The Importance of Perception and Consciousness for E-Learning

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The article presents the results of a research on perception during the learning process of adults in a virtual environment. The aim of the research was to determine why the process of e-learning introduction in Slovenia has been slowed down. Perception and its effects upon learning are important on the conscious as well as on the unconscious level but they have not been given as much attention as in the classical learning environment. Disturbed perception which results from the lack of expertise in preparation of the e-environment is a serious obstacle for learning. The objective of the research was to find solutions for the actual teaching practice but at the same time the research emphasizes that conclusions cannot always be made on the basis of former facts about students. We have to bear in mind that the impact of technology changes the students as well. Lack of professional arguments and of good practice leads to pedagogical conservatism which can cause the school's progress, also in the area of adult education, to be directed in the opposite direction from the one required by business processes in the organizations in which the adult students come from or in which the students are employed after they finish their education.

Key words: e-learning, e-education, virtual learning environment, perception, adults, remembrance

1 Introduction

1.1 Theses on causes of deceleration of e-learning development in Slovenia

Within the material[1] learning environment we pay a lot of attention to student's perception, meaning sensual perception and comprehension of the world, and therefore these aspects are well researched. Colors, interior design, sounds and order all matter to the learning process. We pay attention to how our senses are a medium for motivational and emotional factors and how we influence our cognitive processes. Intensive research into the brain brings new information that deepens our knowledge on learning. Teachers think of the material environment as of greatest significance regarding successful learning.

The Virtual environment gets far less attention. Since we think of classical learning and e-learning as complementary processes, the virtual learning environment plays a complementary role to the material learning environment. A roguish comment, that in a classical classroom a blackboard on the ceiling or pictures on the floor, puppies that poop around, putting down rakes or hanging out laundry would be hardly desired and no one demands that the students climb up a ladder and get the material they should later on read with a magnifier, usually astonishes the listener. But these sorts of »arrangements« are not unusual in a virtual learning environment. A possible reason for this is the poor involvement of humanistic professionals such as experts in education, adult education and psychologists and so cybernetic and technical criteria prevails – somewhat as if classic classrooms were a matter of the building and furniture industry exclusively. A lack of cognitive experts' contribution is also present. They could optimize the conditions for learning and thinking, though at the moment they have to few possibilities to transfer the fruits of extensive research into practice. Perhaps this is one of the reasons for the decrease of starting expectations of e-learning, while business environments are in the process of informatization and need people capable of e-learning[2].

During evaluation of e-materials and the e-environment we gather learners' reflections and participants call our atten-

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[1] To point out the contrast and because of separate discussion, we will reffer to the classical environment as *material* and the electronically created environment as *virtual*. A partial synonym for material is *real*. We use this term in the article when we are discussing the fruits of natural processes and when we are talking about the world itself, not its imitation. In the material world we can perceive in two different ways: *physically*, meaning by touch of the body or *from a distance*, by medium, e.g. joy-stick or keyboard. The material environment and learning will also be referred to as *classical.*

[2] *Learning* is a lifelong conscious or unconscious, organized or random process of attaining knowledge and development of the *personality*. Organized and intentional learning are called *education*. If they are supported by IT, they are called *e-learning* and *e-education*.

tion mostly to obstacles and disturbances in sensual perception and psychologically conditioned processing meaning perception of the objects and impressions that are important for learning. First place among disturbances goes to obstacles on the way to information (Rebolj and Globočnik 2007): stiff navigation, not easily assimilated content, chaotic screen, unwanted sounds, ergonomic obstacles and wrong solutions, and also lack of stimuli (protracted content, boredom, too long menus, getting lost on the learning path, »depressive« colors) and unsuitable stimuli (jokes and sounds that do not belong to the content, too much text, too few pictures, »disorganized« material). Indirectly we can sense the braking functioning of the unconsciousness, for instance decrease in motivation with no apparent cause.

To appropriately compare results we would also need to answer the question of how much an individual student has changed under the influence of information technology. We should not make any more conclusions on the basis of knowledge about the noninformatized[3] student. Information technology does some tasks for the new-day student and this student accepts it as a biological characteristic – it can perceive instead of the student, process these perceptions and shows the first signs of artificial consciousness. We can ask ourselves in what measure are we dealing with a »new man« and a »new student«?

Teachers, during debates and surveys on various technologically supported forms of education, also bring our attention to the misleading and/or imperfect perceptions that lead to failure and this fills them with doubt. They understand their pupils less and less. Are the pupils in renovation? Are the pupils outrunning the teachers? Perhaps we just cannot understand and explain them by existing pedagogical concepts. For these reasons we place perception, from stimuli entrance to its processing and connecting it to the consciousness, at the center of the following research. The other pole of interest is the student, perhaps changed under the influence of IT (»new student«). Though we did not research this second pole, it calls for caution in judging by »old student's« standards.

1.2 Perception of learning environments and learning

Perception as defined in this article is an entrance activity in learning that continues after the reception of stimuli as processing of information in the central nervous system and then storing in the memory. Educators know how to arrange the classic learning environment in a way to support learning and can give good advice to self-learning students on how to arrange their learning environments. Care is taken of the right stimuli and appropriate intensity and synchronicity for a certain student. If perception is not regulated, stimuli can get in each other's way and exhaust or even irritate the student. Perception includes the whole body moving around in space. Can we replace this physical experience of the body in the virtual environment? Merleau-Ponty (2000), who later wrote Phenomenology of Perception, in his early works as a fan of the Cartesian cogito claims that a thought about the world cannot replace the experience of the world. Critics opposed him, saying that it is not the being of the body that receives and sends out signals, but the participation of this body in space. Merleau-Ponty (2000) himself later on denied the cause and consequence relationship in perception. He sees the body in movement and considers it to be thinking and understanding. In this manner perception does not need the material environment.

The first virtual experiments brought out doubts. Can any experiment replace the experience the student would otherwise gain physically? Klahr et al. (2007) researched gaining experience in three situations: distance experimenting[4] (student executes the material experiment from a distance, for example with the help of an artificial hand), virtual simulations[5] (student sets the parameters, starts the film in a material environment and then watches it) and virtual experimenting (student experiments in a virtual environment with virtual means and a physical medium, e.g. keyboard. Parameters can be changed during the process).

