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Implementation Of E - Learning In To OHS Education

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Abstract

Development in the field of science and technology affects the interest of the elements of educational innovations. The application of information technologies (IT) is associated with their dynamic usage on not only in real life, but also in the education. It is necessary to take advantage of the younger generation interest in working with information technologies. The focus of the work with computer is to streamline and optimize selected phases of teaching. The improving of school education results in raising educational level. The education, as important part of the development process, has its relevant position. The educational content, knowledge, abilities and skills, must be usable in further studying and in the daily practice. To follow OHS rules in chemical laboratory means the establishment of theoretical knowledge, skills development and appropriate safety habits. E-learning technologies afford the creation of really innovative authentic learning tasks oriented on compliance of OHS principles. In this article we presented the example of one OHS topic oriented on injuries in chemical laboratory with using e-learning.

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Keywords: Occupational Health and Safety (OHS); E - Learning; Information Technology (IT); Educational Process;

1. Introduction

An important part of preparing people for the occupational processes is specially the education and training (Robson and Stephenson and Schulte, et al. 2012). The increasing level of education reflects the improvement of education in our schools (Kozík, & Feszterová, 2011). The variety of acting factors (traditions of university education as the highest level of the educational system, an enormous increase in the dynamics of knowledge in science and technology) are an incentive for the implementation of the innovative process in all areas of training (Kubíček and Kropáč, 2004). There are a growing number of adults who are increasing their levels of achieved education (Líšková, 2008 ; Tong and Lin and Chen, et al. 2006). A key factor that drives economic development and affects the economic status of individuals is human resources (Kozík and Feszterová, 2010). In today's world, where information is becoming an essential driver of development in all

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spheres of human activity, the prospect of development of each country is based on the learning society (Prauzner , 2010). Improving the quality and effectiveness of the education is currently a priority task (Noga, 2012). The article proves the importance of education in field of respecting the safe work and the prevention of student's health. The aim of e-learning courses for students is to become familiar with the importance of OHS (including chemical safety, proper manipulation with chemical substances and mixtures, providing first aid when life-threatening situations take place, as well as immediate intervention when material assets are in danger) in forms of Power Points presentations, on-line seminars and examples of everyday practice.

2. Educating of future graduates

In preparing future graduates are to requirements for training, existing fields and disciplines, using the latest knowledge of science, technology, methods and trends. Implementing preventive measures, particular programs and measures aimed at improving working conditions and elimination factors causing occupational accidents, occupational diseases and other damages to health from work are the most effective means of improving occupational health and safety. E-learning is one of option, which expands knowledge and information in education and training.

2.1. E-learning in OHS - education and training

An integral part of school training is taking care of health and safety in education (Líšková, 2013) (Serafín & Feszterová, M. 2010). Into the content of education should be especially incorporated the health and safety issues [14]. The basic principles of OHS define the circuits of measures aimed at reducing the number of occupational accidents and occupational diseases. It is necessary to lead the young generation to the principles of safe work and health from an early age (Kozík & Lukáčová, 2010) E-learning presentation is oriented on increasing students familiarity with the issue of safe work with an emphasis on health and the environment. In practice, it means that before starting work, students must be familiar with the risks and safeguards that apply to chemical substances and chemical mixtures they will work with. E - learning has very important role in education (Kozík, & Lukáčová, 2010) Danger to health caused by chemical substance can be limited or completely excluded with the perfect knowledge of the effects of chemical substances and with the respecting of their safety arrangements(M. Feszterová, M. 2008)By theoretical adopting of the correct reactions and work habits while working is a prerequisite for successful and creative way of coping with assignments (Základy prvej pomoci). It is the specialized education, which has incorporated the issue of OHS and the gaining of new abilities. For good result it necessary know information on a chemical substance on its properties, guidelines for first aid, fire precautions, storage conditions, information on the toxicity, reactivity, methods of disposal. Students of the Department of Chemistry, the Faculty of Natural Sciences and the Department of Technology and Information Technologies, the Faculty of Education, Constantine the Philosopher University in Nitra in the academic year 2009 - 2013 participated in e-learning course, whose main theme was learning the principles of compliance with health and safety. 333 students participated in this course during these four years. The e-learning education portal is located on the Constantine the Philosopher University, Nitra web page, in the Moodle LMS. This e-learning portal provides space for preparing online difference courses and creating new study materials. OHS course includes study texts and tools for managing the process of instruction, provides tools for creating tests and communicating in the course participants and tutors. Within this subject learners realize the importance of concrete pieces of information and their application in other subjects and practice. Within this course students realize the importance of concrete pieces of information and their application in practice. The course supports methods of selfstudy and is appropriate for students of both the full-time and part-time form of study. It is structured in 13 weeks, while each chapter has three parts: explanation, practice and feedback, which can be used in various ways, e.g. for preparation of study materials, either in the form of presentation of lectures (in the form of PowerPoint presentation, texts), index etc. The practical activities include practising and feedback and check and evaluate students' knowledge (in the form of tests, tasks), recommend literary sources etc. The process of test preparation, creating databases of tasks, testing and evaluation are crucial and provides space for learner´s active participation in the process of knowledge development, and at the same time

monitors the process of gaining knowledge for the tutor. Above all, the e-learning course mediates information by adding such activities as questionnaire, forum, chat and survey. The example is 1 lecture/topic/two hours of e-learning course focused on "injuries in chemical laboratory".

