

Tutorial System for Work Security and Health in SMEs According to the European Union Directives

Rodica Mihalca, Adina Uță, Anca Andronescu, Iulian Întorsureanu

Abstract: *This article presents the author's research for developing a tutorial system, being able to deliver proper training of specialized personnel in Small and Middle Enterprises (SMEs), in order to eliminate or reduce the risks of these enterprises to an acceptable level, according to the European Union directives.*

INTRODUCTION

Proper risk prevention requires proper training. This study aims to accomplish a tutorial system, able to deliver proper training of specialized personnel in SMEs, in order to eliminate or reduce the risks of these enterprises to an acceptable level, according to the European Union directives.

The SMEs have certain characteristics concerning the risks faced by their employees. In a systemic human-machine approach, we can consider the following issues:

- Human operator: the workforce has a basic to medium qualification, without focus on work security and health. The workforce is also less stable, depending on season or economic contexts.
- Machines: the most SMEs are using older generation machines, simpler, but less appropriate concerning the work security.

One of the main aspects of the tutorial system design is the design of the information structure as basis for the system. This structure should provide the following characteristics: coherence, clarity of objectives, inclusion of all relevant aspects in the solution space of the considered domain, continuous updating of knowledge regarding risk prevention, interactivity orientation of the system to support learning, efficiency of the educational process.

TRAINING FOR WORK SAFETY AND HEALTH

Training for work safety and health is important, one side for the workforce, in order to avoid work accidents, and on the other side, for the education of future specialists in the field.

Risk prevention at the workplace is a must for all enterprises, regardless their size.

To be efficient, the prevention activity must be systematic and correlated with other activities, both in the technical domain, and related to education, controlling etc.

The prevention activity has a strategic, long-term dimension, and a tactical, short and medium term dimension.

Following, the ten basic strategies for prevention or reducing hazards in manufacturing activities are presented, based on the European Union documents.

The strategies can be used isolated or grouped in packages, selected according to the existing risks in the workplace.

The strategic approach of the prevention activity is a big step forward in the field of work safety, moving from reaction (when risks occur) to preventive action.

1. Prevent the danger from happening in the first place.
2. Reduce the existing amount of danger.
3. Prevent the occurrence of the existing danger.
4. Changing the way of emission of danger factors from the source.
5. Separation in time and space between dangers and elements that need protection.
6. Separating the danger with physical barriers.

7. Modifying the relevant properties of the danger.
8. Increase the resistance to danger.
9. Countermeasures for natural events like flooding, fire, earthquakes etc.
10. Stabilization, rehabilitation and repairments of affected objects.

In the field of work security and health, people involved in the educational process within a SME are all the employees of the organization, regardless their position. This statement can be grounded on the following aspects. Within a SME, all employees carry on, in one way or another, a productive activity, depending on the specific nature of the SME. While carrying on those productive activities, the entire personnel, starting from the general manager must be aware of the risk factors specific to the kind of SME they work in and of the risks that could lead to economic and human losses. Also, all employees must be aware of the importance of preventing such risks. In accordance with the their specific attributions, the employees must be trained to: efficiently allocate the necessary resources for risk prevention, correctly identify risk factors, correctly identify risk components(frequency, seriousness, cause, consequences), audit of work security and health within the SME, technical and organizational ways to prevent risks, possibilities to ensure adequate wok conditions.

THE NEW ORIENTATION TOWARDS RISK PREVENTION IN THE EUROPEAN UNION

For organizing and alignment of legislation and practical activity of work safety, the E.U. Council has adopted the Directive no. 391 / 1989 regarding the introduction of measures for improving the results of workers' safety and health.

The directive contains general principles concerning the prevention of professional risks, protection and work safety, as well as information, consultation and general guidelines for implementing the stated principles. It is completed by member states' own directives, which take into account the technical standardization and harmonisation in the EU member states. The framework directive covers both public sector and private enterprises.

The connection between the accidents, professional illnesses and the work process is emphasised; the work process is understood as social activity, as element of the production process and as result of establishing and functioning of a working system.

Among the ideas introduced by the framework directive, the most important refers to the necessity of adapting the production activity to the characteristics of the human operator. These concerns: the ergonomic design of the workplace, choosing the work equipment, choosing the protection equipment, choosing the methods of work, making tedious and machine-paced activities easier.

This new orientation shows a greater attention towards protecting the human, as a consequence of material, technological and social progress. On the other hand, the new orientation derives from the actual technological developments, which offers a broad spectrum of solutions for the most production processes.

GOALS OF TUTORIAL SYSTEMS FOR RISK PREVENTION IN SME'S

The typical goals of the tutorial system are related to providing appropriate education and training efficiently, in the area of risk prevention in SMEs.