Knott (2007) claims that we can gain experience in a virtual environment foremost if we have gained our primal experience, which is the basis for the following ones, in the material environment by the so-called hands-on learning. Some other researches confirm that virtual experiments and simulations can be used for widening or gaining experience which one would otherwise experience by coincidence (flying in an airplane) or are normally dangerous (radioactive radiation) or cruel (death incidence). Today's comprehension of virtually gained experience (e.g. on-line) sees them as a quality complement to material world experience. Since we can plan them and exclude anything inconvenient or nonessential and we can repeat them, they valuably contribute to the knowledge and shared experience of man. With the help of older technology some professions (pilots, captains, and skiers) have used such acquirement of experience for a long time.

The material environment does not enable ideal perception, especially if we consider the need for participation of the body. The latter is obstructed in a classic classroom. School regulations, presence of others, free use of surface, learning materials and physical obstacles are obstructing the student's perception more than the virtual environment does. Merleau-Ponty (2000) claims that the most important source of perception is the sense of touch and the second is eyesight, but most important for perception is movement of the body during perceiving. Can we touch without material touching? Heidi

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[3] The term *informatized* is used to determine a person who has internalized the concept of automatic information managment and is skilled in working and learning on-line and/or in the virtual environment. In this article assimilation of this concept will be called *informatization* (at the level of individual, process, organization, etc.).

[4] *Experimenting* is a procedure during which we change different parameters in a real situation section, observe the consequences and measure and analyze the effects.

[5] *Simulation* is a synoptical imitation of working reality, if needed especially adapted for observation (e.g. decelerated or magnified) in which we direct the process with the intent of attaining experience and skills.

Cooley (Cooley, 2004) believes that human perception of the e-environment evolves by regular and motivated work behind the screen. When one starts to use the virtual environment, one sees it as a two-dimensional picture that later on becomes a 3D space of which the user becomes a part. More on the subject can be found in chapter 3.1.1. where we describe the perception of virtual environment in our sample. We emphasize here that these findings relate to non-mobile technology[6], where a person is either in a material or in a virtual environment for a longer period of time. In our previous research, where we surveyed users on evaluation of the e-environment, we have also confirmed that perception of the virtual environment is developing and that it is probably dependent on the amount of time actively spent behind the computer (Rebolj, 2006). Adult students between the ages of 25 and 35, who have used the computer continuously since high-school, feel comfortable and homely in a virtual environment – the computer with all its capabilities becomes a part of the student, and the student's virtual and material environments unite. People who have used the computer for less than two years, »live« outside it and see the virtual environment flat as a board, picture or television, into which they also do not enter.

The sense of touch is very important for perception. Researchers like Marzano (1993) say that we touch when we are included and strongly involved in a situation, which equals body movement in the material world. Movement here represents a strongly interested exploration of space. In this way we can touch in the virtual environment. We touch with the cursor on the flat screen, but our eyes see a picture in space and our vision is drawn to details. It does not mirror but constructs, adds Strehovec (2006). He sees eyesight as more important for perception than the sense of touch. Feeling without touching has been known for a long time, a person can fumble in the dark with a stick or in troubled water, and an organ player who knows the organ like his own home explores the instrument with pedals and keyboards.

1.3 Issues on consciousness in light of man's informatization

When speaking of perception, i.e. receiving and processing information, we are often interested in human action resulting from this process. By observing action we can make conclusions about perception. Similar to perception, actions can be conscious or unconscious.

1.3.1 Perception and consciousness

Considering our problem, Cvetko (2002) offers a useful presentation of consciousness when saying that people have two kinds of stimuli receptors: one sort to preserve life and one sort to perceive their bodies. Stimuli transfer to the central nervous system, where we process the information into a representation of ourselves. If we are aware of it, we are talking about consciousness. Consciousness is absent only during special states of the body, such as coma or sleeping. Peruš (2000) on the other hand defines consciousness as a dual community – the centre of the first part is »I« and of the other »pure consciousness«. Consciousness seems unified on the outside, but Peruš claims it is internally constructed. For studying e-learning Hoffstadter's (1979) definition is also interesting. He connects consciousness to intelligence and believes that consciousness has the ability to step out of an assignment on which it is working and see what it has done until that moment.

In learning consciousness plays an important role since it determines the direction, intensity and speed of effort. Many forms of adult learning that evolve in modern adult education practice are based on consciousness reinforcement (Brečko, 1999) as a basis for learning. A student should be aware of himself/herself and observe himself/herself during learning, analyze and take charge of his/her own learning process. We can also understand consciousness as the final result of perception.

Even lower technological levels actually even the first use of tools enabled man to expand his body physically when needed. In his consciousness he integrated himself with objects or devices, for example blind people using their canes, musicians and their instruments or typists with their typewriters. The network computer offers a lot more to the human race. It helps with perception and processing information, it supports the nervous system and in this way contributes to formation of consciousness. In comparison to simple tools, IT supports man in a stronger and more versatile way; you could say it is renovating people. Since informational technology is enforcing itself at the society level it is becoming a necessity. Without it people can lose their social networks or fall down the social ladder, learn slower or become (in comparison to others) intellectually impaired (Bakračevič Lukman, 2000). One's position in the social network is on the other hand important for learning.

1.3.2 Meaning of the unconscious

During the learning process it is not important whether perception is conscious or unconscious, what matters is the effect of all perceptions[7] that shows itself in action. Unconscious perception can be relieving. Students learn easily, they are in a good mood, filled with energy sometimes not knowing why; they do not have to invest in this state. On the other hand, unconscious perception can obstruct learning. The community of unconscious is built out of signals that are not perceived by human receptors, or else they are perceived, but the central nervous system does not process them to the level of consciousness. People react both to the conscious and the unconscious. The unconscious expresses itself in relations between two or

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[6] *Mobile technology* is a sort of ICT, that is mostly enabled by wireless internet and satellite navigation and is ergonomically adapted to people (size, weight, picture resolution) so they can carry it with them. It enables the merger of the material and the virtual enviroment within human perception. Opposite to it is *non-mobile technology,* where a person alternatively goes from the material into the virtual environment and back.
[7] Perception includes receiving the stimuli.

more people, for example as influence of one person's actions on another person's actions (Merlau-Ponty, 2000) or in the relation between man and machine. The teacher's conscious actions can often be unconscious for the student. The teacher unconsciously sends out signals that can either facilitate or obstruct learning. This also goes for agents from the environment that can be advantageous or disadvantageous, which students describe with words like depressive, sad, restrictive, decrease in concentration...learning environment. These signals also come from the virtual environment. When learning with a teacher it is easier to see and correct the observed consequences of the unconscious learning destructors than in the virtual environment, where they are harder to spot. For example, many times students are not content with e-materials as can be seen during evaluation, but even they cannot describe exactly where the discontent comes from. Authors of the material are surprised by low evaluation results, since they were convinced the material was good. Sometimes users are checking out some hyperlinks for a longer time and they click on the others only once and never come back. Also in sorting learning elements by quality, which in reflection relates to popularity, the results of student evaluation are often surprising. We can only assume that the reason for this is that the authors measure with conscious criteria (objective measures of quality) and learners, on the other hand, mostly use unconscious criteria (effect of general satisfaction).

