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USE OF CAD APPLICATION IN THE EDUCATION OF COMPUTER ERGONOMICS

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Abstract: This paper presents the effect of education, which is classically done so far , and the proposal for the constant influence of modern CAD applications - computer animation. Based on a completed research it was determined that several hours working on computers can cause a range of health problems. As a sample of the study there were selected groups of young people professionally-oriented to working on computers, and as a basis we used data from the questionnaire for safe work on the computer that the participants in this study completed. For some of the negative consequences of long-term work on computers, which are linked to long-lasting improper body posture while working on computer, it is planned an impact of animation to constant education and health care.
Keywords: computer ergonomics, education, computer animation

1. INTRODUCTION

In contemporary world, the use of computers is growing almost exponentially. Computers are used in business, education and for fun and communication. Computer use is especially popular in young people who every day spend more and more time searching the Internet, making movies and music, participating in social networks, discussion groups, etc. On the other hand, young people unfortunately play less sports and go rarely to recreation in nature, all of which mainly results in improper body posture, obesity, eyesight problems, unsociability, alienation and other. If a young person is also professionally oriented to working on computers, the risk of the aforementioned health problems is significantly increased.

Several hours working on computers every day causes a range of health problems, starting from minor ones to potentially fatal ones.

We are going to mention only some of the adverse consequences of working on computers: eyesight problems, dry eyes symptoms, glaucoma, addiction, anxiety, insomnia, headache, nausea, discolouration and cancer of skin (due to constant and multi-year holding of laptop in the lap), nutritional problems, obesity, diabetes, thrombosis, as well as injuries that according [1] can be classified into three groups:

- injuries due to repeated straining (paresthesia of the hand, injuries of tendons and muscle connections, tendinitis, tenosynovitis; a detailed description of the symptoms can be found in [9]
- disorders of upper extremities function (reduced movability and pains in upper extremities)
- problems with spine (pains in spine, back, neck, myofascial syndrome; a detailed description of the symptoms can be found in [9])

A more detailed description of the diseases that occur as consequences of working on computers can be found in [3-6]. According to these sources, persons who spend more of 30 hours per week working on computers have increased risk of the occurrence of some of the aforementioned health problems.

There is a wide range of measures that can be undertaken with the aim of reducing the risks of diseases occurrence connected with long hours of working on computers. Moreover, there is an array of ergonomic products on the market, products adapted for human body (keyboards, mouses, chairs) which application can significantly reduce the adverse effects of working on computers. We are going to single out only some of the mentioned measures that can help proper body positioning, and a more detailed list and the description of measures can be found in[1]and (7-12). One of the most wonted measures are: proper seating at the table, the monitor should be at a distance of 60-110 cm from the eyes, after an hour of working with the computer make a break of 10-15 minutes, provide quality monitors and monitor the protection of reflections and flashes of light.

The aim of this paper is to show the impact of education on the awarness of proper posture while working on computers. Education in the field of computer ergonomics can help us to avoid above mentioned health problems. With classical education we influence on the awareness of the students as we have demonstrated and shown through the research. Due to the good results obtained with education we continue with our research that has spread in the form of constant influence education.In order to give even more effort in computer ergonomy education we are currently working on a computer animation, which we plan to set up as screen savers on the computers in our computer labs. The animations should remind our student on the correct posture.

2. CONDUCTED RESEARCH

For the needs of this paper we conducted a research regarding computer ergonomics.

2.1. The aim of the research/ Motivation

The aim of the conducted research was to analyse the effects of lecture on computer ergonomics presented to students of Higher Education Technical School of Professional Studies in Novi Sad in the school year 2010/2011 and 2011/2012. The obtained results should serve as a starting point for the preparation of material for lectures on the same topic that should be presented in the school year 2012/2013 to students of the first year of all studying groups in the subject *Computers.* We should single out the questions that the students gave inadequate answers to, therefore pay more attention to additional education of students on the topic during ergonomics lectures.

Having in mind that the test also contains questions about possible consequences to students' health, the authors of this paper got the idea to elaborate a concise manual by the application of computer animation about proper ergonomic position in working on computers. The animation will be going on automatically every single hour on computers in computer laboratories. At the end of school year 2012/2013 the students will be surveyed again.

2.2. Research methods

The methods applied for the needs of this research are the following:

- Participants: students of Higher Education Technical School of Professional Studies, Novi Sad.
- Instruments: Testing in the field of computer ergonomics. The test was a written multiple choice or with questions where students are required knowledge of ergonomics computer or in another part of the test that the symptoms they feel or how they set up the computer at home.
- Procedure: Student did the test in terms of lectures in the computer. Testing was carried out individually and anonymously. The test for about 20 minutes as needed to each student do all the questions in the test.

