectiveness of virtual education? Are there any gaps in the research that require further investigation and information? What does the literature suggest for the future?

Specifically, in the second chapter we:

- Clarify the idea of *virtual education*, it's position in the field of education and considers the term of *quality of virtual education;*
- Review the findings of the original research and try to assess the quality of the analysis itself;
- Identify general gaps or omissions in the researches of quality of virtual education;
- Discuss the possible improvements in the current state of virtual education development.

We primarily concentrate on evaluation techniques of virtual education and summarize the key information and findings of the other papers, articles, and essays that dominate in the literature.

We consider quality of virtual education from one specific point of view – from the point of view that refers to the roles of cognitive science and cognitive psychology roles in education. Specifically we are considering the role and the importance of the Multiple Intelligences theory. Educators pay little attention to non-technical things nowadays. The aim of the research is to show the significance of psychological and cognitive approaches in education and particularly to consider possible ways of utilizing Multiple Intelligences theory in developing virtual education tools.

In the third chapter "Multiple Intelligences theory" the theory is presented. The theory appeared in 1983, when it was first presented in the book Frames of mind: the Theory of

Multiple Intelligences by Howard Gardner - a professor at Harvard University and the author of many books and articles. His Theory of Multiple Intelligences utilizes a different view on the nature of intelligence than the most of other theories do.

Theory of multiple intelligences has challenged long-held assumptions about intelligence - especially about unitary concept of intelligence. Howard Gardner proposed a definition of intelligence that recognizes many different and discrete facets of cognition and confesses that people have different cognitive strengths and contrasting cognitive styles.

Gardner first identified 7 intelligences and has since added an eighth. Many people get surprised finding the categories he has chosen, because they never thought of them as intelligence before. They are:

- linguistic intelligence,
- logical-mathematical intelligence,
- spatial intelligence,
- bodily-kinethetical intelligence,
- interpersonal intelligence,
- intrapersonal intelligence,
- musical intelligence,
- naturalist intelligence.

Traditional teaching in real classrooms successfully uses MI theory in education. At the same time there are almost no works or ideas of applying it in virtual education. So dwell on a more wide approach than in case of traditional education. Some general applications of Multiple Intelligences to virtual education courses are also considered.

1.1 Research problem

The main question we consider in this thesis is: *What is the role of the Multiple Intelligences theory in improving the quality of virtual education?*

Virtual education (e-teaching) is still young and developing research area. It made scientists to reexamine all learning approaches and methods from an entirely new point of view. Are traditional teaching approaches still efficient for virtual education? Is e-teaching really good? What should we change in present and past teaching approaches to fit new needs of learners and educators?

According to the main question we need to consider some topics related to it to determine some basic terms and the background of the subject. First of all we need to define the term *virtual education*, the way we interpret it here. One more question is *what is quality of virtual education? What are the main terms of e-quality (quality of e-teaching)? What can and should be done to improve it?*

A typical advertisement to be found nowadays is „Electronic Learning engineers and designers provide training software to industry" and psychologists seem not to be necessary to create the future world of education. Possible reasons of this state of affairs are that the power of psychology is not visible in areas where suffix e- is used; the current development of virtual education is primarily driven by technological dynamics and profit expectations - not yet by psychological and pedagogical aims and goals.

One of the aims of the thesis is to show the importance of cognitive psychology being the foundation for virtual education and concepts of teaching.

One of the most compelling, yet controversial new approaches to education reform is Multiple Intelligences Theory, or MI. Conceived of by Howard Gardner of the Harvard Graduate School of Education and Harvard Project Zero, MI first swept the worlds of education, cognitive science and developmental psychology in 1983 with the publication of Gardner's treatise, *Frames of Mind*. Dealing with virtual education from psychological

point of view, this theory could help to better understand needs of specific learner and make virtual education courses really learner-centric and learner-specific.

In this thesis we analyze and to elucidate the main question, whether the Multiple Intelligences theory should be considered in virtual education, how profound this study should be and what are possible ways of using this theory in development of virtual education?

1.2 Method

The main research method is comprehensive literature analysis. It includes collection and accumulation of information, books and articles on relevant topics, their analysis, correlation and comparison with related literature.

2. Quality of virtual education

Quality is the totality of features and characteristics of a product that bear on its ability to satisfy given needs (Quality glossary). Quality of virtual education in its turn is a combination of properties that a virtual education tool must have to be treated as a quality product. There are a number of views on the quality of education. In this chapter we debate the matters of virtual education, its quality and some of the problems virtual educators are faced to. Particularly, we focus our attention on specific educational matters of virtual education – problems of educational technology, psychology and cognition.

2.1 Virtual education

First we need to define the term *virtual education* or *e-teaching.* To be honest upon the beginning of the research I used to call it *e-learning,* as they use to call it. But then we realized that this name is a wrong one. The term E-learning has a different meaning.

First of all, e-learning means self-learning. To take an example, Google can be used as an e-learning tool. Dublin Lance (2003) in his article evenly says that Google is ”the world’s most powerful e-Learning tool”, no matter what you are searching, you end up spending hours exploring and learning about related and unrelated topics. So, this is e-learning by its own.

And what call e-learning – is creating and developing virtual tools for education – that is *e-teaching* in fact. The use of the word “e-something” was very stylish lately, so that “e-” was added almost to everything, such as e-commerce, e-business, e-tailing, e-government, etc., sometimes paying very little attention to the meaning of the words. So we would better talk about e-teaching, but from the other hand “e-something” is a cliché already, so, to avoid clichés, we will mostly use the term *virtual education* now and then.

What is virtual education? Why virtual education? What is the difference? Is it better? What are the advantages of virtual education? These are some of the questions we are going to highlight.

2.1.1 What is virtual education?

In general, ***virtual education*** *(e-teaching)* – is education via the Internet, network, or standalone computer. Network-enabled transfer of skills and knowledge. Virtual education refers to using electronic applications and processes to learn. Virtual education applications and processes include Web-based learning, computer-based learning, virtual classrooms, and digital collaboration. Content is delivered via the Internet, intranet/extranet, audio or video tape, satellite TV, CD-ROM, etc. (Harvey 2004)

Though virtual education became reality already and occupies its fitting place among educational approaches, it is still being discussed. There are still many controversial points which are considered by educators, psychologists, sociologists, etc. As an example let's take one of these vexed questions into consideration. There are two opposite views on virtual education:

1. It removes barriers by providing anonymity and improves access, and thus removes all kinds of traditional discrimination.
2. It causes discrimination and division of learners who are familiar with tech and computers and those who are fluent in English from those, who are not (as most of virtual courses are still given in English).

One important advantage of e-teaching is that it "prevents the learner from being treated unequally by peers or instructors" (van Damm 2004). E-learning allows the learner to overcome their physical and disabilities, and make them equal in comparison with other learners. Also some researchers claim that e-learning can eliminate gender discrimination and conceal gender. This problem arouses as it is well documented that males and females perform differently in face-to-face situations, usually to the detriment of women. So e-learning demonstrates here one more benefit solving this problem.

Returning to opposite views on e-learning mentioned before, van Dam disproves the second claim that e-learning creates discrimination. Talking about concern that e-learning creates technology barriers, discriminating people, who are less technically sophisticated. Research performed by Deloitte Consulting (2004) showed the following results. Comparing the results achieved by the group of learners who were considered IT specialists

(56%) with the other learners; it was shown that technological ability does not create an e-learning inequality.

In a similar manner the second question was answered. Here English-speaking learners were compared with learners for whom English is a second (sometimes third) language. The result was that "English - second language" learners outperformed their English-speaking colleagues. The first reason of such results is that non-English-speaking learners had to use dual-language dictionaries, which made them to deal with course material in more details. The second – is that retesting was allowed. Means one more benefit of e-learning – self-paced learning and possibility for the learner to improve his skills and therefore grades in the course of time.

As a conclusion van Dam says that:

- E-learning removes traditional barriers
- IT skills are not critical to success in e-learning
- Language is not a barrier if the learner has sufficient time to achieve results.

This is only one of a number of existing moot points regarding virtual education. While the debates continue, virtual educations keep on developing and strengthen its positions.

Distance education

The question arises, what about *distance education* then? Is it a different approach, or is it the same?

To answer this question, in our opinion distance education used to be an independent approach, when virtual education in general did not exist. Distance education used such tools as tape records, TV, mail delivery, and some others. Within the last decade or so, distance education has changed noticeably by the use of computer-based learning, internet-based learning, videoconferencing and a variety of other technologies. I would say that it has developed into something more powerful and universal, called virtual education, and became one of its constituents. Though virtual education and distance education still do appear as to be different approaches in the literature and articles, we believe that saying

virtual education we mean distance education included, and saying distance education, we are talking about an instance of virtual education.

Conventional learning

Introducing virtual education we have to say about the approach, which is opposite to it, as it is called now *conventional learning* or, in simpler words *classroom (traditional) learning and teaching*. This is in fact what is meant by *education*. All the other educational approaches including virtual education are being built upon it and are based on principles of traditional teaching. It seems to be natural, as far as traditional education has a long history and had been developing for centuries. Of course, it is obvious that new educational approaches are developing on their own, acquire new properties, new points of view, they get new results, develop their own policy which sometimes radically differ from the classical one. This is also one of important breakpoints of virtual education, and it is hotly debated among educators. Nevertheless we have to acknowledge, that education has moved to the next phase of its development, and thus we can't avoid changes in the concept of education in general.

Blended learning

One of some important issues to be mentioned here is the significance of *blended learning* in education and thus the significance of virtual education technologies.

Blended learning - is (in simple words) a mixture or a combination of virtual learning and classroom learning. In general it has on-line and off-line components.

There are seven criteria for evaluation of learning suggested. Going through these criteria, one can easily see some advantages and disadvantages of virtual education as well as classroom learning, and the way these two approaches supplement each other.

Over the last 50 years cognitive psychologists produced few schemas of learning evaluation. Actually these schemas seem to be very similar, and as a result we can get the following general categories:

- Knowledge

- Procedural skills
- Mental skills
- Interpersonal skills
- Psychomotor skills
- Attitudes
- Aspirational learning

To explain them shortly:

Knowledge or comprehension learning depends very much on memory and recall. Knowledge consists of information, facts, concepts, figures, ideas or principles. No doubt, a general understanding of the meaning of the knowledge is also important. The learner may be expected to show understanding by being able to list, define, tell, describe, identify, show, label or name. After taking knowledge further he would probably also be expected to order, group, make inferences, interpret, contrast, predict, associate, distinguish, estimate, differentiate or summarize. This is completely covered by e-learning, knowledge management and the web. As search and retrieve replaces memorization, these resources have become learning resources.

Procedural skills involve following processes or routines from memory, manuals or computers. There is knowledge of some of the procedures required. Here the learner may be expected to apply, demonstrate, calculate, complete, solve, modify, relate, classify or find. Software procedural (systems) learning is best delivered on the screen. It is a skill some learn by doing, usually in small steps that are brought together into entire procedures. Other procedures may require actual work with plant or in the workplace.

Cognitive skills involve applying theories and approaches in new situations and solving problems using required skills. Problem solving is proved by performing effective solutions. These skills are usually learnt by doing. However, the real application of skill may need some social reinforcement and human intervention through coaching or e-tutoring.

Interpersonal skills have been realized as a separate group of skills, in addition to emotional intelligence. These are skills in listening, questioning, presenting, interviewing, counseling, appraising and so on. They also include writing, telephone skills and electronic communication skills using email, etc.