When dealing with the unconscious relating to informational technology it is logical to bring up *the information glove*, which became known in the 90s. To steer in 3-dimensional virtual reality the hand is supposed to be of utmost importance, so tools have been mostly ergonomically adapted to the hand. Of course touch of skin and an object in not possible in virtual environment. The hand controls the interactive writer (keyboard, number pad or joy-stick) connected to a machine (computer, phone) which is strongly connected to vision/eyesight, eyesight is connected to the brain and the brain directs the hand. This circle hand-writer-machine-eyes-brain-hand represents a very intensive according to Strehovec (2006) unconscious connection we can also call *the perception loop*. Along with the already mentioned intensity another characteristic is bound to this loop – inertia that maintains the intensity of reception and processing. Another important characteristic is a tendency to shrink the loop, which can be practically described as »less clicks to perception«. A person feels and negatively reacts to any disturbances in this flow.

The perception loop is - besides in e-learning - also established, for example, when using a cellular phone with a screen or other communication devices and when playing games in a virtual environment. We could talk about similar connections in the past when using a classical telephone or telegraph, but they did not seem important at the time. In the informatized environment connections are more intense, there is more »body« participation, and modern mobility is the cause that »not only eyes and one hand participate, the other hand and both legs are also involved« (Strehovec, 2006).

Experience of working with students shows that disturbances in the perception loop are a source of negative emotion and decrease in motivation. Deceleration of perception can
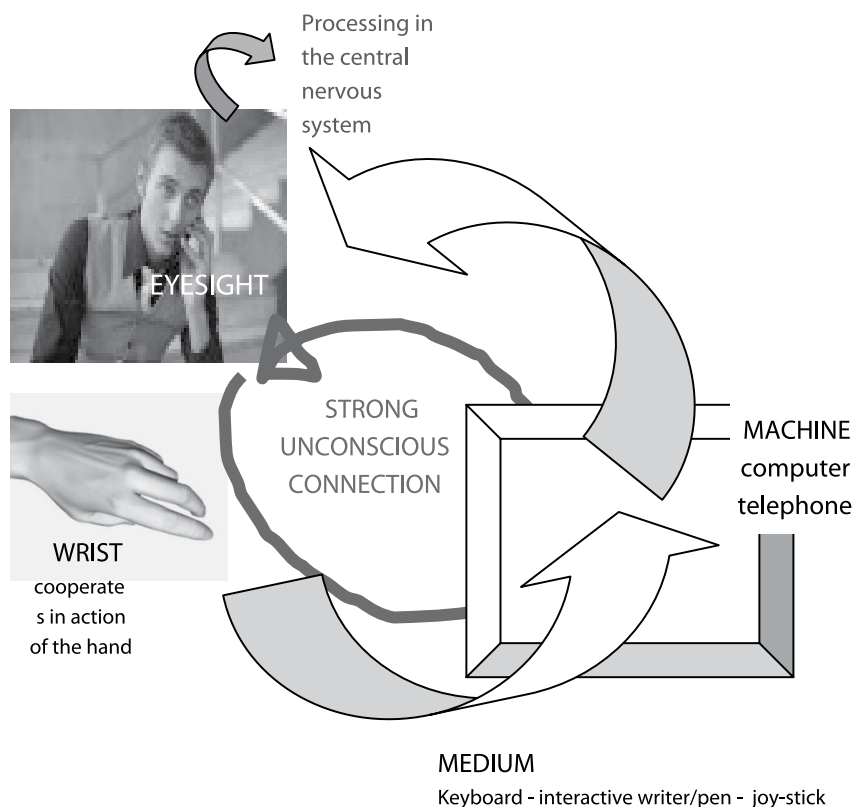

Figure 1: Touching in the virtual environment

be unpleasant, for instance because of searching for information on a disorganized or inconsistent screen view, or perhaps due to low readability. Researchers claim that reception and processing should be a matter of seconds and that everything that lasts more than three seconds (or sometimes less) can be disturbing. Obstacles in this connection can be various, sometimes it is the long path, straying about or jumping movement that the interactive writer has to go through because of badly organized menus, sometimes it is necessary to turn over screen pages, or else it is just strain of watching the screen. A small loop, movements that can be made in a second, short cursor paths and continuity of movement, on the other hand, have a facilitating effect.

Unconscious perception is important for learning since it takes less energy. One of the paths to unconscious actions is repeating of the conscious ones. Strehovec (2006) gives an example of unconscious writing text messages on cellular phones even though we cannot explain the letter order. We also do a lot of things in a virtual environment without knowing how to describe our actions. The virtual environment should be designed in a way that automation of repeated actions is possible, and this also goes for its changes due to updating.

1.4. Informatization and the learning man

The answers to the question of who is the new man as a product of informatization are different. Some say that man develops greater intellectual and physical capacities, others point out the common action of man and technology. Man takes on more pleasant tasks since technology can take care of the unpleasant ones. Some sociological debates bring us to the conclusion that people could be disburdened if they took advantage of this, but they commence more complex issues. In this way man is not disburdened but more efficient with the same energy investment. In the light of learning we are mostly interested in the answer to the question of whether it is easier to learn or whether people learn more, or perhaps, both and what this shift inversely contributes to people's intellectual abilities, social relations, self-image and social position. We need this answer also to estimate how much we can rely on existing truths about the adult learner in research. It is true that

technology, inventing tools, progress in science and mastering the material world have always influenced man. In view of this fact, man has always been renovated under the influences of technology, but informational technology accelerated this process and research can hardly keep up with the changes.

