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E-education between Pedagogical and Didactic Theory and Practice

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Education systems confront new requirements to become more efficient and contribute more to the economic success of society. At the same time there are new challenges for the education systems to perform their tasks using advanced technology. In capacity, information technology considerably surpasses the current learning technology. Supported by Internet it creates an electronic parallel to the standard school and learning. Unfortunately there is only sporadic evidence that supported by information technology, learning and education system as a whole can be considerably improved. In spite of that, we believe there is no way back and e-education is not just a temporary whim. Even though we do not know exactly who should perform what and to which scope. The passiveness of pedagogues, the lack of empirical research and the occurring expansion of the market for e-education products without their quality assessment is not of advantage to this progress. The spread of e-education production without considering the professional opinion of pedagogues, who beside their practical work must also engage in developing their own pedagogical theory, might not benefit the existing education achievements. On the other hand, didactics can by analogy be applied also in the web environment, consequently creating the related assessment mechanisms of the electronic education elements.

Keywords: Didactics, e-education, informatization, IT, information technology, multimedia, interactivity, knowledge quality

1 Introduction

The schools in Slovenia seem to be at a turning point, where they have to face greater expectations, created by the economic and technological progress, which require certain modifications and adjustments, as well as answers in the area of education technology support and, above all, in the field of information technology (hereinafter IT). I was stimulated by a statement made by a representative of a Slovenian branch of a foreign programming company, a pure technician, as he described himself, who pointed out that insufficient cooperation with pedagogues is the main cause of the currently poor Slovenian e-education production. On the other hand however, e.g. among principals, we can hear that it is enough to have a computer programmer set up an e-environment for the school. If the programmer does not know how to complete this assignment, s/he should look it up on the internet to see how the others have solved this problem. Some schools turn the problem of IT implementation over to the computer science teacher. In the last few years, rather substantial resources were intended for the e-materials. However, the above-mentioned programming company has concluded, on the basis of close monitoring of the development in this field, that e-materials are not used much, which means that the teachers have not been convinced of their benefits. Professional errors can also be detected, as well as incorrect assumptions regarding e-education, which point out poor knowledge of some educationalists.

Further on I would like to present questions regarding school, education and virtual environment learning, which can be answered mainly by pedagogy and didactics. When requiring answers from these two professional fields, we have to interrogate whether the IT implementation modifies and complements them and thus influences the theory. We should encourage integration of pedagogy in e-education, as well as its empirical research.

Many questions were raised by educationalists in various seminars and surveys and they require answers. Lack of information diminishes their motivation for technical and technological upgrade in schools, which reduces progress of schools and consequently of society.

2 Retrospective

According to some researchers, e.g. dr. Kornhauser, the beginning of the e-education theory goes back to the 1950s, when computers came into use. However, some researchers claim that its beginnings go way back to the antique era, since they had already used questions in order to guide a student during the learning process. They were familiar with organization of material into cognitive units, so that the students progress step by step. Some elements important for e-education were introduced in

the Middle Ages, when an individual teacher was making sure that the student was active. Later on, Komenski was encouraging teachers to teach less and let the students learn on their own, and Pestalozzi claimed that teachers should only give students a starting point on the path to knowledge, which the students should later seek on their own. The movements occurring later were criticizing the inefficient school system and attempted to build a new one, based on the individualization of lessons, autonomy of teachers and schools, self-learning, flexible approach to the teaching content and its real-life aspect.

In programmed lessons, under the influence of cyber pedagogues, automated learning and learning process management was developed, as well as the automated information transfer and feedback. Cybernetic approach, insufficient participation of pedagogues and lack of research, in addition to rapid introduction of computer programmed lessons in 1960s, due to the sudden great enthusiasm, led to the loss of significance of such learning. However, it provided useful information for e-learning. Besides certain technical questions of learning, the learning principle of activity, responsibility transfer of the student's success and autonomous search for knowledge, remained on the riddle of history. Other important aspects include the experience on how to train a student to develop self-learning skills, lesson individualization and the importance of flexibility of the teaching content. However, the disadvantages of the technically-based programmed lessons and other mistakes from the past should not be repeated in e-learning today.