Nevertheless, people also need to practice these skills with other real people, role playing and workshops. There is an opinion that with team-oriented skills, delivery moves to more collaborative events, whether with offline or online learning.

Psychomotor skills. These may be in sports, dance, music, driving, crafts, keyboard skills or flying an aircraft. They usually involve the actual learning and practice under the tutoring of a coach. Some specific skills, like keyboard skills, can be learnt through e-learning. But for example, in flight training, these skills are learnt through a combination of theory, flight simulation and actual flying.

Attitudinal change assumes the learner to be aware of present attitudes existing and to be able to understand and apply them. E-learning here is used to explain values and allow the learner to decide when values are to be supported or rejected.

Aspirational or transformational learning requires personal improvement for the learner. At this level, the learners may need to be part of a peer group or receive personal training. They may also need a various set of knowledge sources.

It has to be mentioned that thinking about virtual education, its development and research one should not forget that according to their nature people hold on to the familiar, and introducing of something new necessarily requires meaningful attention to all previous methods and experience.

Lifelong Learning

All of the mentioned approaches of learning can be summarized and thus they form phenomena which are now called *lifelong learning*.

Trying to define this term one can find quite few definitions of *Lifelong Learning*:

- *”Learning in which a person engages throughout his or her life. It includes but is not limited to learning that occurs in schools and formal educational programs.”* [www.mnvu.org/mnvu/265.jsp]
- *”The process of changing perceptions and practice to meet the rapidly changing demands of the knowledge society by moving away from learning as preparation for life and work, to learning as an integral part of life and work.”* [www.ao.bham.ac.uk/aps/glossary.htm]
- *”The concept of 'continuous personal development' through student centered (self-actualized) learning. Lifelong learners demonstrate: the ability to accept themselves as well as others spontaneous but ethical behavior a strong focus upon problems outside themselves the ability to capitalize on the qualities of detachment and solitude independent stability in the face of hard knocks freshness of appreciation deep feelings of identification, sympathy, and affection for humankind profound interpersonal relationships a democratic character structure strong ethics with definite moral standards philosophical, unhostile sense of humor a special kind of creativeness the ability to function independently as a part of the growing tip of humanity.”* [www3.sympatico.ca/krewski/mde615groupc/glossary.html]

Lifelong learning has appeared on the political agenda. In this setting Lifelong learning is defined as *"all learning activity undertaken throughout life, with the aim of improving knowledge, skills and competence, within a personal, civic, social and/or employment-related perspective."* But of course lifelong learning is also a personal issue which concerns personal development. (van Weert 2002)

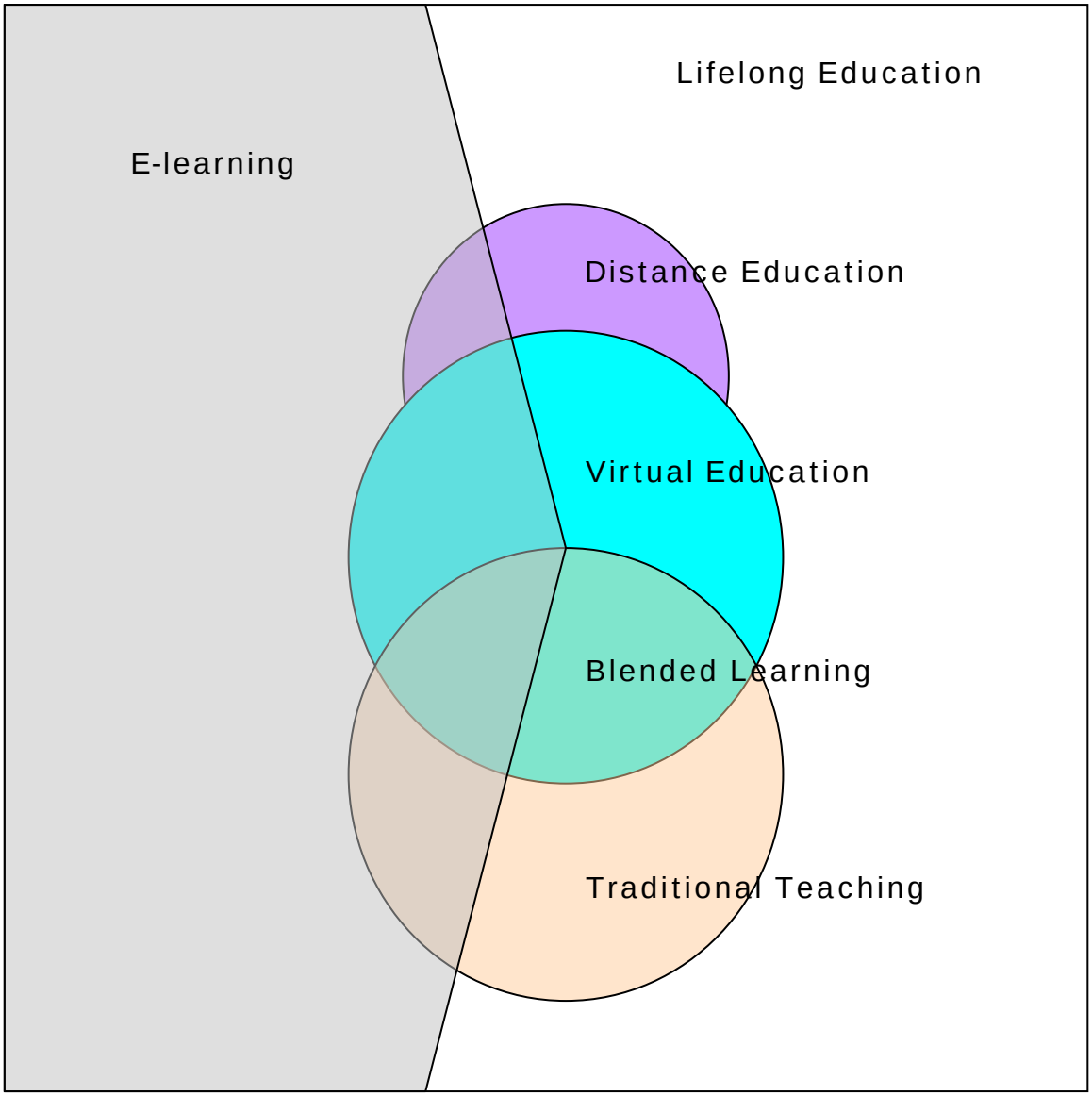

Figure 1. Relations between present-date educational approaches.

As it was mentioned already before, lifelong learning summarizes all educational approaches that exist nowadays. The main idea of lifelong learning – learning through the whole life is almost impossible without virtual education being involved.

In the figure 1 the relations between modern educational approaches are presented. Virtual education developed from a part of distance education into self-dependent and powerful approach, which in combination with traditional teaching generated one more approach – blended learning. All of these approaches are supported and supplemented by e-

learning. As it has been already mentioned before saying e-learning we mean any *self-learning* which people can afford using Internet – search engines, online encyclopedias, journals, forums, any interaction with other people, and in general Internet itself as a huge source of information.

2.1.2 Advantages of virtual education

Virtual education has definite benefits over traditional classroom training. While the most obvious are the **flexibility** and the **cost savings** from not having to travel or spend excess time away from work, there are also others that might not be so obvious. For example:

- **Reduced training costs.** Perhaps most significantly, virtual education can produce a lower cost per learner than instructor-led training. (However, custom e-teaching may have a higher up-front cost for design and development.) Synchronous programs will have continued costs associated with the instructor managing the class, but will still be lower than traditional courses. Also there are no travel time expenses.
- It is **self-paced.** Most of virtual education programs can be taken when needed. E-teaching gives students a chance to speed up or slow down as necessary. It is self-directed, allowing students to choose content and tools appropriate to their differing interests, needs, and skill levels.
- It moves **faster** - According to the article by Jennifer Salopek in "Training and Development Magazine," e-teaching courses progress up to 50% faster than traditional courses. This is partly because the individualized approach allows learners to skip material they already know and understand and move onto the issues they need training on.
- It provides a **consistent** message – virtual education eliminates the problems associated with different instructors teaching slightly different material on the same subject.
- It can work from **any location and any time** – as interactive e-teaching can be delivered in many formats – floppy diskette, corporate networks, CD-

ROM's, corporate intranets, even over the Internet. E-learners can go through training sessions from anywhere, usually at anytime. This "just-in-time" benefit can make learning possible for people who never would have been able to work it into their schedules prior to the development of e-learning.

- It can be **updated easily** and quickly - Online e-teaching sessions are especially easy to keep up-to-date because the updated materials are simply uploaded to a server. CD-ROM-based programs may be slightly more expensive to update and distribute, but still come out cheaper than reprinting manuals and retraining instructors.
- It can lead to **increased retention** and a stronger grasp on the subject - This is because of the many elements that are combined in e-learning to reinforce the message, such as video, audio, quizzes, interaction, etc. There is also the ability to revisit or replay sections of the training that might not have been clear the first time around.
- It can be **easily managed** for large groups of students – it is easy to define schedule or assign training for employees and track their progress and results. Managers can review a student's scores and identify any areas that need additional training.
- **Multi-cultural learning** – this is quickly becoming an important challenge for trainers. Using streaming techniques, e-teaching can handle multiple languages and cultural idioms to ensure that the learning environment is made as "comfortable" for the learner as possible.
- **Interaction with peers** - participating in discussion groups and chat sessions to trade ideas and learn from others.

2.1.3 Levels of virtual education

Virtual education falls into four categories, from the very basic to the very advanced. The categories are:

- **Knowledge databases** - not necessarily seen as actual training, knowledge databases are the most basic form of virtual education. An example are knowledge

databases on software sites offering indexed explanations and guidance for software questions, along with step-by-step instructions for performing specific tasks. These are usually moderately interactive, meaning that you can either type in a key word or phrase to search the database, or make a selection from an alphabetical list.

- **Online support** - is also a form of virtual education and functions in a similar manner to knowledge databases. Online support comes in the form of forums, chat rooms, online bulletin boards, e-mail, or live instant messaging support. Slightly more interactive than knowledge databases, online support offers the opportunity for more specific questions and answers, as well as more immediate answers.
- **Asynchronous training** – is virtual education in the more traditional sense of the term. It involves self-paced learning, either CD-ROM-based, Network-based, Intranet-based or Internet-based. It may include access to instructors through online bulletin boards, online discussion groups and e-mail. Or, it may be totally self-contained with links to reference materials in place of a live instructor.
- **Synchronous training** - is done in real-time with a live instructor facilitating the training. Everyone logs in at a set time and can communicate directly with the instructor and with each other. You can raise your cyber hand and even view the cyber whiteboard. It lasts for a set amount of time - from a single session to several weeks, months or even years. This type of training usually takes place via Internet Web sites, audio- or video-conferencing, Internet telephony, or even two-way live broadcasts to students in a classroom.