1.4.1 Man's consciousness and its branches

Consciousness is a process phenomenon, so it has no location in the brain. The definition varies among psychologists and so do their opinions on external signs of consciousness. The definition of these signs determines whether we can attribute consciousness only to humans or also to some animals or even intelligent machines.

There are programs that can validate execution of certain tasks by other programs, which is enough to determine consciousness according to Hoffstadter (1979). Computer processing of perception, similar to processing in the central nervous system and partial interpretation, is also possible. Peruš in 1999 (Peruš, 2000) names one of his chapters Speculation on Possible Consciousness of Computers... and expresses doubt. As the main obstacle, he points out the too small capabilities of computers of that time to grasp the complexity that would relate to the complexity of »self«. Besides, at that time he believed that the condition for this is integration of technology into people and their world. At the same time he mentions the possibility of merger of the natural and artificial, physical and psychological and that computer systems could become connected to people as co-processors. Computer consciousness could in this way become a branch of human consciousness,

Considering the fact that we can also perceive with the help of informational technology and that this technology can process this information and acts accordingly, can we deny the embryo of artificial consciousness?[8] The question is what exactly the role of technology in the process of human consciousness is. What is the connection between artificial consciousnesses to the human biological one? Can technology with its better perception contribute to higher levels of consciousness? It is highly plausible that the relationship between biological

Table 1: Structure of the sample

age / regular use of computer	16-20 years	21- 35 years	36-45 years	46- 55 years	above 55 years	SUM
before year 1990	0	0	3	2	0	5
between years 1990 and 1995	0	4	14	6	0	24
between years 1996 and 2000	0	12	45	14	2	73
from year 2000 on	12	44	55	10	2	123
last 2 years	0	0	22	8	3	33
SUM	12	60	139	40	7	258

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[8] The term *manipulation* referrs to directing another person without their will cooperation (in neutral meaning).

and artificial consciousness is still being formed and as a result forecasts are not reliable.

Human consciousness and self-confidence, as consciousness about one self in one's own abilities, are important for learning. Even though consciousness about learning is not a condition for learning it is important in the process of acquiring knowledge what the learner does consciously and what unconsciously, and if he/she is aware of improving his/her own learning.

2   Methodology

2.1 Research sample

As a research instrument we used a survey that included the answers of 258 people aged between 16 and 64, who were at the time included in formal secondary and tertiary education in 11 schools for adults. All participants have experience in learning in virtual environments, since this was organized by the schools as a complement to classical learning. Assistants who conducted the survey all took part in designing learning e-environments in participating schools, so they knew for sure that the basic conditions for e-learning were satisfied, which was the main condition for participation in the research. Surveying took place in March 2009.

The sample is socially and culturally heterogeneous. Due to generational, experiential, social and cultural diversity, which are factors of IT availability, it is appropriate for researching our problem. When preparing the questionnaire we relied on experience from the previous two years when we surveyed users during implementation of e-environment learning. These results and the results of some other researcher available on-line led us to the conclusion that perception of the virtual environment is in the highest correlation with the total amount of time spent on working with a network computer, and in lower correlation with age, sex and a person's social and cultural background.

2.2 Content of research

The survey included questions for which we had well grounded expectations that they would reveal some sources of standstill in e-learning development and therefore offer some answers to practice and guidance for further research. Some questions could be answered with the help of a 5- or 3-degree evaluation scale, which seemed reasonable since the participants could express the intensity of their observations in such manner. Considering this, the answers were ponderated from 1 to 5 (5-degree scale) and 1, 3 and 5 (3-degree scale), respectively. The questions were related to:

1. Perception support by e-learning environment optimization
2. Effect of the hybrid[9] material/virtual environment, enabled by mobility of technology

3. Perception and remembrance
4. Consciousness of one's own learning/perception of perception of learning
5. Unconscious perception effects

2.3 Gathering data, processing and interpretation of results

Approximately half of the adult students filled out the surveys in the classroom and the other half got the survey by e-mail. The first group got the instructions orally and the other group in writing. Typing the data into Excel and statistical processing was done by economy students during a course on Business mathematics and statistics.

3   Results and discussion

3.1 Possibilities for support of perception with optimization of e-learning environment

Today comprehension of learning is going back to Piaget's thoughts (Labinowicz, 1989). This means that a student should be active and at the same time can regulate and direct his/her own learning. Learning should be close to authentic situations. Learning is a social process that takes the form of social exchange, which we also need to assure in every e-environment.

Heidi Cooley (Cooley, 2004: 133) explains how a person perceives the virtual environment framed with a screen. She writes about levels of perception a person climbs up with time spent behind the screen. First of all the image on the screen seems like a board or a picture. Later this perception evolves into »a view through the window«, a 3D picture in the distance while the person is still outside the picture. With further use the person steps into the virtual environment, it surrounds him/her. On the highest level known today the person lives, functions in and masters the virtual environment and this environment becomes a part of this person. For a person to function well in a virtual environment, the concepts and structures of the material environment have to be parted from.

Generations, born into the informatized society, do not have to let go of old concepts and they walk through the developmental phases of virtual environment perception with speed of light. They actually arrange their material environment according to the »new« concept. These generations have an advantage in e-learning. Others catch up with them when they assimilate automatic information management, the concept and structure of virtual environment, but they have to let go of the material environment concept. Besides the learning content perception, also wholesome perception of the learning environment where this content can be found is important for the learning process.

The question was interesting to the participants, though demanding, since they had not yet thought about it. If we

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[9] The term *hybrid* is used for products of mixing virtual and material elements in a learning environment or intertwining of virtual and material environment, and vice versa, in such a way that the learner conceives them as one.

Table 2: How do you perceive the virtual environment (e.g. classroom, created with IT) when you open it on your screen?

Answer	Number	%
1. Two-dimensional, like a board or a picture	3	1.2
2. Three-dimensional in the distance – like a view through the window	24	9.3
3. Like a three-dimensional environment in which you are entering	114	27.1
4. Like an environment that comes towards you and surrounds you	45	17.4
5. Like an environment that surrounds you and gives you energy	24	9.3
6. It sucks you in and you become a part of it	74	28.7
7. You take it in and it becomes a part of you	18	7.0
SUM	258	100

consider that the quality of perception is related to body participation, and if the body participates it also uses touch in the environment, then 61% of the participants (answers d-g) have perception of the virtual environment appropriate for learning. On the other hand, 39% of participants do not. Cooley's claim on the development of virtual environment perception has been confirmed. Participants who have used the computer regularly and reasonably for the last two years perceive the e-environment as a board or a view through the window, long-term users on the other hand are sucked into it or they internalize it.

