WORKER INTERACTION – IMPLEMENTATION OF A SAFETY TRAINING MODEL ON CONSTRUCTION SITE USING MULTIMEDIA KIOSKS

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Abstract - Every year, approximately five thousand people die while working in Europe. The investment in prevention has not been directed to a great extent to the training of workers. Workers in construction, typically have low or no formal education, a factor that does not facilitate traditional face to face training. Therefore, it is urgent to find solutions that suit the particular conditions of the construction sector and provide adequate training for workers. The causes of accidents in construction are two: lack of prevention and bad practices. Information is a fundamental tool for prevention, making workers aware of risks and accident prevention. Training is essential to create the necessary competences, to change behaviours and attitudes. A solution to accomplish information and training is the implementation of multimedia kiosks on construction sites, running an eLearning program for construction safety. The solution is based on the interoperation between the kiosk on site and the centralized management of the databank on safety.

Index Terms - Construction, safety, e-learning, kiosks, training of workers, automated training, construction site.

BACKGROUND

The rate of work accidents in the European Community is still very high. Every year, approximately 5500 people die while working. To lower this rate, it is necessary to reduce the exposure of workers to different risks. The construction sector is different from most other working sectors, due to the cultural profile of workers and also due to the variability of construction sites. Europe has made considerable progress in this area, concerning the organization and implementation of prevention measures, involving the different stakeholders of this sector. In fact, during the last years, the number of accidents and death by accident has been decreasing significantly has a result of these initiatives. However, this investment in prevention has not been directed to the training of workers. Workers in construction, typically have low or none formal education, a factor that doesn’t facilitate traditional face to face training. Therefore, it is urgent to find solutions that suit the particular conditions of the construction sector, and provide adequate training in critical areas like safety.

CONSTRUCTION SECTOR

The construction sector has specificities that create obstacles to the implementation of prevention policies used in other industries. The construction site is always different, constantly changing due to construction, on
the outside, exposed to weather factors and poor lighting and hygienic conditions. Additionally, this sector usually has longer shifts and workers have to deal with dangerous machinery and high risk procedures. Workers motivation is also conditioned by poor contractual links and reduced training.

Official data regarding deadly accidents, show that the contribution of the construction sector represent a large percentage of the total number. For instance, in Portugal, during the years of 2001, 2002 and 2003 there were 88, 103 and 156 fatal accidents in the Construction sector. On the other hand the total numbers of fatal work accidents in Portugal in all sectors during the same years respectively is 181, 219 and 280. These numbers are data provided by the official agency Inspecção Geral do Trabalho (Work General Supervision).

**RATIONALE**

The causes of accidents in construction can be divided in two groups: lack of prevention and bad practice. The causes of the first group are the ones where most of the investment has been made. Regarding the second group, information and training are critical measures to reduce the number of accidents, but investment in this area is still deficient.

Information is a fundamental tool for prevention, making workers aware of risks and accident prevention. Training is essential to create the necessary competences, to change behaviours and attitudes. Information and training, together, will make the worker acquire a better knowledge of the productive process, identifying risks and predicting accidents [1]. These tools should be easily accessible at all times, to all workers.

A solution to accomplish information and training just in time, at the right place, is the implementation of multimedia kiosks on the construction sites, running an eLearning program for Safety in Construction. Having in consideration the conditions of the construction sites and the profile of workers, the kiosks should be a support for information and training. The main training program will be based on an application developed for the European Project – E3 (e3.up.pt), which will be adapted and complemented to suit the needs of each partner. Learning objects previously developed or designed to purpose, accordingly to International rules and recommendations, will be available in a simple and accessible interface. An online connection, will allow that updated information is always available. The construction company will use a centralized databank that will manage the information to provide the adequate answers to the scenarios and questions placed by the workers in the construction site. It is this interoperability, to answer properly to the questions and training demands, between the kiosks and the central databank that will allow the development to be used in further construction sites and in similar safety scenarios.

**OBJECTIVES**

The objectives for this initiative are the following:

a) Development of a training model using ICT, based on the implementation of multimedia kiosks on Construction Sites.

b) Facilitate the access to critical information on the construction sites.

c) Improve the knowledge level of workers, regarding Safety measures and procedures.
d) Evaluate the impact of the implementation of the kiosk system and the acceptance level among workers.  
e) Analyse the viability to expand the system to a larger scale, including other areas of knowledge or other industries.  
f) Evaluate the impact of this initiative on the number of accidents.  

INNOVATION

The use of multimedia kiosks as a training and information system at construction sites is innovative [2]. To use in place computer based learning, in a self-paced system to train construction workers on a critical subject is not a usual strategy. Considering the characteristics of the sector, this model proposes an integrated system to pass knowledge, create competences and evaluate individual and group results. Based on the expertise of eLearning specialists, experienced Civil Engineers and professionals from Continuing Education, this system will use rich media like audio, text, images, animations and interactive games, to create an appealing learning environment [3]. It intends to be a versatile tool that can be used mainly as a self-learning system but also to support for face to face training. Additionally, it can be used as a quick-reference on the subject of Safety, present in place. The inclusion of assessment items will allow to measure impact of the system at the individual level but also will give an overall perspective of the implementation.

To extend its applicability use, this system will be available in different languages, and should incorporate European and National legislation and recommendations of the countries where it is implemented. For this reason, the collaboration with interested different partners from other countries is essential.

TARGET GROUPS

The target groups of this initiative are specially the construction workers. These are the main reason for this work that requires the change of the culture of safety among the construction workers [4]. Only with the training and education of the main actors of this subject the significant progression of the quality of safety is possible.

Other targeted groups are relevant for the success of this training. These are the construction companies as providers of the safety conditions and responsible for the construction workers performance [5]. A secondary type of targeted groups are the developers of hardware and of software for these kiosks that comprehend the continuing education institutions, eLearning communities, workers unions and government agencies responsible for safety of workers.

OUTCOMES

The initiative will have the following groups of outcomes:  
a) Multimedia kiosks with application on Safety in Construction, based on an e-book produced by the University of Porto. It will be adapted to the new media, assuming the touch-screen as the preferential user-interface. A possible extension may exist to include versions in different languages and information from other countries involved.
b) International Knowledge base on Safety in Construction, as the result of the collaborative work of the different partners
c) User guides, to support the user and improve the learning experience
d) Assessment items will be created to complement the application, referring to each module. This will provide data to evaluate the impact of the initiative.
e) Training events, specifically addressed to familiarize construction supervisors with the project and the application. This event should be critical to the acceptance of the project by the workers.
f) Motivational strategies should be developed and applied during implementation to increase the acceptance of the kiosk by the workers.
g) Impact Report that integrates the results of the implementation of the project, as well as the assessment results.
h) Dissemination Initiatives.
i) Project website with relevant information about the project.
j) Active participation in conferences.

FEASIBILITY

The initiative takes place with the support of a construction company that will support some costs, provide training for a group of pilot workers and use their own expertise in using training for the construction workers. A major important partner is the company that provides services of supervision of safety as external auditor that will contribute with independent analysis of the methods and of the tools proposed. A third important partner is a company involved in entrepreneurship that will perform the promotion and dissemination of the kiosks and of the learning materials. This company will also be engaged in the choice in the market of the hardware that will support the kiosk concept. Finally the contributor to the software creating the virtual training platform is the University of Porto through the office of Elearning support. It is a multidisciplinary team aiming at a complex product but with high expectations in terms of results. This has been a concern from the beginning of the project implementation due to the difficulty in having in the same set the necessary competences to achieve acceptable results. The project is in an early stage and difficulties are dealt by the management group that has all parties represented.

REFERENCES