2.2 What is the Quality of virtual education?

What is quality in general? Here follow few definitions from different glossaries:

1. ”Quality relates to the characteristics by which customers or stakeholders judge an organization, product or service. Assessment of quality involves use of information gathered from interested parties to identify differences between user's expectations and experiences.”

www.aph.gov.au/dprs/publications/Anrep2001/030_Glossary.htm

2. ”Quality is the totality of features and characteristics of a product that bear on its ability to satisfy given needs.” www.2asc.com/ascweb/products%20and%20services/risk/Best%20Practices/content/resource/gloss.htm
3. ”Quality - degree to which a product or service meets or exceeds a customer's requirements and expectations. Simply, quality is generally "whatever the customer says it is." www.eglin.af.mil/46tw/StrategicPlan/glossary.htm

In general one can say that all these definitions are right and reflect the real meaning of the term quality. In our case when we are talking about quality of education, moreover virtual education, the last definition doesn’t work as it does in some other cases. Asking the opinion of the customer (learner in our case) is necessary, but quality of education is not necessarily “whatever the customer says it is”. The customer might know what he likes, what features he wants to see in virtual education products but it doesn’t at all mean that these are the best properties of the tool to get the highest and the most efficient result – understanding, memorization, retention and ability to apply gained skills in practice.

The general debate over the values of virtual education very often consists of agitated causticity. Proponents of virtual education claim that it is as good as traditional education, and even better in many cases, that e-teaching is able to solve all the problems traditional teaching confront with. Opponents return that virtual courses can not grow up to the standards of the traditional classroom.

So let’s take a closer look, is this really so? Does virtual education, for example, work better for some academic subjects than the others, or better for some students than the others? What are the problems virtual education confronts with? Are library and information resources sufficient under virtual education? What multipliers are necessary for successful course completion? What is the proper way to evaluate the results of virtual courses and virtual education in general? What are the criteria? Are there shortcomings in

this evaluation itself? How can teaching process that differs so much from the one which has been practiced for hundreds of years incarnate quality education?

2.2.1 Quality of virtual education

There are a number of different evaluation criteria, which were and are created to assess the quality of virtual education courses. Here we present relatively complete version of an evaluation criteria one could use to evaluate a particular virtual education tool:

A high-quality virtual tool in our opinion should answer advisably to the most part of the following requirements:

1. Gain attention - to engage the learner positively. Virtual course should look attractive to the user. It's somehow a matter of design… but anyway the course should correspond to the group of people it is made for.

2. Identify the learning objectives - to set the learner's expectation relating to content and learning activities

3. Stimulate recall of prior learning - to retrieve existing or underpinning knowledge upon which current study will build (if the course requires some prior knowledge). Announcement of the course should contain information about prior knowledge required.

4. Present the content - to transfer the new knowledge and skills utilizing the most appropriate range of delivery and interaction (interface design)

4.1 Orientation. Requires a new learner to take a pre-course student tutorial to familiarize themselves with hardware and software requirements, the education site requirements, and courseware navigation. In the course syllabus and opening announcements, direct learners to exit the course and take the tutorial if they have not already done so.

4.2 Obvious visibility. Course elements, objects and controls, like those that aid learners' navigation, should be visible, obvious and, ideally, intuitive.

That accomplished, it's in the instructor's interest to provide clear instructions to learners, in multiple places in the course, for using the elements and controls or recognizing objects. Such instructions, though they may seem redundant, help ensure course usability for learners.

4.3 Simplicity. Keeping the number of actions and objects to the minimum is necessary for good functionality of the course material. Adding a lot of "bells and whistles" doesn't mean improvement. In fact "too much or too many" may actually be a distraction to learners. That is, course usability is often reduced when a designer goes for too much "glitz."

4.4 Help support. Learners should be in control of seeking needed help. That said, the course syllabus and/or opening announcements should clearly state how learners could seek help, both within the course and by going to the site Help Desk. Just because this material was covered in an orientation tutorial doesn't mean learners will remember it. Well-placed announcements and instructions to learners will always help reduce the burden on the instructor to answer similar questions from multiple learners.

4.5 "Chunking" (clustering). A key to good instructional design is to "chunk" material into usable sections that can be accessed easily and completed readily. It's always an important point to remember that this advice applies to the number of units in a course and the number of content items in each unit as well as the more common application of "chunking" to the actual course content.

5. Extracting - to facilitate rehearsal and practice such that the new knowledge and skills are effectively captured and encoded into the long-term memory *(long term memory - detalize)*

6. Provide feedback - to continuously reinforce learning progress and to promote learner attention and engagement

7. Estimation - to monitor the learner's progress towards mastery and to effective on the job performance

8. Improve retention and transfer:

8.1 Varying the types of content - Images, sounds and text work together to build memory in several areas of the brain and result in better retention of the material.

8.2 Creating interaction that engages the attention - Games, quizzes and even just required manipulation of something on the screen creates more interest, which in turn builds better retention.

8.3 Providing immediate feedback – Virtual education courses can build in immediate feedback to correct misunderstood material. The more immediate the feedback the better, because each step of learning builds upon the previous step. If no feedback is given, then the next step may be building upon an incorrect interpretation.

8.4 Encouraging interaction with other learners and an instructor - Chat rooms, discussion boards, instant messaging and e-mail all offer effective interaction for virtual learners, and do a good job of taking the place of classroom discussion. Building an online community significantly influences the success of online programs.

We can also make an evaluation of the course from the technical (implementation) point of view. This is the one side of virtual education assessment which most of evaluation attempts are usually reduced to. They are usually rather detailed ones and even touch upon some psychological questions.

It can be defined as follows:

1. Interface

- homepage's attractiveness and appeal
- Text and graphics legibility
- Content organization

2. Navigation

- Course navigation simplicity and ease
- Indications of learner's learning history
- Learner's good control
- Ability to return to the previous location at the learning process
- Availability of necessary navigational and technical information
- Presence of search tool or note-taking function

3. Supervising: Teachers or tutors availability and interactiveness if the course has ones

4. Learners' interaction: Possibility of interaction with other learners

5. Efficiency and detailed elaboration of the presented information

6. Presentation

- Different instructional methods such as examples, explanations, simulations, diagrams
- Use of media (graphics, audio, animation) presenting the information and it's effectiveness
- Use of prior knowledge of the learner, making him recall and relate new knowledge to the old one
- Correspondence of tone and language to the level of the knowledge, skills and experience of learners

7. Practice activities

- Providing practice opportunities (to apply new knowledge)
- Suitability of the practice tasks for the level of the course

8. Feedback

- Results of learner's performance (grades)
- Explanation of learners' mistakes
- Assessment questions to test learners' knowledge

9. Course introduction

- Information on target audience, prerequisites and course duration
- Previous students' comments on the course
- Course preview materials (an opportunity to take a short "test drive" of that course)

- Preliminary tests to check student's level and prior knowledge required for taking the course

These are the characteristics of virtual education courses which are mostly paid attention to. They are usually rather detailed ones and even touch upon some psychological questions. But it most often happens that evaluators of a particular virtual course forget about educational characteristics of the tool at all. People tend to pay attention to the word *virtual* most likely, then to the word *education*. So being carried away by interest to technical implementation they forget even the basics of education and pedagogic, etc. But the process of development of virtual education can't be held up by technical matters only, and it does not.

Multi-models of quality of education

While we are trying to find some general definition of quality and quality of virtual education, there are still can be quite few views on its meaning. In general the term of quality of education still seems to be an obscure and disputable concept. It seems that quality of education is a multidimensional matter and can not be assessed by only one characteristic. As an example researchers of quality of education (Cheng et al. 1997) introduce seven models of quality in education. I strongly believe that as these models are described widely enough and that they are applicable to any kind of educational approach including virtual education. It is obviously important that for developing educational tools and strategies we need to understand the nature of quality of education, which can be done by reviewing different concepts and approaches of its assessment.

The proposed seven models of quality in education are: the goals and specifications model, the recourses input model, the process model, the satisfaction model, the legitimacy model, the absence of problems model, the organizational learning model.

To be more specific here are the description of each model:

- *The goals and specifications model:* It defines quality of education as "achievement of stated goals and conformance to given specifications". It is built upon

an assumption that the particular educational institution has some clear, protracted general goals, specifications and standards. These can be students' academic progress, rate of attendance and dropout, professional qualifications of stuff, number of graduates, etc. This model might be useful if the goals and specifications which are used for assessment of quality of education are clear enough and are accepted by all involved parties, and that there are appropriate points which can be used for evaluation whether the institution have reached the education standards appointed. An advantage of this model is that "it enables the institution management to focus attention on key components of education programs" (Cheng et al. 1997).

- *The recourses input model*: Education quality is a natural result of achievement of quality resources and inputs for the institution. It assumes that some scarce and high-quality resources are necessary for education providers to achieve their objectives and provide quality services. In this model, education quality is assumed to be "the natural result of achievement of scarce resources and inputs for the institution." (Cheng et al. 1997) The education quality indicators for this model may include high quality student inspiration, qualified staff, better equipment, more financial support. This model can be useful when the connections between quality of inputs and outputs are clear.

- *The process model:* Education quality is seen as "smooth and healthy internal process and fruitful learning experiences in education, experience in process is often taken as a form of educational aims and outcomes." Therefore, this model assumes that an educational institution possesses high quality of education if its internal functioning is smooth and "healthy". This model might be useful if there is a clear relationship between the process in institutional and educational outcomes.

- *The satisfaction model:* According to it "education quality is defined as the satisfaction of strategic constituencies." The model assumes that education quality must be determined by the scope to which the performance of education providers can satisfy

the needs and expectations of its customers. It is the very popular model used in the business sector to assess quality.

- *The legitimacy model:* Education quality is "an achievement of an education institution's legitimate position or reputation. Now, under the impact of rapid changes and developments, the educational environment becomes more challenging and competitive." The legitimacy model assumes that an educational institution has to be accepted and supported by the community in order to survive.

- *The absence of problems model:* Education quality - absence of problems and troubles. It is often easier to recognize problems in an institution or approach than to identify its quality. The appropriate indicators and measurements which can provide concrete evidence of quality are usually difficult to catch. Instead of looking for quality in an education program, one inspects it check whether any problems exist. The model assumes that if there is an absence of problems, troubles, weaknesses, and so on, this educational institution is of high education quality. This model is useful for example when the criteria of education quality are somewhat unclear but there is need for improvement strategies.

- *The organizational learning model.* This model considers education quality to mean continuous development and improvement. It assumes that education quality is a dynamic concept involving continuous improvement and development for members, processes, approaches and outcomes. The model can be useful when educational institutions are developing or involved in educational reform, for instance in a changing external environment.

These seven models have their strong and weak sides. They can not be applied everywhere within any conditions. One model can be applicable in some special context and the other one can not. But they definitely should be taken into account when making attempts to assess the quality of education, including virtual education, and educational institution in general.

2.2.2 Cognitive science and cognitive psychology

We are talking about cognitive science and cognitive psychology because they play significant part in education. As both of them are claimed to be the sciences that deal with the human cognition, human mind and mental processes, their first aim is to define what is going on in human mind and how do people learn, remember, forget, recall, perceive, understand. How they deal with the information they get? How they get the information? These subjects are important part of educational science. As far as we are talking about the quality of virtual education from this point view, we have to know what are these sciences all about, to pay attention to the knowledge they give us to understand how do people learn and what are the best ways and approaches of teaching.

2.2.2.1. What is cognitive science?

Cognitive Science - is a multi-disciplinary field developed in the 20th century to study the processes and activities of the mind and brain, particularly those having to do with intellect, emotion, and rationality. Some of the most important disciplines which contribute to cognitive science are philosophy, neuroscience, computer science, psychology, and linguistics. Other fields, such as sociology and anthropology may also play a role in cognitive science.

William Rappaport (1996) mentions that there currently two main paradigms of cognitive science. One of them is "connectionist computational cognitive science" and another one is "symbolic computational cognitive science". We will try to avoid sophisticated explanations of their difference. Just to say in general that there are few ways or merging these two approaches and at the same time tendencies to set one above another.