3 Whose task is e-education?

Educational cybernetics, which implemented educational technicism, was criticised. It is important to point out the opinion of Gerlič (2000) and other domestic and foreign experts, namely that e-education is primarily a pedagogical or a didactic problem, which means that it cannot be solved only by informatics and computer science, without participation of pedagogic field. The answer to the question whether the educational IT is pedagogically neutral is also negative. The development of e-education requires pedagogical theory as well as practical knowledge about the educational process, which the teachers manage to gain through practice.

Nowadays Slovenia still lacks the systematic approach to implementation of e-education. The viewpoints of teachers on this subject differ, which leads to various levels of their involvement. Some of them show interest, while others tend to withdraw from this process and leave it to others (Rebolj, 2007). In spite of the above-mentioned crucial role of didactics, cooperation with the information scientists is required, in order to establish proper conditions for e-education implementation. Teachers need to get professional support from pedagogues (theorists) and participate in establishing the conditions, planning, implementation and evaluation of e-education, which requires additional knowledge. According to the data from some European countries, the programmes in which the teachers acquire the so called e-competence, apart from the practical skills also include pedagogical theory, which is a result of development of pedagogical thought, due to the IT implementation.

Principals and teachers have to be capable of designing the needs of schools and have to assess whether the presented technology is adequate from the pedagogical point of view. The emergent market offers e-materials, syllabi, didactic aids and various services, e.g. for preparation of virtual schools, portals and learning environment. If we do not decide to purchase an open source platform, there are other options, e.g. learning or content management system, authoring tools, school organization software, cooperative learning system, or project work system. As the supply on the market is growing rapidly, it is necessary to 'sift the wheat from the chaff' (Rebolj 2008a).

Educationalists have to spend money reasonably, which means that they need to know what they purchase and what they would still need in the future. What is good and what will be useless for the school. Recognition of the dark sides of IT is also very important and can present a problem for the non-experts, who are drawn to the attractive technology.

IT implementation in education is a theoretical problem as well as a problem of empirical research in pedagogy and didactics. Even in the countries with a great deal of experience in this field, the empirical foundation is rather weak. The reason for this may be their excessive confidence in the positive outcome of IT implementation in schools and their belief in its necessity, in order to provide computer literacy for the students, although its contribution to the knowledge and learning might not bring the expected results.

4 What do we want?

The role of a computer in learning, revision, testing, grading and personality development processes may vary (Colin 1992). These processes can be:

- computer assisted,
- computed, i.e. based primarily on computer support,
- classical, with some computer aid,
- computer managed,
- web based and accessed by computers (internet).

A combination of the listed options is also possible in the above-mentioned processes. Populistically speaking, the goal of the current use of computers is to form an efficient information society, which requires efficient individuals that are able to learn, work and create with computers. This is important for an individual's career, the basis of which is formed in the early youth and can offer a relatively stable foundation for life. This basis presents an important starting point for the development of an individual's career, which is marked by two dimensions: a career in the view of an employer and a career in the view of each individual. One of the reasons for IT implementation in schools is to develop the students' career-building capabilities and to establish the possibilities for career development.

We need a successful society and for that the need of a greater learning efficiency and greater quality of knowledge has increased. Efficient learning leads to a greater quality of knowledge, obtained with less effort (Conner, 2006). The end of the process therefore results in greater competence of a student, without the wasted effort in the learning process. Psychological conditions can improve substantially, as the students are constantly aware of what they have already learned and what they are still to learn. The exhausting drill can be replaced by far more pleasant activities.

Quality of knowledge can be achieved by the constantly updated contents, offering adequate cognitive load (Mittal, 2007), pleasant learning atmosphere and measures that have a positive impact on memory.

The attempts of trying to teach students ''everything'' have stopped. The school does not try to select the ''right'' knowledge from the endless collection of human knowledge and pass it on to the students; not to the extent it used to in the past, that is. The students have to be trained and have to obtain proper skills in order to be able to find the necessary information and knowledge when they need it. That requires proper organization on the part of a student, taking on responsibility, maintaining critical distance to oneself and adopting the ''learning to learn'' techniques. The learning process can thus be described as a two-track system, i.e. following the learning goals and socializing students.