3. Injuries in chemical laboratory

Injuries which can occur at work in chemical laboratory can cause wounds by action of heat, chemical agents or objects (thermal, chemical, mechanical wounds). The most important measures to minimize the injuries are preventive (precautionary). Each failure which threatens the occupational safety should be immediately announced to the head of training. The work with chemical substances must be carried out with absolute care and concentration.

3.1. Explanation part

- Presentation contents to the injuries occur in the chemical laboratories, their causes and selection.
  - It is important to recognize if the wound is simple or complicated.
  - By occurrence of more wounds the life-threatening ones are handled first and subsequently the less serious wounds (Dobiáš, 2005)
  - Life-threatening situations are: apnoea (short-term breath failure), asystolia/cardiac arrest (heart´s stop), intensive bleeding, unconsciousness and shock.

- Book explains the most important part of the presentation.

3.1.1 Mechanical wounds

Mechanical wounds are caused by mechanical factors. Mechanical wounds are consequences of careless manipulation with laboratory objects and tools at various activities, e. g.: working with glassware (cutting tubes), operation under vacuum, when inserting glass tubing into rubber stoppers. In most such cases result surface wounds which heal without scars, but also complicated ones can occur. Accidents involving glassware are a leading cause of laboratory injuries. These can be avoided by following a few simple procedures. In general, the used glass equipment must be designed for specialised tasks and must not be cracked, broken or damaged. It is necessary to prevent injuries by following safety instructions and using personal protection (eye and face protection, protection clothing) (Základy prvej pomoci)

3.1.2 Thermal, cryogenic and chemical burns

Heat burns (thermal burns) are caused by fire, steam, hot objects, or hot liquids. Burns injure the skin layers and can also injure other parts of the body, such as muscles, blood vessels, nerves, lungs, and eyes (Dobiáš, V. 2005)Burns are defined as first-, second-, third-, or fourth-degree, depending on how many layers of skin and tissue are burned. The deeper the burn and the larger the burned area, the more serious the burn is. Another ranking of burn injuries is based on percentage of damaged skin (three degrees). Cryogenic burns. Bringing the skin into contact with something extremely cold causes symptoms similar to a heat burn (pain, blistering). That's a cryogenic burn. In a chemistry laboratory, CO_2 dry ice and liquid nitrogen are particularly infamous for causing cryogenic burns. Chemical burns follow standard burn classification and may cause extensive tissue damage. The main types of irritant and/or corrosive products are: acids, bases, oxidizers, solvents, reducing agents and other. Chemical burns occur very frequently during chemical experiments e.g. at work with sodium, generation of hydrogen or at preparation of acetaldehyde. The wounds can be complicated and combined with mechanical wounds. These wounding are mostly caused by carelessness or confusion of chemicals. Also unproper disposal of unused chemicals can cause injuries and in some cases can lead to explosion. E. g. during long-term storage of ammoniacal solution of silver salts (Tollen´s reagent) silver nitride is formed (Ag_3N), which is highly explosive.

3.1.3 Thermal wounds

The severity of thermal wounds depends on duration of the contact and on the temperature difference between skin and the hot laboratory object (vessels, gas-burners, racks, traps, screens) (Dobiáš, 2005)
Burns can occur:

- At work with glass in burner´s flame (bending glass tubings, sealing the ends of glass tubings, pulling-up capillary),
- During handling chemicals or chemical reactions (at burning white phosphorus or other chemicals),
- By electrical arcing. When electrical arcing occurs, perhaps as a result of accidental short circuit, the heat generated can be intense and, even if it persists for only a very short time, it can cause deep-seated and slow-healing burns. The main determining factor at electrical arcing is the electric resistance of body tissues. The higher is the skin´s resistance the deeper is the local damage (burn). At lower resistance of the skin the systemic effect of the current is extensive (Dobiáš, 2005)

Signs and symptoms:

- Thermal injury or burn an effect a surface skin (superficial skin) as wll as the damage can penetrate into some of the underlying layers (Základy prvej pomoci)
- The damaged surface of skin causes a massive loss of body heat,
- The victim immediately feels sharp pain, after tens seconds skin redness occurs or after a few minutes blisters are formed (Základy prvej pomoci)
- Burn wounds larger then few open hands initiate a probable shock(Dobiáš, 2005)
- Burn injury is one among the most aggressive stress-triggers (Dobiáš, 2005)

Burns are caused by a variety of external sources classified as thermal, chemical, electrical, and radiation . Chemical burns can be caused by over 25,000 substances (strong base or a strong acid).