Rappaport (1996) also says that the best way to find out what are main contents of cognitive science is to check research in the individual science discipline, which themselves can be said to be a research in cognitive science. According to him the first discipline to talk about is *artificial intelligence*. Of course, we can not say that all artificial intelligence research is cognitive science research, but in some points it is, for example such as computational psychology or computational philosophy.

The second one is *Linguistics*. There is also some controversial point, if we can consider linguistics to be a subset of cognitive science. Here are also some topics belonging to cognitive science, for example cognitive linguistics.

Philosophy. Philosophers have always been studying nature of mind phenomenon of intelligence, language, epistemology and consciousness. So, probably it was in the foundation of cognitive science.

Psychology. Cognitive psychology is the central discipline of cognitive science. It explains the basics and gives grounds of cognition processes.

Cognitive science. These are really interdisciplinary researches, which mean that different methodologies from different cognitive sciences (Artificial Intelligence, Philosophy, Psychology, etc.) are applied to solve some common problem.

Cognitive science based on the principle hypothesis that thinking can best be understood in terms of representational structures in the mind and computational procedures that work in these structures. Since there are a lot of disagreements about the nature of the representations and computations that make up thinking, the central hypothesis is universal enough to accomplish the current range of thinking in cognitive science, including connectionist theories which build the model of thinking by terms of artificial neural networks.

According to the Stanford Encyclopedia of Philosophy (SEP) some of the current theories about the nature of the representations and computations to explain the way the mind works are as follows:

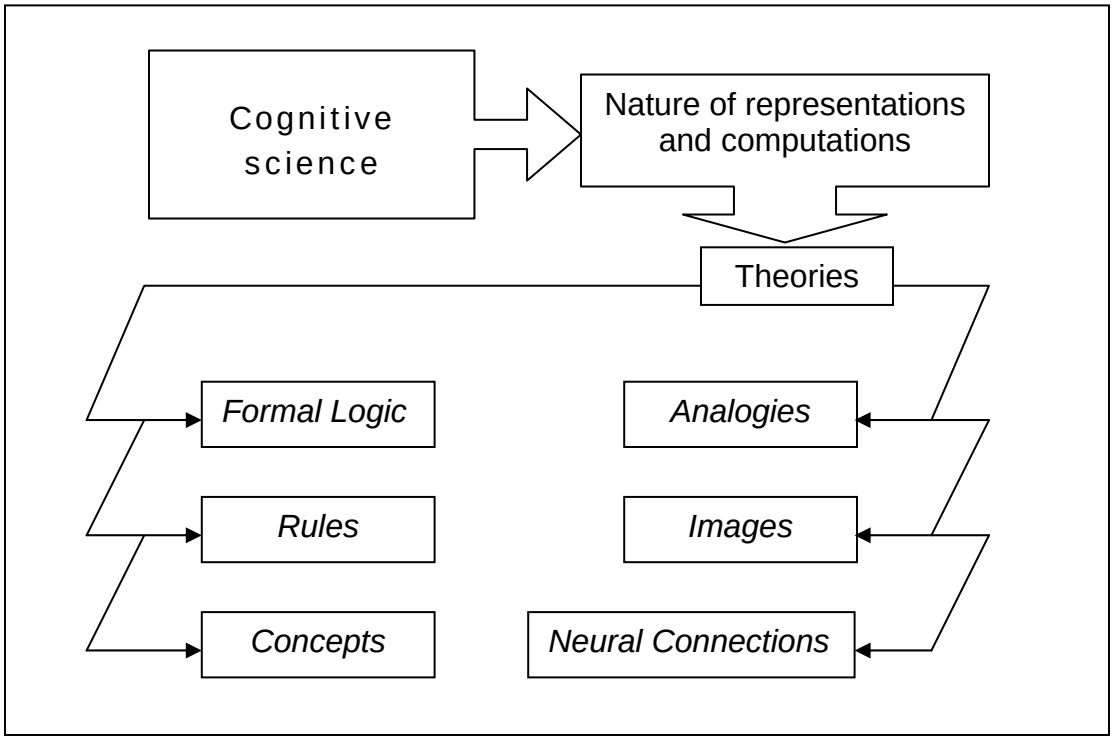

Figure 2. Current theories of Cognitive Science

1. Formal logic

Formal logic gives some strong tools for to look at the nature of representation and computation. Propositional and predicate calculations serve to express many complicated kinds of knowledge, and many inferences can be done in terms of logical deduction with inferences rules such as modus ponens. (Modus ponens, according to Wikipedia (Latin: *mode that affirms*) is a valid, simple argument form: If P, then Q. P. therefore, Q.)

The description schema for the logical approach as it is explained in SEP is:

Explanation Target:

- Why do people make the inferences they do?

Explanatory pattern:

- People have mental representations similar to sentences in predicate logic.
- People have deductive and inductive procedures that operate on those sentences.
- The deductive and inductive procedures, applied to the sentences, produce the inferences.

2. Rules

Human knowledge is more often naturally described in terms of rules of the form IF… THEN…, and different kinds of thinking can be modeled by rule-based systems. The SEP explanation schema used is:

Explanation target:

- Why do people have a particular kind of intelligent behavior?

Explanatory pattern:

- People have mental rules.
- People have procedures for using these rules to search a space of possible solutions, and procedures for generating new rules.
- Procedures for using and forming rules produce the behavior.

Computational models based on rules have provided detailed simulations of a wide range of psychological experiments, from crypt arithmetic problem solving to skill purchase to language use. Rule-based systems also were practically important in suggesting how to improve learning and how to develop intelligent machine systems.

3. Concepts

Concepts, which partly coincide to the words in spoken and written language, are an important kind of mental representation. There are computational and psychological reasons for leaving the classical view on concepts saying that they have strict definitions. Instead, concepts can be viewed as sets of typical features. Then concept application is just

a matter of getting an approximate match between concepts and the world. Schemas are more complex than concepts that correspond to words, but they are similar as far as they consist of number of features that can be coincided and applied to new situations. The explanatory schema used in concept-based systems is as follows:

Explanatory target:

- Why do people have a particular kind of intelligent behavior?

Explanation pattern:

- People have a set of concepts, organized via slots that establish kind and part hierarchies and other associations.
- People have a set of procedures for concept application, including spreading activation, matching, and inheritance.
- The procedures applied to the concepts produce the behavior.
- Concepts can be translated into rules, but they bundle information differently than sets of rules, making possible different computational procedures.

4. Analogies

Authors of SEP say that "analogies play an important role in human thinking, in areas as diverse as problem solving, decision making, explanation, and linguistic communication." Computational models simulate the processes of people retrieving and mapping source analogs to apply them to target situations. The explanation schema for analogies is:

Explanation target:

- Why do people have a particular kind of intelligent behavior?

Explanatory pattern:

- People have verbal and visual representations of situations that can be used as cases or analogs.
- People have processes of retrieval, mapping, and adaptation that operate on those analogs.
- The analogical processes, applied to the representations of analogs, produce the behavior.

Of course, not all thinking is analogical, but analogies can be very useful in applications such as education and design.

5. Images

Images (visual, etc.) play a significant role in human thinking. Graphic representations capture visual and spatial information in a usable form in comparison to long verbal descriptions. Computational procedures which are fully suited to visual representations usually include examining, finding, zooming, rotating, and transformation. These operations can be really useful for producing plans and descriptions in domains to which pictorial representations apply. The explanatory schema given by SEP for visual representation is:

Explanation target:

- Why do people have a particular kind of intelligent behavior?

Explanatory pattern:

- People have visual images of situations.
- People have processes such as scanning and rotation that operate on those images.
- The processes for constructing and manipulating images produce the intelligent behavior.

Imagery can support learning, and some figurative perspectives of language probably have their roots in imagery. Psychological experiments suggest that visual procedures (such

as scanning and rotating for example) use imagery, and some of recent neurophysiologic results confirm a close physical connection between reasoning with mental imagery and perception.

6. Neural Connections – one more theory presented by SEP.

Connectionist networks that consist simply of nodes and links are very useful for understanding of psychological processes that contain parallel constraint satisfaction. These processes include aspects of vision, decision making and meaning making in language understanding. Connectionist models can simulate learning by methods that include Hebbian learning and back propagation. Connectionist approach explanatory schema is as follows:

Explanation target:

- Why do people have a particular kind of intelligent behavior?

Explanatory pattern:

- People have representations that involve simple processing units linked to each other by excitatory and inhibitory connections.
- People have processes that spread activation between the units via their connections, as well as processes for modifying the connections.
- Applying spreading activation and learning to the units produces the behavior.

Modeling of various psychological experiments showed the psychological relevance of connectionist models, which are, at the same time, only rough approximations to real neural networks. Lately, computational models of the brain became biologically richer. These models are not a main alternative to computational accounts in terms of logic, concepts, rules, images, and connections, but they should interlock with them and show how mental functioning can be performed at the neural level.

Cognitive scientists study the nature of intelligence from a psychological point of view, mainly by building computer models aiming to help to clarify what happens in our

brains during problem solving, remembering, perceiving, and other psychological processes.

2.2.2.2 Cognitive psychology

Cognitive psychology is the study of psychology related to the mental process of knowing including the aspects of awareness, perception, reasoning and judgment. The study of the nature of various mental tasks and the processes that enable them to be performed. According to Wikipedia *Cognitive psychology* covers a broad range of research domains, examining questions about the workings of memory, attention, perception, knowledge representation, reasoning, creativity and problem solving.

Cognitive psychology is radically different from previous psychological approaches in two key ways.

- It accepts the use of the scientific method, and rejects introspection as valid methods of investigations, unlike phenomenological methods such as Freudian psychology.
- It posits the existence of internal mental states (such as beliefs, desires and motivations) unlike behaviorist psychology.

The study of cognitive psychology gives us ability to understand how do people get their knowledge and skills and what exactly is going on in learner's mind. Thus we could improve methods and approaches used for teaching, learning, memorizing, etc. What kinds of information representation are the most suitable for a learner? How to make learning, for instance e-learning, more successful, interesting and motivating? These are only few questions, to be answered by means of cognitive psychology.

Modern development of cognitive psychology.

Anderson (2000) says about three main influences for its modern development:

- Research on human performance during World War II. Cognitive psychology was integrated with the area called information theory (analyzing processing of information, perception, and attention).

- Developments in computer science – a great number of concepts from computer science became used in psychology.
- Linguistics appeared to be much more complex, than it was believed to be before.

Relevance of Cognitive Psychology to Human Computer Interaction

- Provides knowledge about what users can and cannot be expected to do.
- Helps to identify and explain the nature and causes of problems users encounter.
- Provides guidelines and methods that help to build interfaces that are easier to use.

History of cognitive psychology

Cognitive psychology is one of the more recent additions to psychological research, having only developed as a separate area within the discipline since the late 1950s and early 1960s (though there are examples of cognitive thinking from earlier researchers). The term came into use with the publication of the book *Cognitive psychology* by Ulrich Neisser in 1967. However the cognitive approach was brought to prominence by Donald Broadbent's book *Perception and Communication* in 1958. Since that time, the dominant paradigm in the area has been the information processing model of cognition that Broadbent put forward. This is a way of thinking and reasoning about mental processes, contemplating them like software running on the computer that is the brain. Theories commonly refer to forms of input, representation, computation or processing, and outputs.