In education of adults we should evaluate the level of »informatization« of an individual who enrolls, which is already common practice in some schools, and pay more attention to the unskilled if they are part of a complementary classical education program. Attractive activities online, such as activities for interest groups, taking care of school administration, web-communities, etc. can be reasonably used to facilitate student integration into the virtual environment.

One of the possible answers was a possibility that the environment »surrounds you and gives you energy«, which was offered on the basis of other researches (after opening the environment comes towards him/her like a projectile), but our participants did not express this feeling.

Participants evaluated learning contents to be the most important factor that influences their emotions and learning content is a factor that is less dependent on the environment. Content is followed by navigation – other surveys have already shown us that navigation can be a factor of emotion, but mostly negative ones when it is clumsy and not positive when it works well. Greater changes in navigation, even though maybe progressive, represent an obstacle for the learner. When we close up the virtual environment after education ends, students miss it. Some schools make use of this and enable former participants of the programs to access a virtual club, an adapted

Table 3: What in the virtual environment influences your emotions in a positive way? (Mean was calculated from an absolute number of answers with ponderation: absolutely not true = 1, mostly not true = 2, partially true = 3, mostly true = 4, absolutely true = 5)

STATEMENT	1	2	3	4	5	SUM	MEAN
Effects (pictures, cartoons, jokes, funny sounds...)	0	30	201	12	20	253	3.2 partially true
Interesting contents	0	11	12	131	87	241	4.2 mostly true
Multimedia (videos, sound records, animations...)	0	34	111	102	5	252	3.3 partially true
Electronic environment itself	56	79	96	4	17	252	2.4 mostly not true
Easy navigation through the environment	21	35	117	68	9	250	3.8 mostly true
Live and virtual praise	11	85	87	67	0	250	3.2 partially true
I GET ATTACHED TO THE VIRTUAL ENVIRONMENT AFTER USING IT FOR A LONGER TIME.	44	30	98	78	45	254	3.7 mostly true
EMOTIONALLY I DO NOT FEEL ANYTHING IN THE VIRTUAL ENVIRONMENT.	56	93	67	33	9	258	2.4 mostly not true

Table 4: What in the virtual environment makes you feel included in the group of fellow-people?
(Mean was calculated from an absolute number of answers with ponderation:
absolutely not true = 1, mostly not true = 2, partially true = 3, mostly true = 4, absolutely true = 5)

STATEMENT	1	2	3	4	5	SUM	MEAN
Lots of possibilities to communicate (e-mail, forum, blog...)	17	51	21	133	34	256	3.5 mostly true
Help, when something goes wrong	0	21	98	87	50	256	3.4 partially true
Feeling of commitment to the group	70	45	40	34	68	257	2.9 partially true
Effects: live drawings, voice response, animated characters...	4	76	160	17	0	257	2.7 partially true
Responses from fellow-students, mentor...	45	66	42	42	60	255	3.0 partially true
Opportunity to observe work of others	6	44	61	74	73	258	3.6 mostly true
Consciousness, that my fellow-students and mentor can see me at work	11	45	102	56	44	258	3.3 partially true
MOSTLY I FEEL LONELY.	86	80	37	5	13	251	1.8 mostly not true
MOSTLY I FEEL INCLUDED.	36	23	66	80	40	245	3.3 partially true

learning environment with possibilities for socializing. Few (16.3%) of the participants felt nothing in such an environment, yet most are emotionally touched.

In the times before the internet has established its value, limited opportunities for inclusion[10] were an important obstacle for successful e-learning. Our surveys did not show this, as we have been introducing e-learning since year 2000 when internet had already been put into force. Inclusion is mostly enabled by on-line services. Participants in this research pointed out greater possibilities for communication and the opportunity to observe the work of others. Alternatives got different support from the participants but none were rejected. For some, e.g. creating a group sense, program support is not needed, since it they can be a consequence of pedagogical organization. Participants deny the feeling of loneliness, but they do not feel included. By increasing some agents of inclusion during planning the e-environment that we have already researched (Rebolj, 2008a) this important factor of effective learning can be improved.

3.2 The effect on learning of the hybrid virtual-material environment enabled by mobile technology

Alternation of the material and virtual environment takes energy. There has been a lot of research done on this subject all around the world. In Slovenia we implemented trial on-line self-directed learning in 2006, and researched this subject among students of elementary schools and high schools (Rebolj and Požlep, 2007) when they were asked about their feelings during general e-learning and during learning in the virtual environment supported by mobile devices. Wireless internet, satellite communication and ergonomical mobile equipment enable the student to become a nomad who constantly »lives« in a network, except when he or she willingly turns it off. The student moves from the material to the virtual world and back again. In this manner the student becomes a crossroads of real and artificial worlds that eventually integrate themselves into one hybrid world. It is necessary to think about what is reasonable to offer to this student in a classical way and what in the form of e-learning. For example, why would we study the forest on-line if it is near to the school? When the student has a wholesome experience from nature, he/she can study it further in the virtual environment and observe accelerated processes, e.g. influence of seasons or effects of pest, consequences of planet destruction or simulation of its economical meaning. When the student comprehends the forest, he/she can go on virtual excursions of forests all over the world and thus construct wholesome knowledge.

Only about 10% of our participants believe they have had experience with the hybrid learning environment, while others just help themselves with certain information from another environment, but do not alternate. Perhaps this question came too early to our participants. Among their own answers the participants mentioned that mostly they do not have any influence on the choice of learning environment, since their learning environment is organized by the school, and therefore they have to adapt not choose. Computers frequently do their routine and math tasks. If a virtual environment is not well prepared, they have too much work to do on their own, so they avoid it. The virtual environment is comfortable if everything is in it not »a little bit in, a little bit out« or »don't know where

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[10] *Inclusion* is a feeling of being with fellow-people, regardless of their actual presence. A person can feel included even when alone or lonely, even if surrounded by people. Some feelings of inclusion can be virtually created. The opposite of inclusion is *exclusion*.