5 IT and pedagogical thought

Neither pedagogical theory nor practice can bypass IT. In the light of experience gained so far, introduction of computers in lessons has broadened the understanding of education and has supplemented the existing didactics. Classical formulas regarding the education cannot offer solutions for every aspect brought by the e-education, especially since the web is in use.

Pedagogical theory arises from practice. First level of practice generalization creates learning principles and the second creates pedagogical theory. Does IT cause changes in practice? The answer to this question is definitely 'yes'. The students study independently, through forums, webpages, e-mail, hyperlinks, and blogs, which are absent in the classic educational practice. Such practice introduces novelties in learning principles and the importance of some principles, e.g. learning principle of activity, is increased. All this has an impact on the pedagogical theory, which can be created through pedagogical research and involvement of the pedagogical experts.

Although teachers are very important in this process, their pedagogical potentials cannot be fully counted on. The time of pedagogical recipes has passed. Pedagogical theory has to make enough sense in practice. Nevertheless, the theory cannot offer solutions to all the problems and cannot answer all the questions that arise in practice.

Some expectations regarding e-learning/teaching are too high. We cannot expect that IT would eliminate problems piling up at school or that we could simply transfer the responsibility for success from teachers to students. Theory can inform practitioners and can guide them when transforming the practice. However, to solve the actual problems, it is necessary to organize systematic and regular discourses, which shall display criticism towards theory as well as practice.

E-education implementation will probably be a slow process but this shall prevent its downfall, after which a substantial amount of time would be needed for the education to rise again. Individual examples of success cannot be the only indicator of improvement in the quality of knowledge and in the quality of students' life in schools, as well as individual examples of bad experiences should not be used as a tool against technological modernisation of schools.

5.1 Cans and can'ts of IT?

''If you have a problem, try to solve it in classic environment first, only then try to use IT, because technology is not almighty and you are less familiar with its environment," wrote Hannafin.

The belief of the greatest optimists, namely that computers and internet will solve all the problems in schools, is wrong. The fact is that IT can not simplify the complexity of modern life and this fact hinders the selection of teaching contents and setting of teaching aims.

Among our educators we can hear underestimating or overestimating statements regarding IT. The underestimators are sure that it is just a fashion fling and that it is only a matter of time before it comes to an end, just like all the unsuccessful school reforms. The overestimators on the other hand believe that IT will offer many solutions to the problems occurring in lessons, which cannot be solved in classic environment. Excessive expectations are not justified, although some foreign researches have shown that classic learning environment can be limiting, considering the current criteria. E-environment or IT support can increase students' motivation, offer a lot more information, extend the attention span, improve comprehension and make lessons more interesting, which are the all direct effects. However, there are also indirect benefits, such as obtaining computer literacy and influencing one's personality (autonomy, self-confidence, ingenuity and learning flexibility).

One of more significant problems that can arise with unprofessional IT implementation is decrease in the students' level of knowledge. In some schools, the desire to maintain a faster, less strenuous and less expensive learning process, has already resulted in superficial knowledge. The content and tasks are less demanding and the lessons are not sufficiently problem-oriented. Post-secondary education level lacks the experience exchange among students and practical dimensions of knowledge, due to the reduced practice, which is a base of professional programmes. Current technological and didactic levels already enable high-quality of practice implementation in web environment.

Even though the result-oriented learning has been reduced due to some changes and measures in the school system, the latter is still predominantly performance-oriented. The results of learning are usually displayed in numbers, which evaluate not only students but also their teachers. Consequently the teachers do not like to leave the 'beaten and safe' educational tracks in schools and do not want rapid changes.

5.2 Changes in pedagogical practice

Changes influenced by IT should be introduced thoughtfully and gradually. Overall preparations are especially important, far more than with the classic form of teaching, because a part of professional energy is transferred from the implementing to the preparatory stage. Theoretical knowledge on the introduction of changes in organizations can be usefully employed here. Thoughtlessness or superficiality can annul the significance of some previous achievements of the school. It shall not be satisfactory if the results are neutral or barely visible, as that would make IT a bad investment. It is important to provide a significant improvement. The questions of what is up-to date and what is outdated and conservative in schools are usually asked by parents, who want their children to be burdened less, when it comes to school. At a Parent's Council meeting at one of the nine-year primary schools one of the criticisms was that the 1st grade pupils are being ''tortured'' with handwriting and that in higher grades the pupils are expected to present legible and aesthetic handwriting when graded. The parents claimed that handwriting is no longer used today and even some of the teachers agreed with this statement. Of course, they were wrong. Handwriting is an excellent method of coordination training for eyes and hands, and later the children will also need manual skills and the sense of aesthetics. Once, dr. Bečaj responded to such complaints, ''It is true that the teachers' solutions to some problems tend to be less appropriate but what will happen if we take this option away?''

