



Mainstreaming occupational safety and health into university education



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FOREWORD

Mainstreaming occupational safety and health (OSH) into the education of children and young people has an important part to play in developing and improving safety cultures in the workplace. This is recognised in European Community strategy on occupational health and safety and in the OSH strategies of the Member States.

In particular, there has been increasing recognition that risk education should form part of the training for those entering manual vocational trades and there has been a great deal of activity to embed it into vocational courses and develop suitable, participative learning methods and resources.

However, professionals entering the workforce also need risk education in order to develop the necessary OSH skills, knowledge and attitudes. This need is more evident for architects and civil engineers who will have legal duties regarding the design, planning and execution of construction projects. But if OSH is truly to become an integral part of business management in all sizes of organisations, then all future managers and professionals need relevant risk education, not just those who will work in high risk sectors. Health professionals also need to enter their careers having a clear understanding of occupational health.

As there has been less activity regarding risk education to date at university-level; and because it presents some special challenges, related to the autonomy of universities and the types of teaching methods traditionally used, the sharing of experiences and resources at the university-level is particularly important. It is important to be aware of the challenges and to identify what seem to be the more successful approaches that can be taken. I hope that this report, which presents a variety of cases from the Member States and beyond, will contribute to this process and provide practical support to all those working on this issue, whether in the field of OSH or the field of education.

Jukka Takala

Director

European Agency for Safety and Health at Work

January 2010



SUMMARY

Introduction

Future engineers, architects, medical professionals and business administrators and managers will all need to take account of OSH in aspects in their working lives. This report presents a variety of cases concerning how OSH has been included in university-level education. Of most interest were examples where OSH was embedded in the programme of other undergraduate studies, such as a general engineering undergraduate course or a business studies course. However, few examples were found where OSH/risk education had been truly embedded within the curriculum of individual courses.

Types of cases

A variety of different types of cases were found, including:

- modules within courses for civil engineers etc. to meet training requirements set in legislation for construction work (to work as site coordinators etc.);
- training for carrying out practical work in chemistry laboratories etc.;
- specific postgraduate OSH courses;
- development of real OSH business cases for use on MBA (Master of Business Administration) courses;
- the introduction of active learning methods into the courses of engineering and architecture students;
- voluntary course modules delivered by staff in ergonomics departments etc. to students in other departments and faculties;
- supplementary e-learning packages, including cases involving partnerships of various universities and external organisations; and
- a safety department involving students in its OSH management system (university compliance with OSH regulations).

The cases were analysed with the aim of identifying trends, innovative factors, challenges and success factors. The report and the cases in it demonstrate that there are more challenges to integrating OSH into university-level education compared to other levels of education. However, the cases also show that steps are being taken to mainstream OSH into university education in a variety of disciplines and in a variety of ways. Furthermore, the cases demonstrate that, depending on the circumstances, there are various approaches that can be used and opportunities that can be exploited.

Challenges

A number of challenges were found in relation to mainstreaming OSH into university-level education. It is important to be aware of these challenges.

Challenges include:

- the need for partnerships with individual universities, faculties and professors;
- convincing professors of the importance of OSH education;
- high existing demands and pressures on undergraduate time;
- lack of suitable OSH educational materials for the university level;



- introducing practical, active learning methods for OSH in a learning environment dominated by theoretical learning methods;
- how to address large class sizes;
- lack of university-level teaching staff with OSH expertise and/or active and participatory education skills;
- sharing of educational resources where there is a strong tradition of guarding information in a culture of intellectual ownership;
- the length of time it can take for changes to be made to a syllabus;
- lack of funds for developing and providing OSH education at university level compared to school level, including funding for pilot projects;
- developing new links at Ministry level where different Ministries cover schools and universities; and
- the continued need to improve health and safety culture within universities.

Contextual factors that facilitate integration

Certain contextual features were found that appear to facilitate the mainstreaming of OSH into university-level education.

Mainstreaming activity is more likely:

- in areas where national OSH legislation places specific responsibilities on certain professionals such as those involved in civil engineering projects;
- where training requirements for safety technicians are specified in law and include university-level study;
- where there is an academic department on site that is engaged in OSH. This appears to be more likely in technical universities;
- where the OSH authority or work insurance body has a training role that could include providing assistance to universities; and
- in those areas where the university has specific OSH duties, for example, for student safety during laboratory sessions and practical work.

Success factors

The cases suggest certain ways and means to approach mainstreaming OSH into university-level education. For example:

- Start by finding and **engaging some receptive individuals** and institutions to work with.
- **Work in cooperation**, do not be prescriptive.
- **Be sensitive to competing curriculum demands** and the pressures on undergraduate time that already exist.
- Limit OSH teaching to certain **key aspects**.
- **Embed OSH issues within courses** rather than as an add-on, especially if there is very limited opportunity for additional modules.
- Provide **suitable OSH educational materials** which are relevant to the study area into which they are being embedded and the way that topic is taught.
- Use **real cases** and look for ways of introducing problem-solving methods, **active learning** etc.
- Provide **assistance to academics** in how to make effective use of the materials.



- Use the **need to provide safety instruction** for practical work as a way of introducing a broader prevention-culture message to those students.
- Use **e-learning and electronic resources** to support and complement classroom teaching, but also make them more widely available for distance learning.
- For student motivation, have the study of **OSH contribute to final grades** or attainment of a recognised diploma etc.
- **Get the timing right** - the university or the discipline concerned has to be ready to accept changes, and the mood has to be right. For example, open discussions when changes are being made to the curriculum or to strategies regarding future university graduates.
- **Engage with professional associations** about university-level curricula.
- **Explore partnerships** - cooperation between universities, research institutes, safety authorities, insurance companies, and industry.
- **Promote and facilitate a whole-university approach to OSH** which combines OSH/risk education with creating a safe and healthy working/educational environment for all staff and students, and actively involves staff and students in the process.