3.1.4 Chemical burns

Chemical burns of skin or mucous membrane are caused by contact with chemicals in a liquid, solid, or gas form. Most common cause of chemical burns are carelessness, pipetting chemicals by mouth and nonobservance of occupational safety and health protection´s provisions (e.g. drinking from chemical glassware). Most frequent cases of skin burning cause hydrochloric acid, nitric acid, sulphuric acid, acetic acid, caustic soda. Caused by dehydration the effect of acids to the skin is immediate and the affected area bites.
Local symptoms of chemical burns on the skin are (Základy prvej pomoci)

- The victim´s skin colour is changing, has pain and at eye burn the eye-lid cannot open,
- After ingestion of chemicals pain and tingle occur in the mouth, oesophagus and stomach, the colour of lips and surroundings of mouth is changed.

For example: hydrochloric acid, acetic acid cause white spots on the skin in affected area, sulphuric acid causes grey spots and nitric acid from yellow to brown ones.
Hydrofluoric acid can cause particularly deep burns which may not become symptomatic until some time after exposure. It etches even the glass and must be handled in fume-cupboard and hands protected by rubber gloves.
At burns caused by hydroxides (NaOH, KOH) their effect is not so quick, but all the more dangerous. They solve proteins and cause deep wounds, which need long time to heal. Concentrated hydroxides cause more severe damages on skin and mucous membranes. Except the above- mentioned chemicals common burn-causing agens are concentrated solution of hydrogen peroxide and bromine. Not only solutions and substances of these chemicals can burn the skin or mucous membrane but also solid chemicals for example silver nitrate, hydroxides of sodium and potassium, white phosphor and others. At work with whatever chemical substance the principles of occupational safety and health protection should be followed. At handling, transferring and weighing spoons, spatula, tweezers, funnels must be used. Taking chemicals into the hands is never allowed.

3.1.5 Scald burns

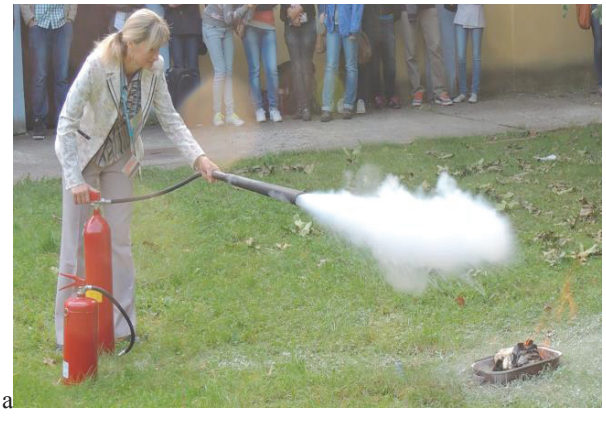
Scald burns are caused by hot liquids, vapours and gases. Locality and way of interaction determine the severity of injury; very dangerous are scalds of face, breast and genitalia. Injury of the respiratory system (scald burn) occurs

when hot vapours or hot gases are inhaled. The mucous membranes of respiratory system become oedematous and obstruction is developed.

Figure 1. Personal protective equipments

Vocabulary is forming with phrases, which explain to important concepts e. g.:

- Extreme cold causes *frostbites (cold burn)*.
- *Chemical burns* occur when living tissue is exposed to a corrosive substance such as a strong acid or base.
- *Thermal burns* or *thermal injury* is a consequence of direct or indirect effects of thermal energy on the body when the exposure time and the energy level of the source is sufficient to damage the organism (Dobiáš, 2005)
- *Thermal wounds* are caused by high temperature (flame, electricity, hot surface, scald).
- *The wound* is simple, if only the skin is damaged and complicated if the wound is deep with destructive signs of muscles, bones or internal organs.
- The most common causes of burns are: fire, hot objects or flame (so called *dry burns*), steam or hot liquids (so called *wet burns* or *scalds)*.
- *Scald burns* are caused by hot liquids, vapours and gases and the occurred wounds are called *"wet wounds"*.



a

b

c

Figure 2. (a-b-c)Examples of individual protection equipments, correct handling with fire extinguishers and resuscitation

3.2. Practice part

From exposure to hazardous chemicals in the work process shall be used: the means of collective protection, organizational measures and means of individual protection (personal protective equipment). (Fig. 1)As a examples we presented individual protection equipments, correct handling with fire extinguishers and first aid, because they are very important for the work in chemical laboratory. (Fig. 2)

4. Conclusions

The aim of presented e-learning course is not only to ensure access to quality information, acquire new knowledge, but also to provide opportunities to link theory with practice, to provide new approaches to vocational education and innovate in teaching and learning. E - learning is favourite education environment for students and teachers too. It has place in OHS education. The aim of education towards OHS with help e-learning is to offer students to needs knowledge and information, to develop habits for safety work.

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