The following chart presents a grouping of system goals in categories like (see Figure 1):

- Risk factors identification
- Risk evaluation

- Security level evaluation
- Risk prevention and security improvement

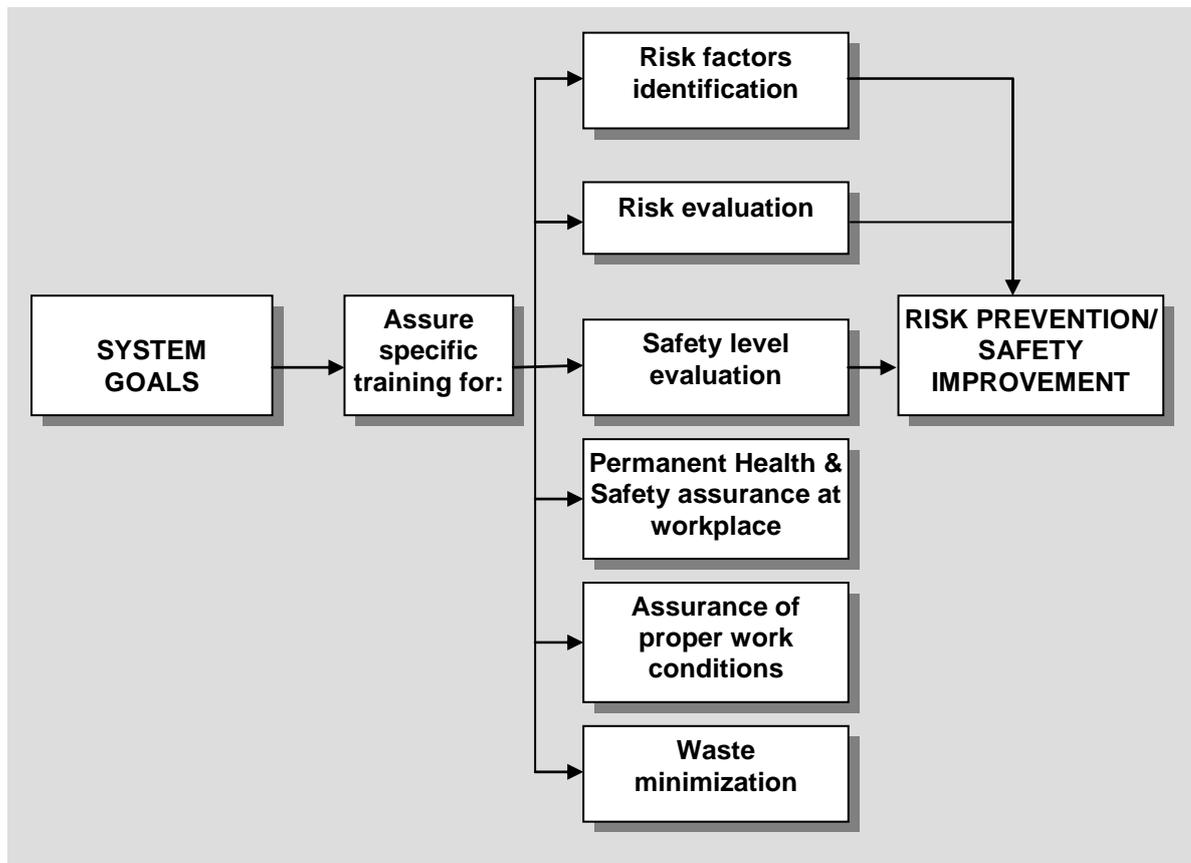


Figure 1. System goals groups

As targets of the education process aiming to assure protection against risks, as well as health and safety, all employees of the SME should be considered, regardless of their qualification and position. This is due to the following aspects:

- All employees of a SME perform, in one way or another, a productive activity connected to the business domain of the enterprise; functional services are minimized or externalized (subcontracted).
- During the performing of their working activities, the entire personnel, from top management to workers, must acknowledge the following facts:
 - The presence of risk factors and risks that may cause economic inefficiency, as well as incidents and accidents, even serious ones.
 - The need to prevent these risks, derived from the very necessity of normal functioning of the enterprise.
- Depending on their specific health and safety responsibilities, the SME's personnel should also consider the following aspects:
 - Efficient resource allocation for risk prevention;
 - Appropriate identification of risk factors;
 - Appropriate identification of risk components: frequency, seriousness, consequences, causes;
 - Internal health and safety auditing
 - Possibilities of risk prevention, such as:

- Technical prevention measures;
- Organizational prevention measures;
- Possibilities of assuring appropriate health and safety conditions at the workplace;
- Possibilities of assuring an appropriate work environment;
- Depending on their position within the company's organization structure and the responsibilities for proper ongoing operation, each participant in the training should be provided with:
 - A specific training syllabus;
 - The set of knowledge to be trained, adapted to the organizational level of the individual (the company manager does not have to know exactly the same as an HSE specialist, foreman or worker.
 - The necessary time for the training activity;

A tutorial system involves two different aspects:

- one aspect referring to the educational design in the field of work security and health, focusing on SME specifics, in order to provide the source of knowledge needed to achieve the objectives;
- another aspect concerning the technical design of the tutorial system.