Eight more ideas for mainstreaming OSH/risk education at the university level were identified:

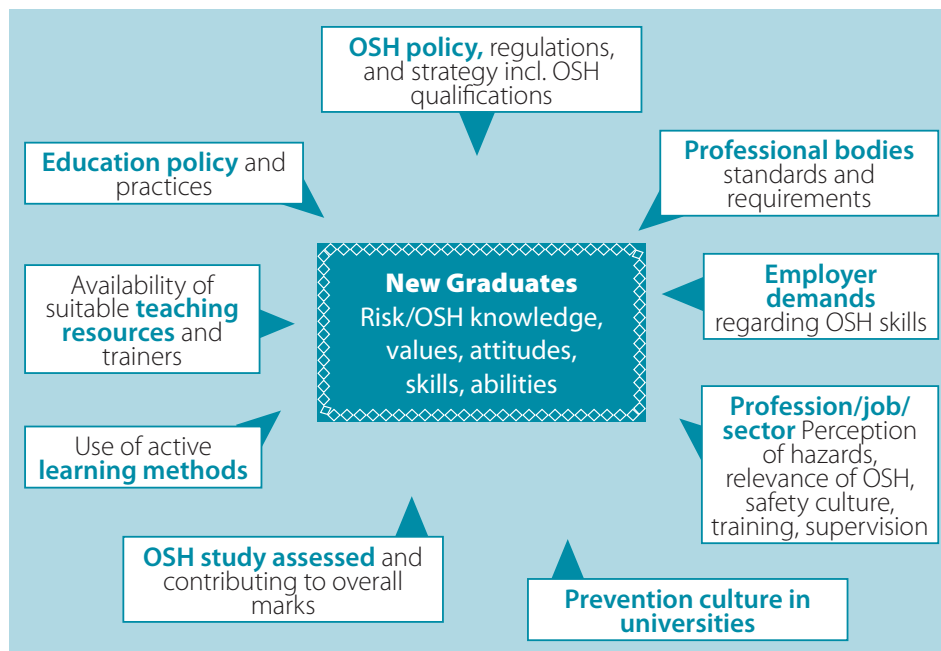
- setting up a **repository for sharing university-level learning resources**;
- **where some OSH education is already occurring**, for example, because of the contextual factors above, using this as a stepping-stone to mainstream OSH more generally into other faculties;
- where **local companies** are cooperating with universities, encouraging them to integrate OSH into their activities for students (provision of lectures, student visits or placements);
- **learning from the experiences of mainstreaming OSH into school education** and good practice in training young workers and adapting them to the university level;
- taking advantage of the increasing use of 'modular learning' and developing a specific **OSH module**;
- **adapting vocational training methods** and resources for use at university level;
- encouraging **employers to identify OSH knowledge as a factor in recruitment**;
- and
- working directly with **business schools to include OSH and economic productivity** in their research and conference programmes as well as their teaching programmes.

Model of factors influencing risk knowledge and skills in new graduates

Some of the various interacting factors that have an influence on graduating students' knowledge, abilities and attitudes concerning OSH are presented in the figure.



Figure: Model of factors influencing risk knowledge and skills in new graduates



Examples of practices

When the University of Salamanca became one of the Spanish universities to offer the OSH technician Master's degree, they took the opportunity to provide some basic resources for all graduating students on a CD ROM and on the Internet, engaging the support of their regional government.

To provide real cases for MBS business studies, students the US National Safety Council used the Robert Campbell Award for excellence in business cases that demonstrate health and safety and economic productivity. They adapt winning examples to fit the case-studies model used by top business schools and work closely with individual professors to encourage them to incorporate the resources into their courses.

In the UK, the Health and Safety Laboratory (HSL) worked with the University of Liverpool, with funding from the national Health and Safety Executive, to develop and embed OSH elements into an undergraduate engineering course. This included incorporating active learning methods and using real accident case studies.

In Germany there are examples of inter-university faculties working in partnership to pool knowledge and resources to develop and share e-learning resources (NOP-online and KMR-dangerous substances in lab courses).

At the Dublin Institute of Technology (DIT), Ireland, the safety services involve the student's union in a participative approach to ensuring the university meets its OSH obligations and to promote an OSH culture.

The Lacobus contest, France, is an example where architecture students must incorporate OSH into designs for architectural restoration projects. Other projects in France have engineering and architecture students working together on projects.



Overall conclusions

There are more challenges to integrating OSH into university-level education compared to other levels of education. However a number of different activities are taking place and there are various approaches that can be used and opportunities that can be exploited.

Ultimately the way forward should be to develop a 'whole-university' approach to creating a safe and healthy work and learning environment combined with risk education. While some laboratory work and research activities can be potentially hazardous, universities as a whole are not very hazardous work areas, however many days of work can still be lost through accidents and ill-health. The approach should combine OSH management to prevent risks with raising awareness and developing knowledge, skills and safe attitudes and behaviour in students and staff, including professors, technical, administrative and support staff.

Support is needed to transfer existing examples of good practice and interventions at the university level and an exchange of both ideas and concrete tools is needed.



1.

INTRODUCTION



To improve the occupational safety and health (OSH) of young people it is generally recognized that a two-way approach is needed – one aimed at making sure that the right measures are in place at workplaces for the safety and health of new starters, and one aimed at integrating or mainstreaming OSH into education. This report focuses on the second area and specifically on the inclusion of OSH and risk education as part of university studies.