Caught in routine, we sometimes disregard the significance of the individual school activities, which will have to be examined more often in the process of their inclusion into e-environment (Reynolds, 2006). E-environment for biology, for example, includes an introduction of a microscope. It took the programmer a week to make a simulation to increase the preparation focus by turning the button on the microscope. Nevertheless, an actual microscope has to be used in practice, since a computer simulation cannot replace it. We could call this a pedagogical error and useless waste of time and money.

One of the major practical problems derives from the concept of combined (blended) learning, where cognitive bridges have to be built between the classic and the web stages (Rebolj, 2005). Analogy with classic environment usually works in web environment, however this is not always the case.

Sometimes the models tested in a classic environment can be reformed into web-environment models, somewhat theoretically and somewhat analogically. Experience in e-material preparation workshops have shown that the best initial way to do it is to reform classic material into web material, preserving the linear structure and the sequence of learning steps. The very first hours of the workshop witnessed a rather slow progress, which later became faster and more dynamic. The teachers were able to identify themselves with the students learning autonomously on the web and the progress became significantly faster. The next e-material was thus based on principles and possibilities offered by the web. In addition, characteristics of the students were considered as well.

The transfer of learning from the classic to e-environment has to be implemented with a critical approach. We have to carefully consider what can and what cannot be transferred and we have to take advantage of the endless new didactic possibilities.

School as a wider e-environment and as an environment for the students has to be well-arranged and organized. In the past, schools were buying different programmes, which are being used to various extends but usually have the role of rather lonesome and unrelated informatization islands (Ferran, 2006). School environment, as well as learning environment, should only have one access. In addition to material, a learning environment also requires web working tools, access to the sources of knowledge and possibilities of various forms of cooperation - all that is necessary but nothing superfluous. The question is, whether it is sensible, from the pedagogical point of you, to separate e-material from the environment, since learning, which requires sources of knowledge, practice in other environments, and group work, is in question.

5.2.1 Excess of classical teaching practice: multimedia and interactivity

Transmitters of information in a classroom with a blackboard and a chalk are only the texts and signs on the blackboard. Historically speaking, school lessons were first enriched by pictures and later on by sound recordings, overlays and films, and in the episcope era, it was possible to discuss the pictures from the books using the frontal teaching methodology. Transmittal of information via various media was named multimedia. Didactic use of multimedia has been treated theoretically but in a web environment its possibilities are increasing.

We can speak of interactivity if a student gets an intelligent answer to a challenge. The relation between them should be reciprocal, which means that the transmitter receives a response, which has an effect upon it. Although we can speak of interactivity in a classic learning environment, it only reaches its true dimension in a web environment.

Multimedia and interactivity are expensive. However, we have to bear in mind that the didactic results are so great that they compensate for the time and money spent on preparation of a certain element of teaching

material. In secondary-level e-materials for mathematics, prepared for one of the EU funds tender, the author (a math teacher) added dancing sinusoids at the beginning, accompanied with loud music, which the young like to listen. However, the multimediality in the teaching content was rather modest. The students commented that the music was disturbing and deconcentrating, which points to a programmatically perfect but pedagogically poor product.

The quality of information does not depend much on the technical perfection of an element if its technical characteristics otherwise enable unambiguous reception. It is true, however, that the media impact makes the students technically ''spoiled'', which means that they are turned off by the technically primitive or archaic elements. Consequences of technical weakness can be mitigated by thoughtful and original solutions. Another important fact that needs to be considered is also the appropriateness of elements for presentation of certain information and to what extent it activates students. It would be wrong to thing that every multimedia element is good and that a greater quantity of elements consequently leads to a better knowledge. Some materials contain too many elements. Confusion is increased by illogical distribution and deconcentration is caused by the excess colours and details, which are not related to the actual contents. Several researchers point out that the results of e-material learning are good only if the multimedia elements are mutually supporting and if they are consistent with the contents. Considering the learning objectives, the elements should be clear, 'ballast-free', i.e. free of irrelevant contents which lack a didactic value.