The application of cognitive theories in comparative psychology has led to many recent studies in animal cognition.

The information processing approach to cognitive functioning is currently being questioned by new approaches in psychology, such as dynamical systems, and the embodiment perspective.

Because of the use of computational metaphors and terminology, cognitive psychology was able to benefit greatly from the flourishing of research in artificial

intelligence and other related areas in the 1960s and 1970s. In fact, it developed as one of the significant aspects of the inter-disciplinary subject of cognitive science, which attempts to integrate a range of approaches in research on the mind and mental processes.

2.2.2.3 Role of cognitive science and cognitive psychology in virtual education

Virtual education is still young and more and more research is done in this area nowadays. As virtual education appeared, it made scientists to reexamine all teaching approaches and methods from the new point of view. Are old approaches still efficient for it? Is virtual education really good? What should we change in present and past teaching approaches to fit new needs of learners and educators?

First question which might be asked here now is "Does cognitive psychology have anything to do with virtual education?"

- Yes, it does.

To be competent in teaching and learning one should have at least basic understanding of psychology of learning, cognition. The principles of learning are based on cognitive psychology: the science of how people process information.

Robert Gagne (Maschke et al. 1999) outlined a number of instructional events that are necessary for effective adult learning:

- ***gain attention*** - to engage the learner positively
- ***identify the learning objectives*** - to set the learner's expectation relating to content and learning activities
- ***stimulate recall of prior learning*** - to retrieve existing or underpinning knowledge upon which current study will build
- ***present the content*** - to transfer the new knowledge and skills utilizing the most appropriate range of delivery and interaction
- ***provide learner guidance*** - to provide reinforcement that acts to embed the cues that will trigger on-the-job performance

- ***elicit performance*** - to facilitate rehearsal and practice such that the new knowledge and skills are effectively captured and encoded into the long-term memory
- ***provide feedback*** - to continuously reinforce learning progress and to promote learner attention and engagement
- ***assess performance*** - to monitor the learner's progress towards mastery and to effective on-the-job performance
- ***enhance retention and transfer*** – contextualize the new knowledge and skills to enable generalization.

As one goes through these events, it can be easily seen that most of the items presented are the subjects of cognitive psychology.

According to Albert (2001) there are four psychological components of a virtual education system:

The *Knowledge Base* contains the structured expert knowledge about the knowledge domain.

The *Student Model* represents the hypothetical knowledge state and other attributes of the student; the student model is the basis for adaptive pedagogical interferences, it may capture e.g. the student's knowledge, misconceptions and general skills, and it has to be adapted to the learning progress.

The *Teaching Model* decides about the pedagogical interventions taking into account the knowledge base, the student model, didactical strategies, the learning context, and the learning goal.

The *Interactive Human Computer Interfaces* (*Interactive Web Interfaces)* are for presenting information to and receiving information from the student.

These four components are also called Domain Knowledge, Student Model, Tutor Model and User Interface. Contributing to the development of virtual education systems as a psychologist primarily means to improve these four psychological components on the basis of psychological theories, models and empirical results.

von Brevern (2004) in his article mentions that the use of virtual education products, draws the importance of psychological (i.e., cognitive) and social rationales which need to be firstly defined, then incorporated into any instructional design model to build virtual

education products. ”Cognitive, social, and even behavioral motives and intentions must be reflected in e-Learning systems more than in any other computer-based systems because learning is constantly evolving and changing, but also re-shaping how we interact on equally a psychological and pedagogical level.” Educators (on-line tutors) and learners interact according to the laws of psychology and pedagogy.

How is cognitive psychology related to virtual education? It is not related. Virtual education is based on cognitive psychology. Fields of study of cognitive psychology such as perception, attention, knowledge representation, memory, reasoning, cognition, etc. are among other basic notions of virtual education.

2.2.3 Current trends in the research of quality of virtual education

Virtual education still has a lot of cons and pros, many problems to be solved and many specific issues to be taken into consideration. Here we will face with some of them.

For example Dr. Robin Mason in ”The Development of Virtual Education: A global perspective” (Farrel 1999) in which he makes a review of European trends in the virtual delivery of education, mentions some conclusions about the growth of virtual teaching in Europe which can be characterized by few specific issues such as ”technology infrastructure limitations, financial impact, human resources impact, learner and teacher acceptance, the reaction of conventional institutions, and demographic characteristics.” (Farrell 1999)

According to Mason some current trends in the research of quality of virtual education are:

- *Human resources*

The training of teachers is finally catching up these days. However, in those countries that are in the forefront of virtual teaching, there is a severe workload issue that needs attention. Many academics are under great pressure to produce research results at the same time as deliver courses to vastly increased numbers of students. While virtual teaching may have some answers to this squeeze, the long-term exploitation of teaching staff is not sustainable. Support staffs are now in greater demand than teaching staff in some places,

and those with ICT skills can command a high salary. According to Mason some conclusions about current condition of virtual education development can be grouped into a number of issues, for example:

- *Learner acceptance*

A number of surveys and researches made recently concerning virtual education show that learners are mostly enthusiastic about virtual education. One of the interesting facts about virtual teaching when opposed to traditional distance teaching is that it is less flexible. (Traditional distance education in Europe usually includes printed materials and local real-life tutorials). Virtual education in general is reading from the screen, studying at the computer with network access, and also carrying out collaborative work online. All these factors make a virtual course less flexible than when reading prepared in advance course texts. However, students greet the opportunity to improve their ICT skills, and the most independent and successful learners enjoy and benefit from the approaches that virtual courses use.

- *Acceptance of constitutions*

Virtual and distance education has gained many supporters in Europe, the traditional universities still pay little attention. And it is explainable. Most of the institutions that are less well-established, less elitist, less well-funded are willingly think over their options and are interested to enter the market of virtual education. As more and more new universities offer some form of virtual education these days, competition has become intensive. Though most of the European countries have some version of an open university, which makes competition between universities less significant.

- *Demographic characteristics*

At the time when many word are said and written about that virtual education will serve the disadvantaged, the far-distant, the unemployed, and the lifelong learner, in reality, nevertheless the early users are the opposite: employed, urban, well educated, and well off.

Actually there are a number of problems concerning virtual education, which are not often considered to be any significant. One of them is “course choice” for example. It is clearly presented by Ormond Simpson. (2004)

One of the most important prerequisites of successful course completion ”course choice” is a first parameter to influence future retention and successful completion of the course or dropping-out of it. The first thing student does before beginning learning – choosing the course. It is obvious that virtual course producers should care and worry about it. If he makes inappropriate choice, for example wrong content of the course or wrong level, he is much more likely to drop out than the student who made the right choice and is taking a suitable course.

There hasn't been so much investigation done in this subject to the moment. Simpson formally divides potential students into the following groups: those who have clear understanding of their objectives, abilities and have course requirements. Also there are students, who have clear but wrong understanding of what they need and those, who will have almost no idea of what they want. Student usually relies on the course title and description to make a decision.

All virtual courses are provided with course titles and descriptions, and there are also some issues about them.

- Length
- Vocabulary
- Conflict between recruitment and retention
- Assumed entry behavior

Probably there are some more elements to be involved, such as course choice guidance, student's comments on courses, preview and diagnostic materials.

From some point of view *student's comments on the courses* are the most common and simple thing to maintain course choice. These are notes written by students, who have recently completed the given course. This element also has a lot of issues to talk about, such as evaluation, costs, limitations and so on. One more element is

Course preview materials – "Taster packs". The main idea is that a student considering a course has an opportunity to take a short "test drive" of that course. It seemed better to select short samples of the course, which are the most typical ones for the specific course.

Diagnostic materials. There are two kinds of them: generic and course specific. Generic diagnostic materials are used to test applicant's suitability for higher education.

Course specific – to test suitability for a particular course. Both of them can be either externally- or self-assessed. Diagnostic materials of any kind can help the student if he is at the right level suitable for the course, but it can't tell the student if the course content is right for them.

Thus all the methods mentioned below have their limitations in terms of cost or the partial view on the courses they provide. The question of what will give the student the best "feel" of the course remains for further exploration.

Virtual educators acknowledge that traditional education still has some indisputable advantages in comparison with virtual education. One of them for example is that keeping virtual learners engaged and enrolled is a tough problem. The reality is that many learners who manage well in classrooms are not ready for online learning. Traditional learners have developed a classroom learning ability and their own strategy over time. For example, they know how to interact with teachers and with other students, and they know how to take tests.

In virtual courses, learners require an expanded set of skills to carry out the learning process successfully. At the same time, teachers need a different kind of design and teaching perspective and strategy for the online work, in contrast to the classroom. "These are two sides of the same coin" says Martinez (2003).

Before the virtual education appeared, it was enough to create and design primarily cognition-based solutions, depending on the ways people process information, and to let the instructor to provide the personal approach to the knowledge delivery. Something similar to that personal approach is even more important online. Martinez claims that research suggests that e-teaching outcomes, including completion rate, improve when the instructional presentation adapts to the learner's aptitude, abilities, expectations, and personality. Good classroom teachers intuitively pay attention to the main of these factors, and adjust content, presentation, and other items to fit to learners as needed to promote learning. Teachers receive important hints from interaction with learner, interaction between learners, and from expressions of learner intent. Learner perseverance is something that has to be inspired and trained throughout the learning and teaching process.

In virtual, of course, the usual access to learners' emotions is not available to an instructor or to a virtual course application (Martinez 2003).

Some other problems virtual learning has to deal with are learners' motivation problems. These are some significant issues having a place in the industry of virtual education nowadays. Thus the question of virtual education quality and virtual courses evaluation and their quality assessment stays very topical.

2.3 Conclusion

Massy (2002) says "The two most important criteria for evaluating quality of virtual education are that it should 'Function technically without problems across all users' and have 'clearly explicit pedagogical design principles appropriate to learner type, needs and context". These 'appropriate to learner type and needs' issues are still not being taken into account by most of virtual education tool producers. E-teaching is developing further from the technical point of view, but very inefficiently in the direction of psychology of learning and cognitive science. The survey made in 2002 showed that "61% of all respondents rated the overall quality of virtual education negatively – as 'fair' or 'poor'". We should expect that the situation is better these days, but as we can see, it still needs a lot of improvement. That's why the question of quality of virtual education needs to be studied carefully.

From a psychological point of view, virtual education systems are preferable. They make it possible to create a world wide collection of data and information which can be used for testing the psychological and educational models of teaching and for improving or refining the virtual education systems. The importance of cognitive psychology for developing internet-based virtual education systems is plain for several reasons. Examples are: theory-based models of learning, reasoning, problem solving, knowledge retrieval, remembering, and retention. Moreover, cognitive psychology provides a methodology for creating and presenting learning objects as for collecting, analyzing, and interpreting behavioral data which are not only answers to multiple choice questionnaires or solutions of problems, but also latencies, eye tracking data, video recordings, or psycho-physiological data. It also offers expertise in computer-based and web-based experimental

methodology for assessing and shaping behavior and for the processes and structures underlying the behavior.

A *virtual education institution* is defined as an organization that, directly or indirectly, uses information and communication technology to provide its educational services, including traditional institutions such as universities or non-educational organizations that distribute virtual educational services. Only few of them today are fully virtual from administration to instruction, but obviously there is a global trend to spread out virtual services in educational institutions, corporate sector, etc.

There are some pedagogical affairs, such as the absence of human interaction, and some legal considerations, such as copyright infringement. But the agreement is that virtual education is a strong direction that education is taking, not just a vogue.