EU Strategy on OSH in education

The European Union Community strategy on health and safety at work for 2002–2006 underlined the need to strengthen the prevention culture by means of education and training (European Commission, 2002: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2002:0118:FIN:EN:PDF>). OSH should be part of an integrated strategy to encompass all the necessary aspects of education, training, research, and innovation for tomorrow's European Union. The Community OSH strategy for 2007–2012 (European Commission, 2007: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52007DC0062:EN:NOT>) again considers the prevention culture to be an important area of action and builds upon the aims of the previous strategy in this area. According to the 2007-2012 strategy, risk education should be included in all levels of education. The strategy also recognises the vulnerability of young workers and therefore the need to pay attention to their health and safety needs.

Elements of the European Community health and safety strategy 2007-12 related to occupational health and safety and education include:

- fostering and promoting a common preventative safety and health culture;
- addressing all parts of society and going beyond the workplace and working population;
- integrating health and safety into education and training programmes at all levels and in all fields, including vocational and university education;
- calling on Member States to use EU funding programmes to develop training projects;
- meeting the needs of young workers;
- paying special attention to the training of young entrepreneurs in OSH management.

To support the Community strategy in the area of mainstreaming OSH into education, particularly through the sharing of information and the exchange of experience on the topic and its developments, the agency has, since 2002, carried out various activities, including publishing reports and organising seminars. The reports provide examples of programmes and practices at national, intermediary and educational establishment level. This report on mainstreaming OSH into tertiary-level (university) education follows on from a previous report that examined how OSH was being mainstreamed into education curricula at all levels in the EU Member States (*Mainstreaming OSH into the education curriculum* (European Agency for Safety and Health at Work, 2009)).

What is mainstreaming occupational safety and health into education?

Safety and health should be an inherent part of lifelong learning from pre-school until post retirement.

'Mainstreaming' or integrating safety and health into education and training means:

- to educate children and young people about dangers and risk prevention and to teach them safety and health attitudes and behaviour; and



- to improve the safety and health culture in schools and other educational establishments.

Mainstreaming OSH into education concerns integrating one policy area — occupational safety and health — into another — education. This means that different systems — with different institutions and different thinking — have to communicate with each other and to take joint action.

Mainstreaming in relation to OSH at the workplace is about making risk management principles and ‘thinking OSH’ an intrinsic part of the way that actions are taken at the workplaces, so that occupational safety and health is not just an additional task. It is easier to achieve this if employees and managers come to the workplace well qualified and with a basic understanding of OSH and having developed a culture of risk prevention already during childhood, youth and early adulthood. Thus pre-work education at all levels, from nursery to university can play a key role in ‘boosting’ the prevention culture.

Main conclusions from the report *Mainstreaming occupational safety and health into education* (European Agency for Safety and Health at Work, 2004)

- Safety and health have to be an inherent part of lifelong learning from preschool education until post-retirement.
- Mainstreaming or integrating safety and health into education and training covers:
 - developing safety and health knowledge, attitudes and behaviour in children and younger people; and
 - improving the safety and health culture in schools or other educational establishments for staff and students.
- The Community strategy on health and safety at work for 2002–06 called for strengthening the prevention culture and improving the quality of work by means of education and training. Operational goals (quantitative and qualitative) for meeting this objective should be set concerning how to prepare children and young people for future working life and how to improve the workplace for teachers and trainers.

OSH in the curriculum of university courses

It is important to integrate OSH into university-level education as promoting a safety culture in the workplace is not just about ensuring that shop floor workers learn how to act safely. Modern OSH legislation is goal-setting and follows a non-prescriptive risk-based approach – risks must be assessed and appropriate measures put in place. All parts and all levels of industry and business need to understand how risk assessment and risk management are essential to good business management.

Future designers, architects, engineers, finance officers, doctors and other health professionals and managers and supervisors at all levels, right up to the director level, are among those who need relevant education about their future OSH roles and responsibilities. Future teachers and trainers also need OSH education in order to deliver OSH education themselves effectively.



For example, in a report by an investigation board following a major train derailment in the UK, caused by failures in rail maintenance, a variety of recommendations were made. These include the recommendation that the 'Education of engineers should deliver professionals who understand their professional responsibilities for [the] safety...and who can apply the principles of risk management.'¹

This report looks mainly at how OSH education is included in the curricula of university degree courses. A curriculum approach to mainstreaming OSH into education is where the integration of safety and health into the curriculum is not limited to one specific, stand-alone subject. Safety and health is integrated as a 'transversal' topic, in other words throughout all levels of education and in different subjects. It is important to embed safety into formal education curricula in order to achieve consistency and a systematic approach to risk education, as well as sustainability and durability.

The Member States set learning objectives or outcomes in their education curricula. These objectives or outcomes for students are expressed in terms of attitudes and dispositions, knowledge and understanding, and skills or competences. According to the National Council for Curriculum and Assessment in Ireland, the outcome regarding safety and health in the curriculum would be to develop dispositions around and attitudes towards health and safety matters, such as accident prevention, risk assessment and awareness of hazards. To act on these dispositions and attitudes certain skills and competences on health and safety are needed. And to exercise the dispositions and attitudes and apply the skills and competences, learners require certain information, knowledge, and understanding (for further information see *Mainstreaming OSH into the education curriculum* (European Agency for Safety and Health at Work, 2009)).