The use of multimedia can be related either to the study contents or to the learning goals. Students become familiar with the study contents in an easier and more pleasant manner, which also applies to its understanding and use. It is important that the multimedia creates shortcuts to knowledge or optimal paths leading to the learning objectives. The selection of multimedia elements has to be careful, with proper quantity and suitable placement in the text (Whalley, 2002). One element is sometimes enough for one information, Sometimes one element is enough to present one information, except when we want to present something multilaterally. Multimedia can increase the level of information memory, e.g. if a student receives information via several elements – reading, graphic presentation, listening – the probability of remembering the information will increase.

5.3 Important goal: the quality of education

The notion of quality is rather complex and can be agreed upon on the national or organizational level, e.g. school (Požarnik, 2004). The actual quality is therefore based on the agreed quality concept, which includes the view of the quality depending on the environment and on the process monitored by the participants. Schools usually adjust the models every school year, which can present a challenge towards reaching greater demands, connecting the quality and the vision of the school. IT does not guarantee quality by its mere existence. Only its pedagogical use and exploitation can provide it.

5.3.1 Student's reflection

An important component of the current quality concept is students' satisfaction, which is determined through the students' reflection of the process they have been subject to. This is usually the relation between their expectations and the gained. It is not about the evaluation of e-materials or teachers on the part of the students. The students express their feelings regarding the use of technology, related to the navigation logic, the amount of the energy used for the technical work during the learning, the portal regulation, and the aesthetics of the learning environment. Even more important are the feelings related to the process of becoming familiar with the contents and the learning atmosphere (Rebolj, 2008b).

5.3.2 Higher levels of knowledge

Recently, we have read some warnings coming from didactitians, namely that e-education implementation could lead to lower levels of knowledge. The reason for scepticism is the emergence of the so called e-education on the education market. However, this is only the name they use, not the real thing and this can be a consequence of a low level of professionalism or merely a desire to make a profit. The abolishment of classic lessons in schools may lead to lower expenses regarding teachers and education area. Poor or partially prepared teaching can sometimes turn into learning summaries of summaries or can be so shallow that the students fail in every practical task.

Various levels of education mean different students, as far as their cognitive abilities are concerned, and different learning objectives. Taxonomies, e.g. Bloom's taxonomy, are helpful in learning objective classification. Higher levels of knowledge, which enable finding and solving problems, as well as result evaluation, can be reached in the early childhood and later on during all levels of education, not only in higher education. It is true though that without the previously-mentioned level, degrees should not be granted. The highest levels of knowledge are not intended only for individuals with great abilities. New pedagogical dimensions arising from e-learning/teaching enable us to reach higher levels than in a classic classroom with the same possibilities.

This thought leads us back to the question what e-learning/teaching or web-based education actually is. Of course the conditions for the latter are not established by merely offering lecture notes or a textbook on the web, replacing the printed form. If we allow the students' absence from practice, if we do not organize exercises on the web or if we prepare e-material, which can be studied in a few hours, we have not accomplished much. However, with the absence of legal basis for e-education implementation, it is difficult to provide adequate levels

of knowledge by merely presenting pedagogic arguments and appeals to the teachers. Schools do not offer enough time for duplication of the teaching process, which means that the same contents would be taught again in the classic manner if the results of the web-based learning are not satisfactory. Normative regulation is necessary for a high-quality e-education. The highest levels of knowledge are provided by special activities organized on the web, which require advanced IT and suitable environment support, such as well-organized forums or special tools, e.g. for project work or web conference. Efficient web based learning, which leads to high levels of knowledge, requires a great deal of pedagogical and technical preparation (Rebolj, 2006).

The complexity of preparation is increased if competences are also being developed during the learning process. This calls for practical work, exercises, experiments, as well as contacts with the actual working and living environment.