It is intensely affecting education development; online virtual learning is less onerous than a corresponding real-life course. Some of the most important factors influencing development and expansion of virtual education are increasingly affordable ICTs, such as personal computers and Internet access, their ability to provide flexible, multivariate learning to a lifelong learners', who are hungry for educational opportunities. Nevertheless, the development of ICT-part of virtual education needs to be more closely linked with educational and pedagogical considerations. A critical proposal is for ICT development to take educational access into consideration. Traditional institutions need to start thinking "beyond the bounds" to be fully effective in the virtual marketplace (Cheng 1997).

3. Multiple Intelligences Theory

What are the features cognitive sciences can provide for virtual education? In this chapter we consider the possibility of the use of a theory first introduced to be a psychological one. We strongly believe that cognitive psychology and cognitive science have a lot of trump cards that are still not noticed by educational and other sciences though they might be really helpful. Here we take up a Theory of Multiple Intelligences and try to consider it's possible use and utility in virtual education.

3.1 Introduction to Multiple Intelligences Theory

The Multiple Intelligences theory was built on a psychological and neuropsychological research. It has its background in understanding and in general view on the nature of Intelligence. So first of all we have to define what do we understand by *intelligence?*

3.1.1 What is intelligence?

Howard Gardner says *for most of human history, there was no scientific definition of intelligence.* According to him first efforts to define intelligence technically appeared just about a century ago.

According to Wikipedia ***Intelligence*** *is a general mental capability that involves the ability to reason, plan, solve problems, think abstractly, comprehend ideas and language, and learn.* Being more or less detailed this definition reflects to the most common and to say classical understanding of the term *Intelligence*. As it is written in one of online encyclopedias (Tiscali 2004) in psychology, *intelligence is a general concept that summarizes the abilities of an individual in reasoning and problem solving, particularly in novel situations*. These consist of a wide range of verbal and nonverbal skills and therefore some psychologists dispute a *unitary concept* of intelligence. There is confusion within

psychology. Some confusion concerning the definition of intelligence arises from the fact there are several possible psychological perspectives on intelligence. Probably the most influential developments in our recent understanding of this concept have come from educational and psychological researchers associated with cognitive psychology.

Many individuals, such as Gardner, Naglieri, and Goleman, argue that our view of human intelligence is far too narrow, leading the way to an expanded view of what intelligence is and what constitutes intelligence. (Yekovich 2004)

Two different views on intelligence.

There are basically *two views* on the theory of intelligence: first are those who believe in one single-line general intelligence (***g***), and the second - those who believe existence of many different kinds of intelligences. Binet founded the French school of intelligence, where intelligence tests were regarded as a practical methods of disuniting the high-intelligence from the poor. Intelligence quotient (IQ) was regarded simply as an average of a number of different not uniform abilities, but not as a real thing with certain properties that could be studied.

Galton founded the English school of intelligence, where they believed that intelligence is a real ability which has a biological basis and can be studied by means of reaction time on simple cognitive tasks.

- **One General Intelligence**

The English school made a massive step forward with **Spearman's** invention of *factor analysis*. Using this technique, Spearman (1904) found that all tests of intelligence have positive correlations on the general factor and called this factor *general intelligence, or* ***g***. When he examined the results of these different tests, he found that there was a positive correlation between the tests for a given individual. In other words, if a certain person performed well on a test of verbal abilities, then the same person also performed well on another test of another cognitive ability, for instance, a mathematics test. Spearman named this positive correlation among tests the positive manifold. This positive manifold was also called the general intelligence factor, or *g*. This is the single factor that determines the intelligence of the individual.

Another strong argument in support of one general intelligence is the fact that there is a very high correlation between reaction time and IQ. According to **Eysenck** (1982), "IQ correlates very highly (.8 and above, without correction for attenuation) with tests which are essentially so simple, or even directly physiological that they can hardly be considered cognitive in the accepted sense." For instance, an example of the type of tests used to measure reaction time is a test in which a light is turned on. The participant is asked to press a button as soon as he or she sees the light go on. From tests such as these, the reaction time can be measured. Given that only very simple sensory and motor movements are necessary to respond, it is difficult to argue that cultural, environmental, gender, socio-economic, or educational discrepancies will affect the participant's ability to respond to the testers' questions.

Jensen (1993), as well as others, synthesized these facts and conjectured that "the most obvious hypothesis is that speed of information processing is the essential basis of *g*, and one possible neurological basis of speed of processing is the speed of transmission through nerve pathways". The speed of information transmission can be reasonably well measured or extrapolated from reaction time scores. Therefore, if an individual has faster neural processing speed, then he or she has a better reaction time. In turn, given that reaction time is highly correlated with IQ, then those individuals with faster neural processing speeds have higher IQ's. Consequently, neural processing speed determines level of intelligence of the individual; this intelligence is the one general intelligence ***g*.**

- **Multiple Intelligences**

Different proposers of one general intelligence all agree that there is a single factor that determines intelligence, and the proposers of multiple intelligences agree that there is more than one single type of intelligence. However, the different proposers of multiple intelligences do not agree on how many different intelligences there are, or could be. The theories suggested by Gardner and Sternberg have the most principle ones. Both of them have their own theory on multiple intelligences; Gardner (1983) believes there are eight forms of intelligence; Sternberg (1985) believes there are three forms of intelligences.

Gardner's theory of multiple intelligences suggests that there are eight different forms of intelligence. They are linguistic, musical, spatial, bodily-kinesthetic, interpersonal, intrapersonal, logical-mathematical and naturalist. In developing his theory,

Gardner (1983) attempted to rectify some of the errors of earlier psychologists who "all ignore[d] biology; all fail[ed] to come to grips with the higher levels of creativity; and all [were] insensitive to the range of roles highlighted in human society" (Paik 2004). So, Gardner based his own theory of intelligence on biological facts. But we are going to get deeper into Gardner's theory later.

Sternberg's theory. Sternberg (1985) felt that the theories that preceded him were not incorrect, but, rather, incomplete. Consequently, his theory, like Gardner's, takes into account creative or musical intelligence. But as for the other six kinds of intelligences from Gardner's theory, Sternberg classifies them into two different types of intelligences: analytic (or academic) and practical. These two types of intelligences differ and are defined as follows: Analytic problems tend to have been formulated by other people, be clearly defined, come with all information needed to solve them, have only a single right answer, which can be reached by only a single method, be disembodied from ordinary experience, and have little or no intrinsic interest. Practical problems tend to require problem recognition and formulation, be poorly defined, require information seeking, have various acceptable solutions, be embedded in and require prior everyday experience, and require motivation and personal involvement.

In addition to Gardner's and Sternberg's theories on multiple intelligences, there are other theories as well, including Thurstone's and Guilford's. Both were proponents of multiple intelligences. **Thurstone** (1924) found several primary mental abilities. According to him these abilities are those abilities that the individual uses in order to survive and succeed in society. **Guilford** (1967) found that the structure of intellect was composed of 4 contents, 5 operations, and 6 processes. Each of these was mixed and matched to come up with 120 different combinations of abilities. (Paik 2004)

3.1.2 History and origin of MI theory

Howard Gardner, Ph.D. is a professor at Harvard University and the author of many books and articles. His theory of multiple intelligences has challenged long-held assumptions about intelligence - especially about unitary concept of intelligence.

In the beginning of 1980's Howard Gardner proposed a definition of intelligence that recognizes many different and discrete facets of cognition and confesses that people have different cognitive strengths and contrasting cognitive styles.

The history of the Theory of Multiple Intelligences begins with the work on the Project on Human Potential proposed to the group of researchers by the Bernard Van Leer Foundation. They were expected to carry out a research on the nature of human potential and how it could best be catalyzed. Then Howard Gardner received an assignment to write a book about what had been established about human cognition through discoveries in the biological and behavioral sciences. That's the way the program that led to the theory of Multiple Intelligences appeared.

Gardner first identified 7 kinds of intelligence and has since added an eighth. Many people get surprised finding the categories he has chosen, because they never thought of them as intelligence before. They are as follows:

Linguistic intelligence: ability to use words effectively in both orally and writing. These are abilities to remember information, to convince the others to help you, to talk**.**

"A sensitivity to the meaning of the words whereby an individual appreciates the subtle shades of difference between spilling ink "intentionally", "deliberately", or "on purpose." A sensitivity to the order among words – the capacity to follow rules of grammar, and, on carefully selected occasions, to violate them. At a somewhat more sensory level – a sensitivity to the sounds, rythms, inflections, and meters of words – that ability which can make even poetry in a foreign tongue beautiful to hear. And a sensitivity to the different functions of the language – it's potential to excite, convince, stimulate, convey information, or simply to please" (Gardner 1993).

Musical intelligence: ability to sense rhythm, pitch and melody. This includes such skills like ability to recognize simple songs and to vary speed, tempo and rhythm in simple melodies. Some of the most central principle component elements of music are *melody* and *rhythm.*

A sensitivity to the melody, ability to repeat easily a long melodies after hearing them only once, good memories for tunes ability to recognize the key and so on. A very good sense of rhythm.

Logical-mathematical intelligence: ability to use numbers effectively and to reason well. Understanding the properties of numbers and principles of cause and effect, ability to predict using simple machines. Consists of *syntactic* and *pragmatic* capacities.

Ability to calculate rapidly, logical reasoning, appreciation of the actions to perform on the objects, relations between those actions, the statements one can make about actual or potential actions and the relationships between those statements.

Spatial intelligence: the ability to sense form, space, color, line and shape. It includes the ability to graphically represent visual or spatial ideas.

The capacity to realize the visual world accurately, to perform transformations and modifications on observations, ability to recreate perspectives of visual experience. Includes an ability to recognize an object seen from different angles, to imagine movement in total or among the parts of the configuration.

Bodily-kinesthetic intelligence: ability to use the body to express ideas and feelings and to solve problems. Include such physical skills like coordination, flexibility, speed, and balance.

Capacity to work successfully with the objects, including fine motor movements of the whole body as well as fingers and hands only. Control on body motions.

Intrapersonal intelligence: ability to understand yourself – your abilities, weaknesses moods, desires and intentions. Includes such skills as understanding how you are similar or different from the others, reminding yourself to do something, knowing about yourself as a learner, knowing how to handle your own feelings. Access to one's own feeling life. A capacity to effect differentiations between own feelings and to label them. Possible ability to detect and symbolize complicated sets of feelings.

Interpersonal intelligence: ability to understand another person's moods, motivations, feelings and intentions. Includes skills such as responding effectively to some other people in some pragmatic way, such as getting colleagues to participate in a project. Ability to notice and make differentiations among other individuals and among their moods, temperaments and intentions.

Naturalist intelligence: ability to recognize and classify plants, minerals and animals, including rocks and grass and all variety of flora and fauna. Also the ability to recognize

cultural artifacts like cars or sneakers. Capacity of identifying patterns and classifying things in nature.

There are still some arguments and unintelligibility about the existence of some other forms of intelligence such as emotional and moral intelligences. Though while being discussed these are claimed to be non cognitive (Holmes 2002), whatever they mean by it, so we are not interested in these other forms of intelligence since they are not licensed by the creator of the theory.

There are obviously some relations between these different kinds of intelligence and one can easily find even more of them. They are interconnected and it may be even possible to find some dependence between them.