Getting OSH embedded in the curricula is only part of the process. For universities as for schools there are three main aims regarding mainstreaming of OSH which should be linked together in a 'whole-university' approach:

- Safety and health integrated as a transversal topic into degree programmes throughout all levels of university education, with it embedded as a compulsory part of curricula. This means that, for example, all engineering students receive some risk education, and that it is not just an optional module or only part of a specialist OSH and engineering degree. Likewise, all business studies students receive some risk education that is relevant to their course and an intrinsic part of it.
- A safe and healthy university environment for both students and staff.
- Learning about OSH as an integral part of any work practice or student placements within companies etc., with organisations offering such placements having in place the necessary preventive measures for the safety of the students that they receive.

Previous findings relating to mainstreaming OSH into tertiary-level education

Some previous research relating to OSH in tertiary-level education

- A Finnish study of teaching occupational safety in schools showed that there are large differences between different school levels. For example, Finnish teachers lectured occupational safety issues for an average of 14.5 hour per term varying from two hours in secondary schools to 23 hours in vocational schools. Lecturing

¹ Hatfield **train derailment** investigation - **interim recommendations, Health and safety Commission, 2002**, <http://www.rail-reg.gov.uk/upload/pdf/incident-hatfield-investigationb1.pdf>



and discussions with students were the teaching methods most often used, and the most common teaching materials were photocopies and textbooks. However, one out of three teachers had no formal education in occupational safety issues. The conclusion of the study was that the implementation of the penetration principle, according to which safety issues are taught in connection with work skills, depends on the initiative of the teacher (Salminen and Palukka, 2007).

- In a more detailed comparison, some differences between polytechnic institutes or universities of applied science and other / generic universities were found. Teachers in polytechnics gave an average of 20 hours tuition in occupational safety issues whereas, in other / generic universities, they taught these topics for 16 hours per term. Lectures and discussions with students were the most frequently used teaching methods in both institutes. Teachers in polytechnics used text books most often, whereas professors and lecturers in universities mostly used photocopies. Over half of the teachers in polytechnic institutes had taken extra courses in occupational safety, whereas teachers in universities mostly did not have any formal safety training. It can be concluded from this study that teachers in Finnish polytechnic institutes were more active in safety issues than teachers in other / generic universities (Salminen, 2007; Salminen and Palukka, 2007).
- In a study at Potsdam University in Germany students were divided to two groups: the first group received lectures on occupational safety as a part of their course, whereas the second group worked without safety lectures. Students who received OSH lectures or who had prior work experience demonstrated better safety knowledge, but the differences were minor and not as high as was expected, with the safety lectures only slightly increasing the safety awareness of students. Overall, the knowledge of students concerning health and safety at work proved insufficient and the researchers recommended a more effective integration of OSH topics in students' education and to offer this as a comprehensive approach for several different fields of this study. Consequently, the education of future teachers was expanded to include a cycle of lectures on OSH. (Ceglarek, 2007a, 2007b).
- Several relevant studies have been carried out for the Health and Safety Executive (HSE) in the UK. A report that they published in 1999 on the extent of risk education in undergraduate degree courses in engineering in the UK suggested that the uptake of risk education was in its infancy and had not yet been formally implemented in any comprehensive manner across degree courses. In addition, it was found that universities generally had many different interpretations of the accrediting bodies' guidelines for the content and extent of risk education (Lee JF, *Education of undergraduate engineers in risk concepts – scoping study*, HSE Books C2.5 10/99).
- Another study published by the HSE established a very limited coverage of occupational safety and health, in full-time Masters of Business Administration (MBA) courses, in a sample of UK business schools. The study found that the explicit occupational health and safety content of the eight MBAs was either non-existent or very limited. Many schools commented that there was a lack of well-documented and suitably-presented case studies appropriate for MBA teaching. The report suggested that the only executable way to encourage consideration of OSH in MBA programmes would be the development of high-quality case study materials that meet the needs of business schools. (HSE, 2007. *Coverage of occupational health and safety on full-time MBA courses in GB business schools*).



Findings of previous Agency work on OSH education at the university level

The Agency's report on *Mainstreaming OSH in the school curriculum* (2009) concluded that occupational health and safety is least likely to be systematically included as an element in courses at university level and that it is the most challenging educational level regarding the mainstreaming of OSH. One reason for this is that universities have a high level of autonomy and therefore there are no common curricula. There is also a lack of teaching resources on occupational safety and health that are suitable and relevant for different university level courses and a lack of professors and lecturers with the knowledge to teach these subjects / topics. In addition, individual professors have to be convinced of the importance and relevance of including OSH as part of their already packed course curriculum.

The full findings of the report *Mainstreaming OSH in the school curriculum* regarding tertiary education are the following:

- In higher education, efforts to integrate OSH should be continued to ensure that designers, architects, engineers, business and finance managers, medical professionals and others who need to know about OSH in their future careers receive adequate education in OSH issues and risk management. There is increasing awareness of this educational need.
- The mainstreaming of OSH into the curricula of university-level courses is the least well developed area and represents the greatest challenge regarding getting OSH into education curriculum.
- Some examples of good practices do exist, for example, in the area of engineering, and there are also some good examples of teaching materials.
- Systematic inclusion of OSH across relevant university courses is more common in those Member States whose university system includes technical universities, including in some of the newer, former communist Member States.
- The greatest challenge of all is to have OSH included in business studies.
- Universities and higher educational institutes are not under the same direct national government control as schools and enjoy a high level of autonomy. They have extensive freedom in what they teach and how they teach it. Therefore there are no common curricula, the extent and content of OSH education varies greatly in the higher education sector, and it might not always be proportional to the level of risk that undergraduates could find themselves managing in their future professional working life. Actions to include OSH in relevant courses such as engineering or business studies are therefore generally ad hoc, and often dependant on the interest of individual professors or particular advocates within professional bodies.
- To promote OSH education at the university level it is necessary to involve professional associations and make approaches directly to relevant further education institutions and universities.
- Individual professors need to be convinced of the need to include OSH in courses but it can be very difficult to persuade them.
- Professors need to be provided with suitable teaching materials that relate directly to their discipline; however, there is also a lack of teaching resources on OSH for university-level courses, although some examples may be found.
- Case study teaching materials directly related to the discipline, whether for engineering courses or business courses, may be of most use to engage both lecturers and students.