Table 5: How do virtual and material learning environments most frequently complement each other during your learning?

STATEMENT	SUM of answers	%
I learn either in the virtual or in the material environment and during intensive learning I do not alternate with them.	95	36.8
When I learn in one of the environments I help myself with information from the other from time to time.	75	29.1
I learn alternately in one or the other environment, but not in both at the same time and I do not alternate with them during learning.	22	8.5
I learn in both environments at the same time, e.g. I read a printed book and study virtual material.	7	2.7
I learn with my laptop, wherever I am (e.g. on the train, in nature...) without any other instruments.	26	7.9
Other.	45	17.4
SUM	258	100

it is«. Some prepare copies from the web to learn on a train or by the seaside, where they are not online. They added that it is reasonable to choose an environment that takes less effort, regardless of technological development. Someone wrote: »The future of all man's activities is a combination of material and virtual and we have to accept it, but I have no intention of extra practicing. «.

Mean was calculated from an absolute number of answers with ponderation: absolutely not true = 1, mostly not true = 2, partially true = 3, mostly true = 4, absolutely true = 5). Pondered means were converted back to answers. When they get an assignment on-line, they have to solve it in their notebooks or put data in web tables and then interpret them in front of the school blackboard. There is a possibility to solve the whole task in a virtual environment, where all the tools are available, but this takes special preparation. When paying more attention we could decrease the satiation with information during learning and add tools to filter and range. Students need general knowledge on information management and instructions for the use of learning sources.

During »the stay« in the virtual environment, interruptions by people from the material environment are disturbing. When students in pairs worked in a virtual environment but in a common computer classroom with the teacher giving them instructions they frowned and tried to avoid his voice. Elementary school pupils chased away their classmates who joined them out of curiosity and are usually welcome during classical work. It is exhausting if they have to solve the task partially in the material and partially in the virtual environment: »It is somewhat as if someone from the street shouted remarks or instructions while they were concentrating on their work in a school classroom. «. On the other hand, it is not exhausting if they work on the assignment in the material world and use the computer for processing data, since they do not enter the virtual space.

Table 6: What is true for you when you are a mobile student, who moves around different locations and from virtual to material environment and back during learning?

STATEMENT	1	2	3	4	5	SUM	MEAN
I can learn in almost any material environment where there are not too many disturbances.	78	10	88	22	50	248	2.8 partially true
If I learn in a virtual environment instructions from a live person, like a teacher in the room, bother me.	0	3	123	114	10	250	3.5 mostly true
Learning with the help of mobile devices, for instance the mobile phone is a good acquisition for me.	80	117	18	40	3	258	2.1 mostly not true
Feeling that learning content is connected to you everywhere and every time is burdening.	31	65	86	72	0	254	2.8 partially true
I am very burdened because too much information obstructs me.	20	43	67	46	76	252	3.5 mostly true
Mobile learning (partially material, partially virtual environment) takes more energy than learning the same content classically.	18	22	32	105	45	222	3.6 mostly true

Mostly not true, say the participants about the positive acquisition of learning with a mobile phone, as the computer industry is trying to show us lately. This time we have no record of the causes, but in the past miniature devices that on the one side relieved the student ergonomically (pocket size), burdened him/her on the other (strain of eyes and fingers). People also like to separate devices used for fun and devices for »serious« activities such as learning.

3.3 Perception and remembrance

An important condition of successful learning is support to student's remembrance, meaning that he or she organizes and connects the perceptions. Information from the virtual world is related to information from the material world and student's experience. Penetrability of the stimulus is important for remembering, since it determines the intensity of perception (Rebolj, 2008b).

Other than perception as an event of meeting information, we also have to take care of the exclusion of unnecessary and the choice of preferential information. Each student has a unique memory structure and his/her own optimal way of remembering. Since it is not possible to please everyone at the same time, we must offer information and links in the virtual environment in various ways and enable students' choice.

When dealing with remembrance we are also interested in the duration of remembrance and recall of information. There is little possibility for drill in the virtual environment so we usually go around it. Often the whole learning process is oriented towards learning, and during this process the student makes sense of the content and uses it practically in various situations with various levels of skills needed. This design serves the retention of the student on the same content, as our participants confirmed.

We also asked them about the effect of a 3D mind map on remembrance, since the two-dimensional version is well researched. Regarding this we tested two statements. The first is related to a table of contents in the form of a tree, which clearly represents the content structure. The other refers to tree-structured material where there are links to additional

texts under the »major branches« (hypertext). We already know the advantages of a flat mind map. Our adult students mostly say that they remember the hyper texted content better. This is a tip for practice in preparing e-materials. If we add a tree-structure table of contents, remembrance will have additional support, since this enables an overview of the content.

As other research has shown, multimedia are important but not at the top of the facilitating factors of remembrance. One third of the surveyed participants say that multimedia mostly do not facilitate their remembrance. Based on other researches, we could presume that multimedia play a more important role in understanding content, maintaining motivation and as a choice for students with special learning styles, but this was not an issue research.

3.4 Consciousness of one's own learning and perception of perception

The intention behind this question was to find out how well adults know their own learning and whether sense important differences in their learning in the classical and virtual environments. Do they observe their own perception? Do they think about their own learning? Do they follow up on their own learning progress and their learning ability?

If we start with the last of the statements, we notice that only a few participants are burdened with the thought of being unsuitable for learning in the virtual environment. The prevalent answer confirms that learning in the virtual environment is substantially different than learning in the material world. Participants also know more about their own learning in the material environment. We can see the opposite regarding the virtual environment. Participants evaluated that it is »mostly true« that they learn more easily in virtual environments than in the material one, and »mostly true« that there are more facilitating factors present in the virtual world, but they know less about their process of learning than they do in the material environment. Factors are either conscious or unconscious but very hard to determine. While schools for adults mostly offer programs for learning about learning when someone enrolls, they have no programs for these new forms of education, there

Table 7: What do you remember better?