2.3. Techniques and tools of the research

The tools for the research are students' test in the field of BZR/computer ergonomics.

The aforementioned surveys/tests contain the following groups of questions:

- questions that test knowledge in the field of computer ergonomics.
- questions that are related to health problems of students that work on computers for many hours.

In the field of computer ergonomics, a survey list is given in the form of a questionnaire with questions in the form of essays for which answers are offered. Survey/test in in the field of computer ergonomics is given in the form of essay, i.e. no answers are offered in advance for a student to encircle.

2.4. Conducted research

In October 2012 we conducted the testing of knowledge of students of Higher Education Technical School of Professional Studies in Novi Sad in the field of computer ergonomics.

The total of 305 students of 16 different studying pogrammes participated in the testing. The testing included all the three the years of studying.

With regard to the fact that the testing was conducted at the very beginning of the school year, students of I year were not able to attend the lecture of the mentioned field, therefore their participation in the testing was aimed at obtaining the insight into students' pre-knowledge in the field of computer ergonomics. The obtained results can afterwards be used for a target lecture.

After the first test completion, once a week students attended lecture on computer ergonomics as an obligatory subject *Computers*. During this education the knowledge was being directed to critical points of the first test, i.e. to issues students were bad at or to topics essential to preservation of their health. Then the survey was repeated with questions in the field of computer ergonomics and their attitude to proper working on computers. In the repeated survey there were questions regarding their health problems.

3. RESULTS OF THE CONDUCTED RESEARCHES

The surveys that the students completed consisted of two parts: part I which represents the test of knowledge containing questions in the field of computer ergonomics and part II which represents a survey on possible presence of health problems connected to long hours of working on computers.in students.

In the part to follow, we presented only some of the results of the conducted research.

The question that represents the staring point in the repeated survey is: After the lecture on proper use of computer, did you decide to change something about computer use? 66% of the examinees answered they changed the way of working on computer, while 34% of them answered they preferred their old way of working on it.

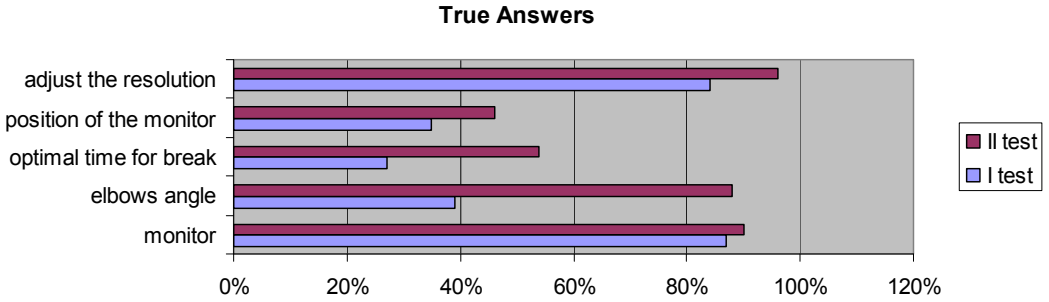
On the basis of greater share of changes in further work, i.e. bigger group that changed something in the way of working, we can continue to analyse the types of changes they made and the extent those changes influenced their health, as ewll as the influence of education.

During the lecture it was frequently emphasized that it was essential to make breaks when working on computers, to have proper body position, good lighting, adequate distance of eyes from the monitor and to buy ergonimic mouses and keyboards.

We are going to single out the questions regarding proper working on computers and make parallel analysis of the first and second test.

Table1 – Questions that point at additional knowledge on computer ergonomics in the questioned students

Questions	False	True
1. The position of monitor in relation to its user? II test	10%	90%
1. The position of monitor in relation to its user? I test	13%	87%
2. Write the angle under which elbows should be bent while working on a computer? II test	12%	88%
2. Write the angle under which elbows should be bent when working on a computer? I test	61%	39%
3. Write optimal time after which a break should be made when working on a computer? II test	46%	54%
3. Write optimal time after which a break should be made when working on a computer? I test	73%	27%
4. How should we position the monitor in relation to light source? II test	54%	46%
4. How should we position the monitor in relation to light source? I test	65%	35%
5. Did you adjust the resolution of your monitor? II test	4%	96%
5. Did you adjust the resolution of your monitor? I test	16%	84%



	monitor	elbows angle	optimal time for break	position of the monitor	adjust the resolution
II test	90%	88%	54%	46%	96%
I test	87%	39%	27%	35%	84%