A seminar on mainstreaming OSH into education held by the Agency in 2002 produced similar conclusions regarding the tertiary education level:

Conclusions on mainstreaming OSH into university courses from the 2002 Agency seminar

- It is very difficult to persuade higher education authorities to include OSH in degree and professional courses; possible reasons for this are that 'risk' is not seen as an academic concept and that there is a lack of competence to teach it.
- Successful integration may rely on persuading sympathetic professionals and academics to assist.
- Professionals are responsible for the safety of other people as well as themselves; therefore they are a key target group.

Learning about Occupational Safety and Health, Bilbao 4-5 March 2002, jointly organised by the Spanish Presidency and the Agency in cooperation with the European Commission;

Full online seminar proceedings:

<http://osha.europa.eu/en/topics/osheducation/index.stm/proceedings.stm>

Report of the seminar (working paper):

<http://osha.europa.eu/publications/reports/310>

Forum publication (summary): <http://osha.europa.eu/publications/forum/8>

The report

Background

As mentioned above, the Agency report *Mainstreaming OSH in the school curriculum* (2009) found that the mainstreaming of OSH into tertiary level education is the least developed area for various reasons. However, examples of good practices were also found. It was therefore decided that it would be valuable to further investigate this especially challenging area.

Aim

The objective of this case study report is to examine concrete examples of where occupational safety and health has been mainstreamed into university-level course curricula, and to provide an analysis of what is taking place. The aim has been to cover a broad selection of good practice courses and types in European Union Member States.

The report addresses the following questions:

- How is OSH being integrated into education at university level?
- To what extent is OSH integrated at university level?
- What educational methods are used?
- In which disciplines is OSH included in university education?
- What obstacles are encountered?
- What are the successful factors?

The report is intended to contribute to the Agency's ongoing work on mainstreaming OSH into education.



Scope

The focus is on tertiary-level 'academic education', covering both universities and applied universities, not apprenticeship vocational training. The prime area of interest was to see where and how OSH had been included in the curriculum of other disciplines, not the inclusion of OSH stand-alone courses in a university's programme. The report includes examples of integrating OSH into courses including: business studies, design, engineering, architecture, and medical/health care education. Despite the intention to exclude stand-alone OSH qualifications, such as bachelors' degrees in OSH, masters' degrees in OSH, and postgraduate OSH diplomas, the report finally does include some coverage of these. The examples, which mainly come from the European Union Member States, but also include an example from the USA, were collected during 2007-8.

Target group

The target audience for this material are both OSH and education policy makers. It is also hoped that it will be useful to those preparing and delivering OSH education at university level, and to OSH professionals who work with university staff to develop OSH in courses.

Structure

The report consists of two main parts:

1. Description of good practices on how to mainstream safety and health into university education in Europe and beyond.
2. Discussion and conclusions about the case studies, taking into account previous EU-OSHA work.

The first part contains 24 case studies and the main findings of 12 additional examples, presented in brief as 'snapshots'.

The criteria for selecting the case studies were:

- innovative examples;
- cases that demonstrate an effective (and preferably evaluated) integration of safety and health into tertiary education;
- cases that are maintained in the medium or long term (sustainable);
- cases that are transferable between Member States, or educational levels and institutions;
- cases that cover a broad range of educational institutions;
- cases from several Member States;
- cases from outside of the EU if there was a lack of examples from within the EU; and
- cases that cover a range of disciplines.



The second part of the report provides an analysis of the examples in terms of any common features and trends seen and what appear to be the success factors for mainstreaming OSH into tertiary education. Recommendations are made for further initiatives to support mainstreaming safety and health into tertiary education at European level and what the strategy could be.