STATEMENT	1	2	3	4	5	SUM	MEAN
I mostly remember contents on printed material better than contents I read on the screen.	63	71	51	43	16	244	2.5 mostly not true
I better remember contents that are supported by multimedia (pictures, sounds, etc.).	1	83	99	22	45	250	3.1 partially true
I better remember contents that touch me personally.	12	60	61	57	64	254	3.4 mostly true
I better remember contents that demand more work that is also more versatile.	0	0	15	32	211	258	4.8 absolutely true
I better remember the contents that are represented in the form of a tree structure.	24	67	14	91	56	251	3.4 partially true
I better remember contents in multilayered texts, arranged as hypertext (with links to additional texts).	22	32	11	188	3	256	3.5 mostly true

Table 8: How well do you know yourself as a student?

STATEMENT	1	2	3	4	5	SUM	MEAN
I learn substantially differently in the virtual than in the material environment.	20	17	14	178	12	241	3.6 mostly true
I know well how I learn in the material (classical) environment.	0	11	125	34	4	250	3.2 partially true
I know well how I learn in the virtual environment.	44	111	62	15	30	236	2.8 partially true
I comprehend easier in the virtual than in the material (classical) environment.	13	14	76	77	78	258	3.7 mostly true
For me there are more facilitating factors for learning in the virtual than in the material environment.	2	61	10	181	12	255	3.8 mostly true
I frequently seek within me for more efficient ways of learning.	3	161	27	45	15	251	2.6 partially true
I perceive my learning progress during learning.	3	13	201	39	0	256	3.1 partially true
It is easier for me to follow up my learning in the virtual than in the material environment.	4	26	67	145	13	255	2.8 partially true
I think I am not suitable for learning in the virtual environment.	54	189	10	2	2	257	1.9 mostly not true

is also a lack of didactical theory and practice, not to mention staff with this kind of knowledge. Following up on one's own progress is usually technically supported in virtual environments. Students can take tests during studying or gather progress points for the progress collection. Thus it is understandable, that most participants find it easier to follow up on their progress in the virtual than in the material environment.

The answer to the question *What has positive influences on your learning in the virtual environment?* is known from reflection questionnaires participants fill out after finished studies. It seems that students are more perceptive of the negative influences than the positive. It is easier to range e-environments or e-materials according to their attraction, but students do not recognize details. Carefully prepared, organized environments have an advantage: structured content, aesthetical image, logical environment, short response time of the mentor and »everything to learn at reach of hand« are attractive, which is greatly in concordance with theoretical conclusions on perception, the information glove and perception loop.

3.5 Effects of the unconscious on learning and student activity

As we mentioned in the Introduction, the existence of the unconscious is often shown in evaluation of e-material or the learning process in the e-environment by the students. Even if there are big differences among answers, the students have a hard time explaining why something is so much better than something else or, for example, what puts them in a good mood in a certain environment and why the other environment does not. We have been asking educators about consciousness

and the effects of the unconscious in e-environments during e-learning didactical seminars[11]. We also asked 38 IT experts from various Slovenian computer companies the same questions during the Days of Slovenian IT 2009, and these questions were also posed to participants of the first part of this research. In the survey for students and educators we named the people students, while the survey for IT experts employed the term users. Even with non-representative samples the differences are so obvious that they are worth mentioning. By valuating the answers (not true=1, partially true=3, true=5) we got the average values for each sample. We transformed them back to answers (under 2. 5=not true; 2.6 to 3.5=partially true; above 3.6=true).

IT experts put the unconscious forward more than the other two groups, adult students are second. IT experts mention that marketing of computer products and services is based on the unconscious. There are some psychological studies in progress that are discovering many more unconscious factors, also some with short-term effect such as fashion. Adult students also wrote that they do not think about the unconscious. Sometimes, though, they have a hard time explaining why certain contents are so easy to learn and others that seem similar, so hard.

Everyone believes in the possibility of manipulating the user, though this is not necessarily non-ethical. Teachers and students believe that unconscious factors can be a relieving help to the learner, and IT experts believe this is even stronger. We can see the mirror image of this with the question of effects of the unconscious on dehumanization (turning people into machines, blocking their minds, emotionally paralyzing them) – teachers believe, that the most and IT experts do not believe that at all.

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[11] Data are summarized from the survey questionnaire for participants of INTER-ES's seminars in August 2007 and September 2008 and the Andragogical institution Maribor in November 2007, 54 people altogether.

Table 9: According to your experience, how important do you think the unconscious is for the user/student in an e-environment?

Statement	Mean Teachers N = 54	Mean IT expert N = 38	Mean Adult students N = 25<e
Unconscious factors have important effects on the user (student) of the e-environment.	2.8 partially true	4.6 true	3.5 partially true
Efforts towards favorable unconscious influence over the user (student) in an e-environment are necessary.	1.2 not true	4.4 true	2.0 not true
Unconscious factors of the e-environment enable manipulating[12] users (students).	3.8 true	3.2 partially true	3.4 partially true
Unconscious factors can be a relieving help to the user (student).	2.6 partially true	3.8 true	2.9 partially true
Unconscious factors can have a bad affect on the user, because they can, for example, turn him/her in a machine, block his/her mind or emotionally paralyze the user.	3.6 true	1.8 not true	3.0 partially true

Researching the unconscious directly is problematic. A better method than surveying would be systematic observation, and an experiment would be even better. A person can be aware of certain actions influenced by the unconscious, but does not know their origin. We recognize the unconscious better when looking back using our memory. Human mentality can suppress the unconscious, especially in relation to unpleasant things. The unconscious is affected by previous experience, which is very different especially when using IT. In the described circumstances, where survey was the only method available, we posed a question relating experience without any known cause.

Participants have attributed the following feelings without known cause (ordered by frequency):

1. Fear or embarrassment on how they are going to function in a virtual environment – 22 attributions
2. Concern that, the technology will not function or that the machinery is not capable enough – 21
3. General joy, satisfaction or feeling good - 19
4. General anxiety or worriment - 14
5. Lack of orientation, feeling of being lost in an unknown environment - 10
6. Not perceiving order, structure, rules - 10
7. A sense of a foreign, unknown world - 9
8. Feeling of being trapped, not free, routine demands, demands on behalf of demands - 9

Judging by the answers, virtual environments most frequently trigger emotions, but possibly some other feelings that can also be pleasant or unpleasant, that calm down or excite students. The »not true« answer is prevalent (54%) to the question about one's own integration in the virtual environment (»It can suck me in or throw me down. «). As the previous answers and theoretical conclusion suggest, integration in the environment is gradual and dependent on length of experience with IT.