5.3.3 Case studies and problem-based learning on the web

Expert meetings abroad have presented many innovative solutions for case studies and problem-based learning on the web and we can really believe that their contribution to the quality of knowledge is great (Lajh, 2005). Scientific evidence has not been presented so far. However, by observing the students, we established that such approach to learning stimulates their thinking and increases their enthusiasm towards learning (Liberatti, 2004).

Problem-based learning on the web is based on the analogy with the classic learning form but the span of the captured information can be much wider (Ko, 2004). Selection and understanding of information, their contextualization and conversion into new knowledge require various learning situations. These are either partial or comprehensive, added by the teachers alone or in cooperation with the students. We can create a problem-based atmosphere in which it becomes a habit to approach new information or tasks in this manner. The students learn through applications, search, by giving arguments and adopting positions, and all these processes make them very active and creative.

Computer-supported problem-based discussions can also be conducted with the illiterate six-year olds. We prepare image-based exercises demanding a problem-based approach and read the instructions to them. Cognitive development of students is of great importance, therefore we have to make the best out of all the options available.

Case study, as a learning form, offers abundant opportunities and reaches higher levels of learning objectives. With a problem-based approach students search for solutions on their own but with a case study students deal and process a given problem. Otmar Lajf ensures us that this form of learning is indispensible in tertiary education, i.e. we cannot speak of a suitable educational process if we neglect it. It can be successfully implemented from as early as the first grade of primary school.

5.3.4 Instead of conclusion: Establishing quality

The conditions for the establishment of quality in e-school are similar to all other kinds of school: suitably supported learning conditions, unbureaucratic culture, non-autocratic school management and trust among all the participants. If these conditions are absent, we have to establish them. This can reach into the very foundations of a school. In practice a frequent question will be whether it is sensible to invest into technology if we do not have the necessary foundation and wouldn't it be better to wait for the mature conditions for establishment of the basic conditions. What is more important and urgent – IT implementation in schools or its quality? From the pedagogic aspect we have to say quality, however we would like both to happen at once.

If we do not cooperate with teachers, we shall not reach a higher level of knowledge on the web. The way leading to e-learning/teaching seems to be very long but it can be shortened. Systematic approach, without any sideways, can lead to fast consecutive steps, which has been proven in a few Slovenian examples of integrated IT implementation in schools. However, the linear path required theoretical as well as pedagogical and didactic knowledge.

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E-izobraževanje med pedagoško-didaktično teorijo in prakso

Pred šolo so nove zahteve, da postane bolj učinkovita in s tem več prispeva k ekonomskemu uspehu družbe. Hkrati pa šola dobiva ponudbo, naj svoje naloge opravlja z naprednejšo tehnologijo. Informacijska tehnologija v zmogljivostih močno presega dosedanjo učno tehnologijo. Z internetom, ustvarja elektronsko vzporednico klasični šoli in klasičnemu učenju. Obstajajo, žal šele posamezni dokazi, da lahko s podporo IT, to je z e-izobraževanjem izrazito izboljšamo učenje in tudi šolo v celoti. Verjamemo lahko, da ni poti nazaj in da ne gre za modno muho. Vendar pa ne vemo natanko, kdo naj se tega loti in kako ter za koliko. Zadržanost pedagogov, pomanjkanje empiričnega raziskovanja in krati nastajanje trga proizvodov za e-izobraževanje brez ocene kakovosti, temu razvoju ni v prid. Prodor e-produkcije brez oči, ušes in mnenj pedagogov, ki morajo razen za prakso poskrbeti tudi za napredek lastne teorije, lahko dosedanjim izobraževalnim dosežkom škodujejo. Didaktika lahko po analogiji marsikaj izvede in ovrednoti tudi v spletnem okolju, razen tega pa vzpostavi ustrezne mehanizme za vrednotenje elektronskih in virtualnih elementov izobraževanja.
Predvsem spodbudi k iskanju prave poti in uravnavi vijugavih poti do kakovosti e-izobraževanju in boljšega znanja je namenjen ta prispevek.

Ključne besede: didaktika, e-izobraževanje, informatizacija, IT, informacijska tehnologija, multimedija, interaktivnost, kakovost znanja