SOLUTIONS FOR THE DEVELOPMENT OF THE TUTORIAL SYSTEM

In order to develop the tutorial system, the authors had the possibility to choose between two approaches: an approach, which uses authorware tools and an object-oriented approach. Each of these approaches has the following characteristics:

- the approach using authorware tools freezes the educational content, but shortens the effort required and the development time;
- the solution using the object-oriented technologies requires bigger effort and longer development time, but has the advantage of allowing system interactive settings and subsequent actualizations of the educational content.

After analyzing system's requirements, the authors have followed an object-oriented approach, for which they have chosen the leading standard language in object-oriented modeling, UML (Unified Modeling Language).

This solution has the advantage of using computer aided design tools in order to optimize code generation, and also give the possibility of reusing pre-designed components from different specific libraries.

Using the UML concepts and diagrams, we captured the basic system requirements and divide the system into components.

The training system functions both on-line and stand-alone and presumes the development of a web-based applications where the user will enter using a username and a password. Depending on his role, a user can be a student, a course manager or an administrator and will have different rights within the system.

First, two major components of the system have been identified: Training and Testing and, for each of them, system requirements have been described in natural language. Some of most important system requirements are depicted below, according to the system components and to the two main user roles: Student and Course Manager.

TRAINING COMPONENT/ STUDENT ROLE

- An enterprise that uses the tutorial system will be able to create a finite number of user accounts. When a new class starts, each student must provide identification details, such as name or institution, and then the administrator assigns

him a username and a password. Subsequently, he can use this login information to enter the application anytime.

- After logging, a student have the following possibilities: can select, from a list of SME categories, the type of SME he is working in; for each type of SME that was chosen, a student can study the main risk factors that correspond with a certain SME type; can manage the training time by himself, but must finish a course in a certain period of time.

TRAINING COMPONENT/ COURSE MANAGER ROLE

- The course manager in the user that has the right to create and update the theoretical content of the training system.
- The course manager must bring up-to-date the legal information regarding SME, the main risk factors and the methods for risk prevention in several possible situations.

TESTING COMPONENT/ STUDENT ROLE

- After studying the legislation regarding risk factors, a student can choose to test his knowledge in this field.
- For each risk factor specific to a SME, a set of tests is defined: partial tests, final tests and case studies.
- Once a test was selected, the student can see the test details and can choose to take the test. After solving it, a test is automatically evaluated and the result is instantly displayed on the screen. A student can take each test three times and the last result is the one that counts.

TESTING COMPONENT/ COURSE MANAGER ROLE

- The course manager must populate the testing component with tests for each risk factor.
- For the partial and final tests, he must add questions, possible answers for each question and specify the correct answer and its score.
- For case studies, the course manager must specify a description of the case study, possible causes that generated that situation, possible measures to take and correlate causes, measures and effects.

CONCLUSIONS

The tutorial system that we have presented must prove its utility in work security and health field for Small and Middle Enterprises; therefore the following topics had to be solved:

- To determine the knowledge categories required for training and testing.
- To design basic educational concepts which form the basis of the tutorial system.
- To allow system access to final users, through a user interface, according to their roles.

Designing the educational content is a significant factor in the overall design activity. The educational content design focuses on three issues:

- Defining specifications, which identify and describe the objectives of the system, the target of the system, and methods, techniques and tools required to achieve the desired results.

- Designing consistent educational concepts as basis for the tutorial system, focusing on: identifying the necessary and sufficient knowledge for the target users; assuring the support for understanding and applying the presented content by the user; assuring an appropriate economic efficiency of the small and medium-sized enterprises.

From the user interface perspective, this must meet the following criteria:

- The interface model must be defined for non-IT people.
- The graphic interface must satisfy the functional requirements.
- The interface assures graphical simplicity and optimization of the developed structured.
- The costs/ resources ratio must be well balanced.

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ABOUT THE AUTHORS

Prof. Rodica Livia Mihalca , PhD, Department of Economic Informatics, Academy of Economic Studies, Phone +4021 319 19 00/313, E-mail: rmihalca@ase.ro

Senior Lecturer Adina Ileana Uta, PhD, Department of Economic Informatics, Academy of Economic Studies, Phone +4021 319 19 00/313, E-mail: adinauta@ie.ase.ro

Assistant Professor Anca Andronescu, PhD Student, Department of Economic Informatics, Academy of Economic Studies, Phone +4021 319 19 00/313, E-mail: andronescua@ase.ro

Lecturer Iulian Intorsureanu, PhD, Department of Economic Informatics, Academy of Economic Studies, Phone +4021 319 19 00/313, E-mail: iintorsu@ase.ro