Practitioners realize that students during learning focus on the main content and method, while other things are marginal, for example diagrams, illustrations, stories, metaphors, music curtains and extra information. These can facilitate or decelerate the learning process, but they do contribute to a richer stock of in-depth knowledge – with a time delay. It is reasonable to systematically invest in unconscious factors of learning and to study the effects.

4 Conclusions and challenges for research in adult education

The reinforcing constructivist approach to learning puts the learner in the center as a recipient who is active in this role. The penetration of informational technology into work and private life has brought greater and quicker changes than the earlier technological developments. This makes research more difficult, since not only the learning process changed but also the former student has disappeared.

In the light of learning perception this »new man« in general and the new man as student demand a different didactical treatment, and didactics need expansion. Even though a lot of didactics from past centuries is still useful - and we will not reject it out of pure technical vanity - new questions are being posed and the »old didactics« has no answers. It is hard to reliably answer the question of what we need more: comprehension of the new day student or a new didactical concept, but for sure there is a lack of non-commercial and relevant research.

We are probably at a point where a fatal decision has to be made. Do we reject technology as a disturbance that is also the fruit and symbol of human development, or do we build up didactics in such a way that we can use technology for

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[12] The term *manipulation* referrs to directing another person without their will cooperation (in neutral meaning).

Table 10: Which are the most frequent experiences in the virtual environment without known cause that you remember?
(Please, evaluate all experiences below or write down one or more of your own.)

EXPERIENCE	%		
	not true	par-tially true	true
Virtual environment can either give me or take away my will to learn.	26	28	46
I can get attached to the virtual environment.	41	32	27
I feel satisfaction or dissatisfaction with myself.	4	30	66
It can suck me in or throw me down.	54	26	20
Learning (work) by nature can be pleasant or unpleasant.	3	15	82
It can emotionally activate or block me.	18	14	78
It can calm me down or get me excited.	12	20	68
It affects my decisions, which would probably be different without it.	12	12	76

learning, education, human growth, career development and for ageing worthy of man? And study the learning all over ageing. Current circumstances leave an impression that we are in a dilemma over whether to put our foot on the gas or the brake relating to e-learning. The third option is to put it in neutral gear and wait for the future to bring us the answers, even though outside of education it is clear that e-learning and mastering virtual worlds are becoming a social necessity and an essential skill of the individual; lack of these skills, on the other hand, segregates and stigmatizes people.

Planning further research would probably be reasonable as a dichotomy: as research into didactics and research on the student and influences or lasting effects of IT on the learners, respectively. Due to the meaning of culturally different conditions in the process of learning, this mission cannot be accomplished through the mere transfer of foreign knowledge.

5   Final thoughts

Several times in the past we have faced attempts at modernization of the class, for example with school television or language laboratories that demanded great expenditure. Again the technology is available but the pedagogical concepts are missing. So the question of what to do with this technology puzzles us. Previous experience shows that the technology was sent to the attic and the teacher continued to teach without it. We can see this tendency also with IT, but it is becoming a necessity in the business world and it differs from the old phono-laboratories.

Besides the dilemmas related to technology, prevalent school tendencies are also important. Oriented towards the future or towards retention of the existing state. Our pedagogical discourse, according to Protner (Protner, 2008), frequently consists of two antinomies: the old and the new school, and the useful versus the shallow school reforms. Both have attributions of value. The concepts polarize when there are no expert arguments for determining what is progressive or what is back-ward at a certain moment in time, what is good, what is bad, what is conservative and what liberal. If there are scientific arguments there will be no exhausting the process of progress. If there are not any, progressive takes the form of imaginary pedagogical practice that has its defenders in a certain political or otherwise defined moment, but there is no point in taking it seriously. There are some signs that we are going into such a state in the field of informational technology.

In order to determine and enforce progress in education, key polemics and reflections are necessary. Shifts, that would enable expert discourse on informatization of learning, have not been sufficiently present enough even though there has been time enough for them. Lack of pleasant reflection automatically brings forth an unpleasant one. In these cases, opposing innovation can become progressive. The business world on the other hand, which will put our adult learner's knowledge into practice, demands competent educated employees.

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Vanda Rebolj finished the studies of mathematics and physics. Later she studied pedagogics and andragogics at University of Ljubljana, Faculty of Arts. She received the master's degree. she finished the postgraduate business study GMP. Informally she finished informatics and management. More than two decades she has been working as a principal or director of educational institutions, for instance primary, secondary and high schools for young and adult students. Most of her expert and research work was directed to adult population, their motivation for education, and talented students. For the last fifteen years, she devoted her investigation to development and implementation of e-learning and its integration to school curriculums. She has been developing the didactics in e-education, and solving organizational problems of virtual environment. She is elected lecturer of Business communication and management in high school programmes Informatics, Mechatronics and in Economy. She lectures and publishes in expert publications. The book E-learning through the spectacles of pedagogics and didactics is the first one with such content in Slovenian language. She strives to effective, humane and knowledge based school. In education, she has the highest title - counsellor.

Pomen percepcije in zavesti za učenje, podprto z informacijsko tehnologijo

V članku so predstavljeni rezultati raziskave o percepciji med učenjem odraslih v virtualnem okolju, ki je bila opravljena z namenom raziskati nekatere vzroke za upočasnitev napredka pri uvajanju e-učenja pri nas. Percepcija in njeni učinki na učenje so pomembni na zavedni in nezavedni ravni, vendar jim ne posvečamo toliko pozornosti kot v bolje raziskanem klasičnem učnem okolju. A motena percepcija, ki je posledica premalo strokovne priprave e-okolja, je pomembna ovira za učenje. Raziskava je bila namenjena odkrivanju nekaterih rešitev za učno prakso. Hkrati pa raziskava potrjuje tezo, da ne moremo vedno zaključevati na podlagi nekdanjih resnic o učencih, saj se tudi ti spreminjajo pod vplivom tehnologije. Pomanjkanje strokovnih argumentov in dobre prakse sproža pedagoški konzervativizem, ta pa lahko šolski napredek, tudi v izobraževanju odraslih, vodi v nasprotno smer, kot jo zahtevajo poslovni procesi v organizacijah, iz katerih prihajajo in v katere po šolanju odhajajo odrasli učenci.

Ključne besede: e-učenje, e-izobraževanje, virtualno učno okolje, percepcija, odrasli, pomnenje