Gardner doesn't insist that these are the only eight intelligences that exist. He and his colleagues are still working on some new dimensions of the theory, including attempts to define and discover new sides and properties of human mind. They go on suggesting and supposing new types of intelligences. Some of them such as digital intelligence, attention, sexual intelligence and spiritual intelligences are being discussed and examined now.

There are four key points of the theory synthesized by Thomas Armstrong (1994):

1. Each person possesses all eight intelligences. In each person these eight intelligence function together in unique way. Some of them are high-level functioning, some are modestly developed.
2. Intelligences can be developed. Everyone has the capacity to develop all eight intelligences to a reasonably high level with appropriate encouragement and instruction.
3. Intelligences work together in complex ways. Intelligences don't exist by itself. Intelligences always interact with each other.
4. There are different ways to be intelligent. For example a person can be absolutely awkward in dancing and excellent in building construction, while both activities are considered bodily-kinesthetic intelligence.

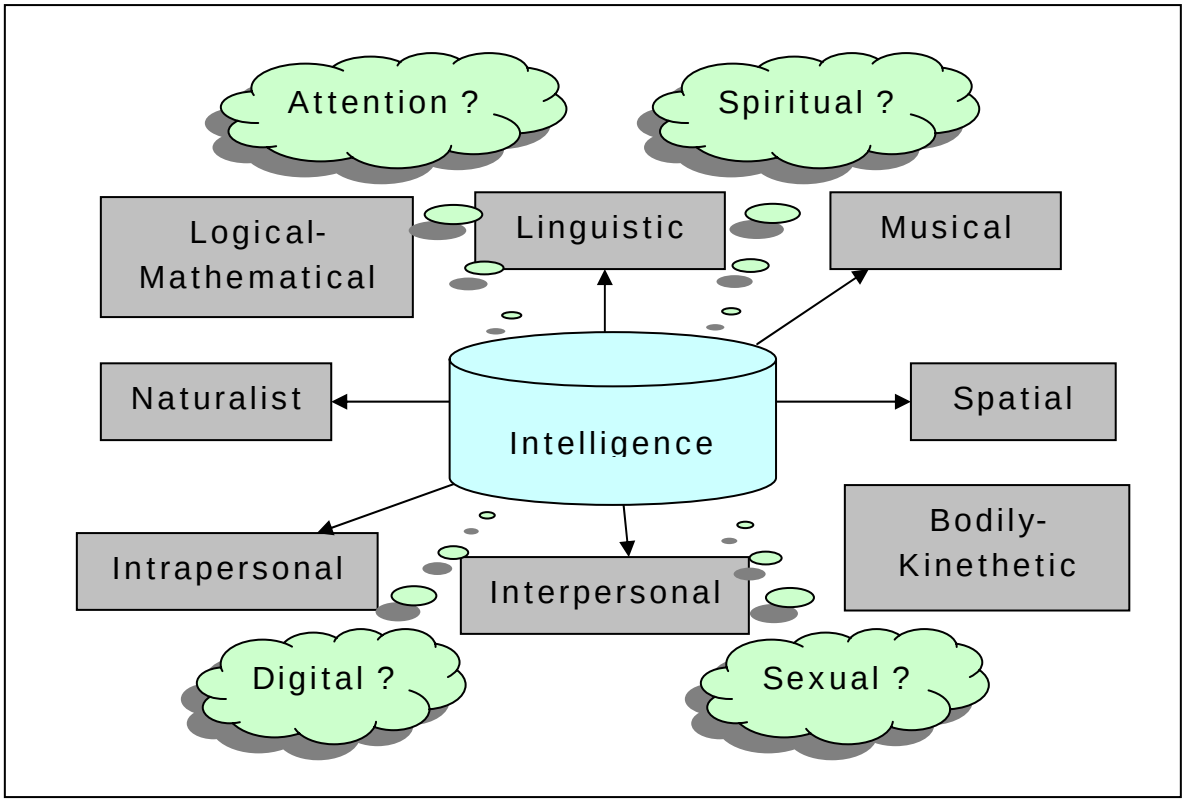

Figure 3. Gardner's Multiple Intelligences "8 + x"

Gardner's theory has a solid biological basis. By studying individuals who had speech impairment, paralysis, or other disabilities, Gardner could localize the parts of the brain that were needed to perform the physical function. He studied the brains of people with disabilities postmortem and found that there was damage in specific areas, in comparison to those who did not have a disability. Gardner found seven different areas of the brain, and so his theory consisted of eight different intelligences, each related to a specific portion of the human brain.

3.1.3 MI theory after 20 years

Gardner says in his book "Intelligence Reframed: Multiple Intelligences for 21st century" that for over a decade he was content to let MI theory have a life of it's own. But after some readings and observations he concluded that he was wrong running such a policy. He got indignant at some things that were brought to follow and proceed with MI

theory. Thus Gardner identified a number of myths about multiple intelligences, which he listed in his book. Let's mention them in brief.

Myth 1: Now as that eight or nine intelligences are identified, researches can and should create a variety of tests and guarantee associated scores.

Reality 1: MI theory represents the critiques of the standard psychometric approach, wherein researchers construct and use tests (such as extraversion or gullibility) to assess its incidence. Being asked to comment on measures of multiple intelligences that other researchers devised, Gardner stresses several general points that any test developer should consider: the importance of the distinction between individual's *preferences* for materials/intelligences and their *capacities* in these spheres and also the importance of drawing on observations of actual skills.

All this brings us to understanding of the fact that all tests and other analogous attempts to ascertain "Multiple Intelligences profile" of a person are not at all efficient. The real, true assessment of intelligences requires much more than paper-and-pencil test. Gardner gives an example: if one wants to assess musical intelligence for instance, he should display a new melody, for example and observe and analyze respondents singing, recognizing, transforming it, etc. Long-term, detailed observations made by competent specialists should be made to get an efficient result.

This was the main reason why we refused the initial idea of using multiple intelligences assessment tests in the research though they are still widely exploited both in education and research.

Myth 2: Intelligence is the same as a domain or a discipline.

Reality 2: Intelligence should not be confused with domains or disciplines as far as it is a new kind construct that draws on biological and psychological potentials and capacities.

Myth 3: Intelligence is the same as a learning style, a cognitive style, or a working style.

Reality 3: The concept of style indicates some general approach that an individual can apply to an indefinite range of content. In comparison, intelligence is a capacity that is geared to a specific content in the world.

Myth 4: MI theory is not empirical.

Reality 4: "MI theory is based wholly on empirical evidence and can be revised on the basis of new empirical findings.

Myth 5: MI theory is incompatible with ***g***, with environmental accounts of the nature and causes of intelligence.

Reality 5: MI doesn't question the existence of ***g***, but its province and explanatory power.

Myth 6: Broadening the term *intelligence* MI theory renders the term and its typical connotation useless.

Reality 6: The standard definition of *intelligence* simply narrows our view on it. "MI theory is about intellect, the human mind and its cognitive aspects A number of semi-independent intelligences presents a more sustainable view of human cognition."

Myth 7: There is a single "approved" educational approach based on MI theory.

Reality 7: MI theory is not an educational injunction. There is always a space between scientific claims and actual practices. "Educators are in the best position to determine whether and to what extent MI theory should guide their practice."

3.2 Implication of MI theory to education

MI theory is very interesting, but what kind of an impact does it have to education and virtual education? In this section we explain why we take this theory into consideration. Computer science can't get along without cognitive science, especially on its educational side, which is mainly represented by virtual education. Cognitive and educational approaches have to be considered and new approaches to be developed. Here we discuss the meaning of Multiple Intelligences theory for educational approaches in general and the possibility of it's usage in virtual education.

3.2.1 The use of MI theory in education

According to his own words Gardner (2003) was writing his book as a psychologist. As far as he was given the mission of the Van Leer Foundation[*], he needed to say something about the educational implications of MI theory. His book "Frames of mind: The Theory of Multiple Intelligences" (1984) contains some educational implications of the theory. And it was educators, who got mostly interested in the theory. Howard Gardner (1993) himself says that "No direct educational implications follow from this psychological theory; but if individuals differ in their intellectual profiles, it makes sense to take this fact into account in devising an educational system." After the publication of "Frames of mind" he got a great number of responses asking or telling him how to use MI theory in education. Gardner at the same time has always mentioned that he is a psychologist and not an educator.

From the educators' point of view the theory of multiple intelligences "seem to harbor a number of educational implications that are worthy of consideration" (Christinson 1998). Educators took the theory, put it together in different ways, and applied to their program and curriculum planning and development. According to educational view on the theory each person according to his/her multiple intelligences condition needs different way and approach for learning and being taught.

Specificity of learning strategy related to multiple intelligences theory.

Bodily-kinesthetic intelligence implies opportunities for physical challenges while learning.

Intrapersonal intelligence implies possibility for the learner to express his/her own preferences and to understand his/her styles of learning.

Interpersonal intelligence means activities that involve learner into interaction with other learners, solving problems and resolving conflicts.

[*] The Bernard van Leer Foundation is an international, philanthropic, and professional organization in The Netherlands. The foundation concentrates its philanthropic efforts on low-cost, community-based projects in early childhood education, supporting families and those children who may be culturally or socially disadvantaged. Official website: http://www.bernardvanleer.org/

Linguistic intelligence considers reach "print environment", providing things to read, to listen to, and to write about and creating opportunities for interaction between learners and tutors.

Logical-mathematical intelligence implies providing manipulating for experimentation with numbers, and providing material for understanding of cause and effect.

Musical intelligence needs using records for listening, musical background for working.

Spatial intelligence implies opportunities for visual mapping activities, for example creating charts and mind maps.

Naturalist intelligence needs focusing learner's attention on world outside, real-life examples, real-life situations and problems to solve.

Since the theory was created, educators did their best to attempt to use and apply it to educational technologies. They used ideas of the theory in different, often in unexpected and strange for the author ways. Even though Gardner didn't mean his theory to be one of the most famous and used in the world of education, as it was first presented targeting psychological sciences and scientists, and even though he doesn't very much believe in those applications it has now, the practical results show, that educational applications of the theory suggested by teachers do work. Thus the theory of Multiple Intelligences continues being under consideration, being used, developed and applied. Traditional education undoubtedly benefits from MI theory. Now, what about virtual education?

3.2.2 The use of MI theory in virtual education

There are three main ideas that appear regarding Gardner's theory in virtual education. How can we apply it in virtual education? How can this theory help us make e-teaching more efficient and effective?

- The first idea is to find out if there are any correlation between learners' Multiple Intelligences profile and their attitude to virtual education courses, as it was already done with traditional teaching before. But first we need to define the term

Multiple Intelligences profile. This term is widely used among educators, who believe that it is possible to determine what are the strong intelligences of a particular person and what are his weaknesses from the point of view of MI theory. The main tools used for it are some Multiple Intelligences tests – a set of questions regarding personal preferences, habits and behavior of the respondent. Then it might be possible to suggest some kind of course modifications for each kind of intelligence or probably assume that not all people can learn by virtual courses equally good, but depending on their MI profile and figure out a group of people whom virtual courses are best for. But then we realized that professor Gardner himself doesn't consider these tests valid. It is definitely possible, but as Gardner himself says, in "MI myths" mentioned before, defining this MI profile is a laborious process, which requires a lot of time, observations and non-trivial examination of each respondent. Thus the term Multiple Intelligences profile exists but differs in the ways and tools used to define it. Though educators mostly continue using these tests in their work and research we would prefer our research to stay respective to the author of the theory. Even though he acknowledged that he can't control further development, consequences and applications of his own theory anymore when it is out to the world.