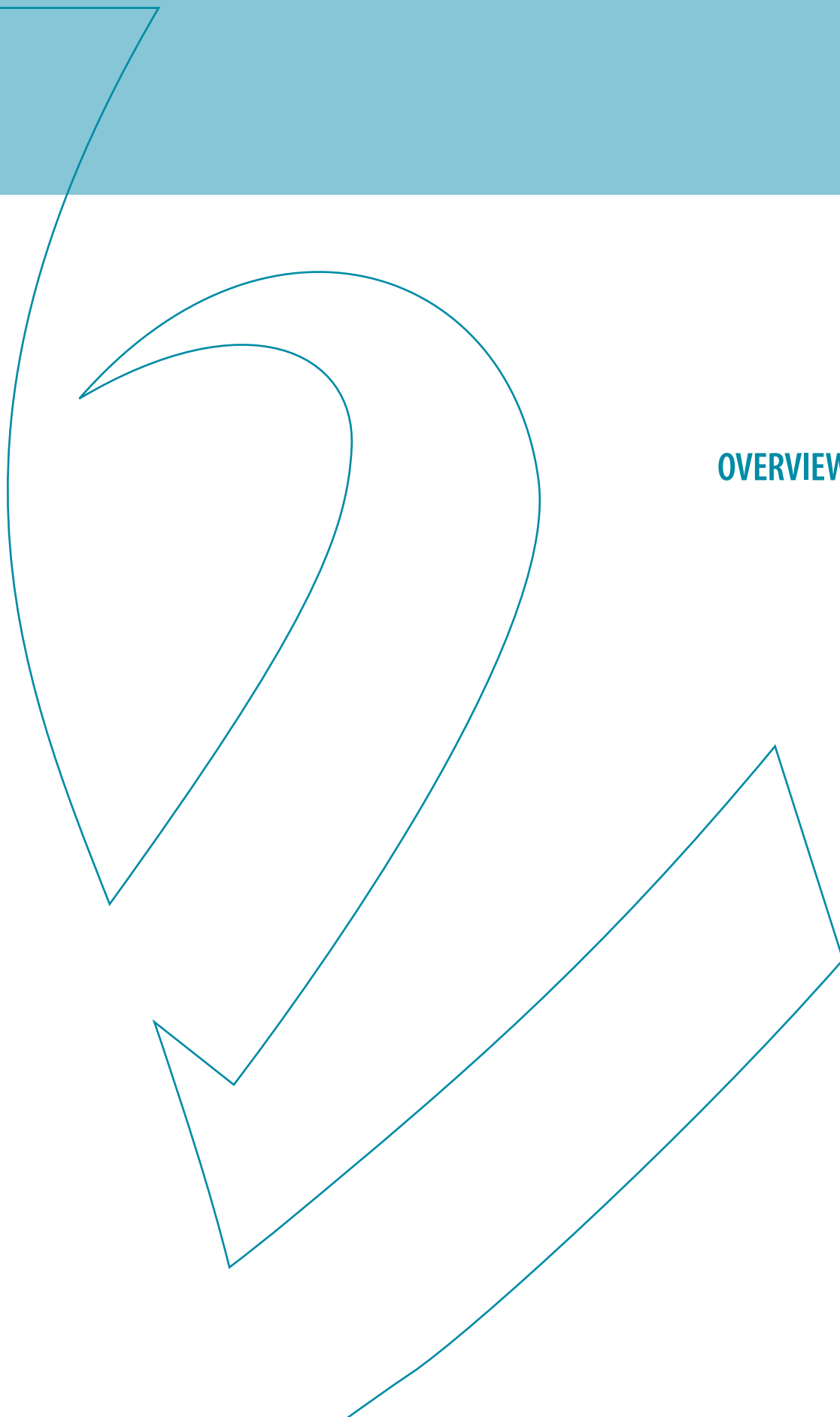
Validation

A draft of the report was discussed by the EU-OSHA mainstreaming OSH into education expert group, whose members are nominated by the EU-OSHA network of focal points in the Member States. A member nominated by the European Network Education and Training in OSH (ENETOSH) also attends this group. A summary of their discussion is given in annex 2.



2.

OVERVIEW OF THE CASES



Good practice databases integrated in chemistry studies: NOP-online and KMR-dangerous substances in lab courses, Germany

Two consortia from German universities developed websites covering good practice instructions. Both websites provide ready-to-use information that can be applied directly by teaching staff at universities. NOP-online provides good practice instructions on safety and environmental issues in organic chemistry laboratory courses. KMR provides health and safety instruction for working with carcinogenic, mutagenic and reproduction toxic substances.

Integral II, Germany

The Institute of Industrial Engineering and Ergonomics (IAW) of the RWTH Aachen coordinated the development of an on-line learning platform concerning industrial engineering and ergonomics, which includes various OSH-related modules. These are suitable for e-learning, blended learning and teaching at universities. Currently the modules are being used in undergraduate lectures for students of mechanical engineering, industrial engineering, psychology, business administration and industrial education.

Introduction to the principles of laboratory safety – prevention and emergency response – handling biological and radioactive substances, Austria

At the beginning of their studies, students at the University of Vienna have the possibility of deepening their knowledge regarding the principles of laboratory safety, prevention and emergency response and handling biological and radioactive substances. The primary objective of the seminars is to raise the students' awareness of the fact that safety and health protection (occupational safety) is an integral part of any research project and that these issues may take on even greater significance when students finish their studies, for instance in their possible future occupation as company safety inspectors. Moreover, the students are expected to become familiarised with basic aspects of safe work practices and to be provided with a legal background.

Risk prevention and health protection in adult education, the Czech Republic

The EDFORSA project aims at improving knowledge and skills through completion of a distance-learning course on occupational health and safety and risk prevention issues for the following target groups: specialists in this field, managers and employers (especially from SMEs), employees and the general public. The partnership formed from various institutions (research institutes, universities, providers of non-formal education, enterprises) from different countries strengthens the transnational character of experience sharing and information transfer from EU Member States to other European countries.

Management of risk in mining and natural environment in academic education and research, Bulgaria

The University of Mining and Geology, St. Ivan Rilski, in Bulgaria, carries out didactic and research activities closely connected to safety issues. The university prepares students to design, organise and carry out work tasks in the area of mining and geology. The scope of interest in the area of OSH covers engineering safety, mining safety and rescue, fire safety, health and safety risk assessment, environmental safety.



The university has a long-term tradition in carrying out these activities, aimed at diagnosis, modelling, and design, as well as in developing methods and approaches to risk in mining and the natural environment.

Risk education in engineering - Development of year one materials, United Kingdom

The Department of Engineering at the University of Liverpool began to reform its undergraduate programmes with the introduction of active learning experiences that will provide Liverpool graduates, branded the 'Liverpool Engineers', with skills and expertise relevant to the needs of modern industry. A key element of this approach is health and safety, and risk awareness.

The University of Liverpool, in association with the Health and Safety Laboratory (HSL), set up a project to incorporate risk education into the curriculum of the undergraduate engineering degree course. Integrating risk education into the curriculum involved defining risk education as a set of learning outcomes, and designing a tool to ascertain students' awareness of risk issues and key concepts. Teaching materials have been developed that use real accident case studies, involving student interaction and team-building exercises to enhance students' understanding of the concepts of hazard and risk.