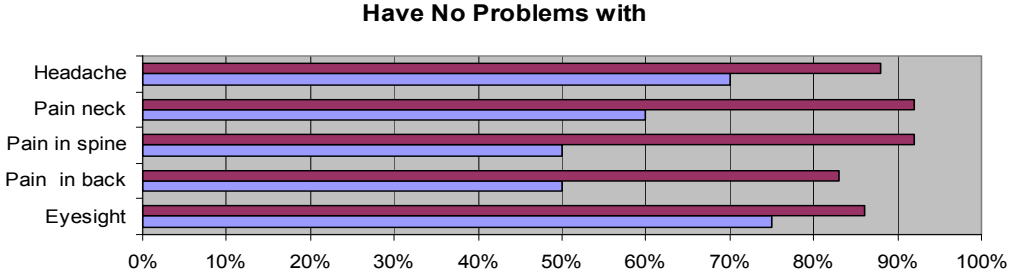
Graph 1 – Gaphic presentation of true answers given to control questions in testing knowledge

From the data presented in Table 1 and Graph 1 we can conclude that there is greater percentage of true answers in the second test. On the basis of questions connected to proper computer use, when comparing results of the first and second survey, we can conclude that education influenced proper computer use and computer ergonomics.

We can follow further the changes of sudents' health as a result of their education.

Table 2 – Questions that point at the influence on health of examinees via computer ergonomics

Questions	No	Yes
1. Eyesight problems in I test	75%	25%
1. Eyesight problems in II test	83%	17%
2. Pain in back in I test	50%	50%
2. Pain in back in II test	83%	17%
3. Pain in spine in I test	50%	50%
3. Pain in spine in II test	92%	8%
4. Pain neck in I test	60%	40%
4. Pain in neck in II test	92%	8%
5. Headache in I test	70%	30%
5. Headache in II test	88%	12%



	Eyesight	Pain in back	Pain in spine	Pain neck	Headache
II test	86%	83%	92%	92%	88%
I test	75%	50%	50%	60%	70%

Graph 2 – Graph presentation of the NO answers to control questions about the influence of computer ergonomics to examinees' health

We can conclude that surveyd students have fewer complaints about pains in eyes, spine, neck and headaches in the second test, i.e. after the education and application of adopted knowledge on computer ergonomics.

4. THE APPLICATION OF COMPUTER ANIMATION

Aiming at education that includes previously stated topics in all the classrooms of Higher Education Technical School of Professional Studies in Novi Sad there was set a poster with recommendation on proper ergonomically projected working on computers.

The research established that beside technical recommendations to be fulfilled, the awareness of a computer user on proper working on computers plays a significant role. If the user becomes aware of the position of his body while working on a computer at every moment and is able to sit

properly, he will have influence on the preservation of his health. This is the idea that is used for further influence on the awareness of the users, in our case students. Then we passed to periodical presentation of body positioning, i.e. to these three steps. In order to achieve periodicity, we applied computer animation that at certain intervals warns the user.

We are preparing computer animation that will activate itself when starting a programme and also periodically during lectures on monitors, warning and reminding of some basic recommendations of proper ergonomic work. That will serve as continual education of the students and staff. The results of the education will be compared with previously achieved results at the end of school year.

The aim of this action is to increase the level of awareness about ergonomically designed working place and behaviour when working on computers, especially with students of information technologies (IT) and designer (D) studying groups. In the second semester (that is to follow) out of total six obligatory subjects IT students attend five subjects with classes on computers, and IT students of the fourth semester attend all the five obligatory subjects with classes on computers. Design students in the second semester have three of six subjects in computer laboratory and in the fourth semester they have four of six subjects in computer laboratory.

CONCLUSIONS

Risk of the occurrences of health disturbances due to improper body posture when working on computers is of essential importance with students of informatics and design, therefore education of it is necessary.

Suggested measures for the reduction of risk are the following;

- ✓ **Education within teaching process:** For three school years in a row, in the subject *Computers* the lectures on safe working on a computer are being held. The subject is attended by students of the first year of all the studying groups It is recommended to continue with this education, as well as that the lecture on this topic be held on introductory lecture of subjects where the teaching is performed on computers.
- ✓ **Setting computer animation:** Safe working on a computer – ergonomic of a working place on all the computers in classrooms of Higher Education Technical School of Professional Studies in Novi Sad. It certainly must not be omitted the care of teaching as well as non-teaching staff (especially administrative services where the employees spend most of their eight working hours sitting by computers).
- ✓ **Spreading awareness about the importance of paying sports:** Starting from school year 2012/2013, the students of Higher Education Technical School of Professional Studies in Novi Sad of studying groups of civil and fire protection have the subject *Physical Education* within plan and programme for two times a week. It is being considered the introduction of the same subject for all the other students, therefore for the students of of information technologies (IT) and designer (D) studying groups.

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