Nevertheless the idea also was to find and mark out the group of learners with some concrete capacities who are really good to be "e-taught". Then educators could concentrate on this particular group of people.

- The second idea (and the most realistic one) is just to take Multiple Intelligences theory into consideration when creating virtual education courses. Multiple Intelligences theory has been widely applied and extended in education, but not virtual education yet. The only paper on this subject we found is Margie Meacham's "Using Multiple Intelligences Theory in the Virtual Classroom" (Meacham 2003). Meacham proposes to construct virtual education tools in a way that they could engage as many intelligences as possible. She even tries to find some possible features that would correspond to bodily-kinesthetic intelligence, which can hardly be seen connected to computer and information technology at first glance.
- The third idea is based on an assumption that people of the same or similar professions probably have similar Multiple Intelligences profiles. For example if most

of programmers have intelligences i1, i2, i3 – good developed; physicians might be good at intelligences i3, i5, i8. Then it might be useful to take in account the audience, the particular course is made for, and to make attempts to fully engage these marked out intelligences; thus the course for physicians could have more stress on i3, i5, i8 – intelligences. Thus, as virtual education is claimed to be learner-centric in comparison with traditional one which is instructor (teacher)-centric, it has to be more specific and answer the needs and abilities of the learner and become the most learner-centric one can ever define. It is obviously difficult to make it clear at least for few most common professions what their strong intellects are (if people of same profession really do have anything in common). One easier way to do it is usage of MI tests, but it is not the most sufficient one.

Of course, these are just some ideas. They are not easy to apply in practice. But it can become a starting point for a research, leading to improvement of virtual education courses and their effectiveness. It actually can develop into a huge statistical and psychological research.

One more thing in using MI theory in education and especially in virtual education is that virtual education is mainly meant for adults, students, elder pupils. Gardner in his books gives examples on little children; he even suggests that it is possible to develop lowly developed intelligences. Though the applications of the theory imperceptibly moved to adults too, we can't be sure that it works the same way for adults, the development possibility, for example.

Traditional teaching in real classrooms successfully uses MI theory in education. At the same time there are almost no works or ideas of applying it in virtual education. So we try to stop on a more wide approach as in case of traditional education. Some general applications of Multiple Intelligences to virtual education courses. Margie Meacham (2003) in her paper makes an attempt to suggest some possible ways of utilization of it in the virtual classroom.

Most suitable aim here is to engage as many different intelligences as possible. It is obviously good not to get caught in targeting only few of them, even though in a very deep

way. It will constrict the course to some group of people and make it uninteresting and unsuccessful for the others.

We have got a huge technical and implementation power these days, which is actually wasted to the things that don't meet the requirements and needs of educational aspects of learning.

Some key points for virtual education tools producers (Meacham 2003) are listed in here:

Considering *linguistic intelligence* provide learners with such activities like

- Listening and telling stories concerning the subject of study
- Taking notes during a lecture
- Text reading and interpreting
- Exchange information and ideas with other learner or tutors in verbal or written format
- Answering written quizzes or surveys

Considering *musical intelligence*, musically-gifted learners are sensitive to music background which the others will not notice at all. It might help or on the contrary irritate, but

- background music could be used to enhance the desired mood
- There is a possibility, for example to associate musical tones with the stages of a learning process, different levels of performance.
- It might be helpful to use sound effects to accentuate the key points in a presentation

As for *Logical-Mathematical Intelligence* learner could try to benefit from activities like

- Working with a spreadsheets or calculating something
- Managing or analyzing an experiment
- Classifying or organizing information
- Developing theories or conclusions based on facts or observations
- Using a problem solving approach
- Summarizing statistics

Spatial intelligence requires activities, which let the learner to

- Deal with detailed graphics or visual effects

- Watch a motion video
- Interpret and apply charts
- Use mind-mapping software or graphic organizers
- Draw and design diagrams

Bodily-kinesthetic intelligence provides a person with ability to control body movements and manage physical objects. Therefore a person intelligent in such a way might respond well to learning activities involving

- ”Hands-on” manipulations with a keyboard or a mouse
- Action simulations that lets learner to place himself in the action
- Game-like activities, which require good coordination, or rapid reaction
- Blended solutions

Intrapersonal intelligence – first of all

- Surveys that focus on how the learner feels about the situation
- Tests to evaluate learner’s success
- Retracing the process of studying
- Learning diary

Activities for *Interpersonal intelligence* include:

- Creating conference groups and discussions
- Role-playing
- Analyzing conflicts, feelings or intentions
- Using verbal skills to build agreement
- Simulations, letting a learner to place himself in a role of a leader

Naturalist intelligent people are the ones who tend to process information best by exploration. They will most probably respond well to the activities that let them

- Search other websites or resources and investigate the topic on their own
- Organize a virtual guide to show the other learner the sites they got interested in
- Going on virtual tours of a company site, etc.
- Create blended learning, which involves live field trips.

These are only some preliminary and the most obvious, even though disputable ideas of probable use of the theory in virtual education. The thing one should never forget when designing a virtual course, is that every person possesses a combination of the various intelligences. Thus the goal is to use as many intelligences as possible.

In our opinion the consideration of possibility of transforming a particular course according to the needs of a current learner is not superfluous. It could be done with the off-line courses at least, by letting the user to set his own preferences on what he wants to see this course like.

3.3 Conclusion

Educators and virtual course developers have to consider that virtual education is not a method in its own, it is "a channel, just like the telephone, TV, the radio and, of course, direct face-to-face communication. As a sophisticated channel, based on a huge network of powerful computing devices and delivering its output through screens, speakers and printers, virtual education supports a wide range of learning methods, including self-study, real-time events, asynchronous discussion, not to mention exploration of the World Wide Web." (Shepherd 2003) This channel by its own is not enough.

In this chapter we considered Multiple Intelligences theory, its origins, its possible applications to virtual education and tried to assess expediency of its usage in developing virtual education courses.

Multiple Intelligences theory presented by Howard Gardner had been developed as a psychological theory considering the nature of a human mind and intelligence. The author did not initially mean it to become an educational theory. But educators did prove that this theory is sufficient to use for educational purposes. Virtual education is a new stage of development of traditional education and it has to inherit all the best approaches from it. Nevertheless virtual education is mostly treated as a technical thing and very little attention is paid to it from the point of view of psychology, cognition and teaching. Multiple Intelligences theory is still comparatively young theory and it is sometimes not treated seriously. However practice demonstrates that it is worth using in education and if we want to get virtual education developed into a strong educational approach, not only based on

technical representation approaches, but having a basis of psychology, pedagogic and cognition, using the prior knowledge and experience of education.

4. Summary

In this work, we have handled questions regarding virtual education and especially the aspect of quality of virtual education. Particularly, in the third chapter we considered so-called Theory of Multiple Intelligences and discussed if it is convenient to use it in development of virtual education.

In general, ***virtual education*** *(e-teaching)* – is education via the Internet, network, or standalone computer, it is a network-enabled transfer of skills and knowledge. Virtual education refers to using electronic applications and processes to learn. Virtual education applications and processes include Web-based learning, computer-based learning, virtual classrooms, and digital collaboration. Content is delivered via the Internet, intranet/extranet, audio or video tape, satellite TV, CD-ROM, etc. (Harvey 2004)

Virtual education has developed from distance education approach and became an independent strong approach. However, there are still many controversial points considered by educators, psychologists, sociologists, etc.

Is virtual education a good approach? What are advantages of virtual education?

Virtual education has definite benefits over traditional classroom training. The most obvious are the *flexibility* and the *cost savings* from not having to travel or spend excess time away from work. There are also others that might not be so obvious, such as reduced training costs, self-paced learning, speed, consistence, availability from any location and any time, easy updating, increased retention, multi-cultural aspects, etc.

What is the quality of virtual education?

There are the terms of quality in general debated. *Quality is the totality of features and characteristics of a product that bear on its ability to satisfy given needs* (Quality glossary) Quality of virtual education in its turn is a combination of properties that a virtual education tool must have to be treated as a quality product. There are a number of views on the quality of education. In this research we focus our attention on specific educational

matters of virtual education – problems of educational technology, psychology and cognition.

What is the role of cognitive psychology and cognitive science in virtual education?

Cognitive science and cognitive psychology deal with the human cognition, human mind and mental processes, and their first aim is to define what is going on in human mind and how do people learn, remember, forget, recall, perceive, understand. How they deal with the information they get? How they get the information? These issues are an essential part of educational science. As far as we are talking about the quality of virtual education from this point view, we have to know what are these sciences all about, to pay attention to the knowledge they give us to understand how do people learn and what are the best ways and approaches of teaching.

Current trend in research of quality of virtual education

Virtual education has still a lot of cons and pros, many problems to be solved and many specific issues to be taken into consideration.

There are a number of problems concerning virtual education, which are often paid too little attention to. To take an example we can mention the problem of "course choice". It is clearly presented by Simpson (2004).

One of the most important prerequisites of successful course completion "course choice" is a first parameter to influence future retention and successful completion of the course or dropping-out of it. The first thing student does before beginning learning – choosing the course. It is obvious that virtual course producers should care and worry about it. If he makes inappropriate choice, for example wrong content of the course or wrong level, he is much more likely to drop out than the student who made the right choice and is taking a suitable course.

Virtual educators acknowledge that traditional education still has some indisputable advantages in comparison with virtual education. One of them for example is that keeping virtual learners engaged and enrolled is a tough problem. The reality is that many learners who manage well in classrooms are not ready for online learning. Traditional learners have developed a classroom learning ability and their own strategy over time. They know how to

interact with teachers and with other students, and they know how to take tests, for example.

In virtual courses, learners require an expanded set of skills to carry out the learning process successfully. At the same time, teachers need a different kind of design and teaching perspective and strategy for the online work, in contrast to the classroom. ”These are two sides of the same coin” says Martinez (2003).

What is Multiple Intelligences theory?

Multiple Intelligences theory was first presented by Howard Gardner in 1981 in his book Frames of mind: theory of multiple intelligences. It’s a psychological theory which presents a different view on the nature of human intelligence. Gardner suggests viewing intelligence as a set of multiple intelligences instead of one general intelligence, which is believed to be measured by some IQ tests and so on. He presents eight different intelligences such as linguistic, logic-mathematical, musical, bodily-kinesthetic, interpersonal, intrapersonal, spatial and naturalist intelligence. The theory says that every person possesses all eight intelligences and the difference is the level of each intelligence a particular person has. Some of them might be on a very high level, some are lowly developed.

What does Multiple Intelligences theory have to do with education?

Though Gardner did not initially mean MI theory to be used in education, educators noticed it, began using and proved the success of their attempts. Traditional teaching suggests a number of possible use of the theory in education. There are also a number of techniques of teaching people with different intelligences developed.

Is it possible to apply Multiple Intelligences theory in virtual education?

We can not claim that MI theory is necessary to use in virtual education tools’ development. But it is successfully exploited in traditional education already, and as virtual education is *education* first of all, we have to consider the experience accumulated by traditional approaches. Only few feeble attempts had been done to suggest some ideas of its usage.

Today virtual education is treated as a technology-based education. To develop it into a serious and reliable educational approach educators need to view all different aspects of it. One small aspect from the psychological point of view is usage of approaches that help to affect learning results, memory, retention and understanding. Gardner's theory is just a small part of it and as soon as we begin taking these aspects seriously, virtual learners will benefit from virtual education courses.

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