Transferring the results of business cases awards initiative to business and engineering schools, USA

The Robert W. Campbell Award acknowledges business cases that demonstrate health and safety and economic productivity. Winning cases are converted into resources for engineering and business schools. They are also used to promote partnerships with business schools and cooperation with professors. The aim is that future generations of business leaders will gain a deeper understanding and appreciation of the intrinsic value of safety, health and environmental management to overall business success through the use of real examples presented from a business perspective.

Multimedia educational package on OSH issues, Poland

The Central Institute for Labour Protection - National Research Institute, in Poland, has developed a multimedia educational package for tertiary education: 'Work knowledge – safety, health, and ergonomics'. This resource uses interdisciplinary, monographic, didactical materials. Two versions are available – one prepared for the teacher and the other (slightly simplified) for those who will study on their own. The package is available in several formats: CDs (accompanied by special software and a manual), on the Internet and as printed textbooks (each of the 8 textbooks is accompanied by a CD). The programme is comprised of 60 hours of teaching and is tailored to three education profiles: technology and physical sciences, natural and medical sciences, social sciences. The whole package is organised in eight independent thematic modules: ergonomics – basics; legal protection of work; anthropometrical and biomechanical factors; physiological factors; psychological and social factors; risks related to dangerous and hazardous substances in the workplace; diagnostics and design of anthropotechnical systems; and managing OSH.

Learning by Doing, Portugal

The Faculty of Science and Technology at the New University of Lisbon offers transversal occupational safety and health courses for graduate and post-graduate engineering students. The OSH skills are developed, not only through theoretical



classes, but also by performing practical risk analysis activities based on real-world work situations, from different fields of activity according to each student's vocational area. Students are also encouraged to use the kinds of measuring equipment employed in an OSH assessment of the work environment. They also practise different manual and computer-based calculation methods, for instance for the estimation of work accident statistics, for the risk assessment of manual materials handling, or for the calculation of the number/type of light sources to adequately illuminate a workplace.

Overview of the inclusion of OSH courses in Portuguese universities, Portugal

The changes in Portuguese legislation, as a result of European directives, regarding the OSH training of 'competent persons' created a demand for OSH teaching in Portuguese Universities in order to provide accredited OSH technicians and to improve the OSH knowledge of engineering graduates in general. There are at least four specific OSH programmes for undergraduate students. In some universities, engineering students have both OSH and ergonomics included in their curricula.

'Programa Universitas' for occupational risk prevention, Spain

The University of Salamanca offers an online training programme for postgraduate students, named 'Programa Universitas', which is aimed at the management of occupational risks. The programme is sponsored by the *Dirección General de Trabajo y Prevención de Riesgos Laborales* of the *Junta de Castilla y León*, with the collaboration of the *Fundación Mapfre* (Mapfre is an insurance organisation) and the *Fundación General de la Universidad de Salamanca*. The course is designed to promote a culture of occupational risk awareness and prevention among newly graduated professionals entering the work market. This programme is based on an internet portal where registered users have access to OSH-related materials and tools. In a complementary programme, the opportunity was taken to produce a CD-ROM providing an introduction to OSH which is given to all graduating students.

Chemical engineering students teach each other OSH, France

The *École Nationale Supérieure de Chimie de Rennes* (ENSCR), a higher education institute of chemistry, revised its teaching methods, in particular those related to instruction in safety and risk prevention. The methodology includes the students giving lectures about basic occupational risk management. With the help of the regional health insurance fund (CRAM), more than 50 topics have been chosen (such as preliminary risk analysis, glycol ethers, workplace design, etc.), which are distributed among various groups of students who then prepare a report on their subject. This report is then validated by a teacher in cooperation with the CRAM and presented by the students to the remainder of the class. This has proved to be an effective way for the school's future engineers to acquire knowledge.

Architectural and engineering students design joint projects, France

Architectural and engineering students worked together for a fortnight on the design and production of models of work areas that took into account comfort, health and occupational risk prevention. The educational experience, that had been initiated five years before in partnership with the French national research and safety institute INRS, was opened up to Swedish, Romanian and Brazilian students. The projects emphasized the importance of cooperation between architects and engineers in designing work areas in which safety is factored in at the beginning of the project.



This partnership project involved *UTC de Compiègne* and architectural school *Ecole Nationale Supérieure d'Architecture de Clermont Ferrand* (ENSACF) working together with INRS and the Auvergne regional health insurance fund (CRAM).

Allowing for occupational health and safety as in the design stage, France

The Lacobus contest provides awards each year to the best architectural restoration training project presented by the students of three schools of architecture in France, Spain and Germany. For the last four years, at the initiative of the French national research and safety institute INRS, the award projects have to take health and safety into consideration during the design stage.

Teaching occupational safety, Estonia

The Department of Work Environment and Safety in Tallinn University in Estonia provides OSH teaching for other departments, as well as dedicated courses, and provides doctoral research opportunities for post-graduate students. The seven lecturers provide 32 hours of teaching per term and guide 16 hours of practical work in the laboratory. There is a basic course for engineering students as well as voluntary courses for all students at the University.

Computer-based learning environment for OSH, Finland

A computer-based learning environment for occupational safety (TYVE) was developed in the Tampere University of Technology in Finland. The programme consists of 12 lectures and in every lecture there is an animated dialogue, a short presentation of the theory behind the dialogue, and a short task related to the topic.

OSH institute provides training in universities and technical professional schools, Greece

This programme of the regional OSH institute provides basic theoretical and practical OSH training in local vocational schools and universities. The programme mainly involves training within vocational schools about OSH, but also includes teaching for university chemistry students (new undergraduates and postgraduates). The programme is funded by the Regional OSH institution, which provides the teaching free of charge and training is given to both professors and students. The programmes are customised according to students' needs, with professors' involvement. Training is provided on the university campus and during normal study times, in order to facilitate attendance. The training includes the use of participatory methods and examples of real work situations using audiovisual means.

Kaunas University of Medicine programme related to OSH, Lithuania

The Faculty of Public Health of the Kaunas University of Medicine (Department of Environmental and Occupational Medicine) carries out courses for the students of the public health faculty. The course for bachelor students in public health covers the fundamentals of OSH. The outcomes set for the course are to develop students' knowledge and skills in the area of legal provisions and requirements in order to prevent and control occupational risks, general requirements for workstations, work equipment and work conditions, protection principles and methods to prevent exposure to hazards. The competences acquired during the course will help the student to assess risks in workplaces and to choose suitable protective measures.



Awareness-raising about safety with students and professors in architecture, Belgium

The construction of a safe building commences with the first step, its design. The role of the architect is therefore crucial and they need to include OSH in their way of thinking, their concepts and the plans for the future use of the building. OSH also needs to be taken into account during the construction phase and architects play an important role here too. In order to prepare the architects for these OSH responsibilities, training was set up to be provided during the final year of the architectural studies. The methodology used is a general, participative and multi-disciplinary approach that favours collective responses to OSH issues.

Integration of OSH at the Faculty of Metallurgy of the Technical University of Kosice, Slovak Republic

The aim of the programme is to include OSH education and OSH management in the educational process at the Faculty of Metallurgy of the Technical University in Kosice. In the second year of level I (BSc level), all students of the faculty learn about integrated managerial systems which are based on the norms ISO 9001:2000 (Quality Management Systems), ISO 14000:2004 and EMAS (Environmental Management systems) and OHSAS 18001:1999. In the third year of level I (BSc study) and the fifth year of engineering study (level II) students of the Integrated Management Department study OSH management. The study programme at the second level places the emphasis on the integration of environmental and OSH management systems into total quality management (TQM). Compulsory subjects evaluated in the final exam are total quality management, and environmental and OSH management.

Integration of OSH at the Faculty of Mechanical Engineering of the Technical University of Kosice, Slovak Republic

In 1993 an OSH study programme was initiated in the Faculty of Mechanical Engineering at the Technical University of Kosice with the support of BUGH Wuppertal (Germany). Collaboration with manufacturing plants, state authorities and other foreign universities through projects, workshops and conferences appeals to students and raises their social awareness and their interest in this field. Since 2001, the Department of Safety and Quality has had accreditation in this area and also has an active and varied research programme. It has improved its qualifications and quality standards, for example, through special certifications, scientific publications and research projects.

Teaching OSH in construction engineering and architecture studies: cooperation with statutory insurance organisations and the Labour Inspectorate, Germany

Civil engineering, architecture, and facility management students attending the University of Applied Sciences (FH) Mainz are taught about safety and health on construction sites. This course enables them to gain an additional qualification as a safety and health coordinator after two years of additional practical experience.

Promoting safety culture at DIT – A step closer to the real world, Ireland

The Dublin Institute of Technology (DIT) provides vocational training, as well as undergraduate degree courses and post-graduate activities. The safety department has introduced a holistic approach aimed at maintaining safety and promoting a



safety culture in the institute, which includes training and a combined approach that targets both staff and students. Part of the approach involves consultation with the students' union and their participation in safety meetings.

Teaching OSH and ergonomics at Budapest University of Technology and Economics (BME), Hungary

OSH and ergonomics are integrated into various degree courses offered across the university, including a compulsory module on the MBA business studies course. The Department of Ergonomics and Psychology in the Faculty of Economic and Social Sciences provides the OSH and ergonomics teaching to the other departments. Theoretical and active learning methods are employed, including project work and use of case studies. SOL is utilised (Safety through Organisation Learning; a safety-related event analysis method developed at the Berlin University of Technology). Students may choose an OSH theme for their diploma theses.



3.

CASE DESCRIPTIONS



3.1. GOOD PRACTICE DATABASES INTEGRATED INTO CHEMISTRY STUDIES: NOP-ONLINE AND KMR-DANGEROUS SUBSTANCES IN LAB COURSES, GERMANY

Universities involved:

- NOP-online (Sustainability in the organic chemistry lab course, funded by the *Deutsche Bundesstiftung Umwelt* / German Environmental Foundation)
 - University of Regensburg
 - TU Braunschweig
 - University of Bremen
 - University of Jena
 - TU München
 - University of Oldenburg
- KMR-dangerous substances in lab courses (Handling of carcinogenic, mutagenic and reproduction toxic / CMR-substances in lab courses)
 - *Unfallkasse* (Statutory Accident Insurance for the Public Sector) North Rhine Westfalia
 - FU Berlin
 - University of Bielefeld
 - University of Marburg
 - University of Essen-Duisburg

Key points

NOP-Online:

- is an interactive database aimed at lab work that has a section where the students can add their comments;
- includes good practice information and online evaluation;
- is linked to environment safety; and
- is multilingual.

KMR:

- is an interactive database;
- is aimed at lab work and teaching staff; and
- focuses on clarity in work instructions and includes good practice information.

Key elements

- chemistry;
- undergraduate level;
- e-learning; and
- course support resource.

Studies: Chemistry studies (B.Sc., M.Sc.), general laboratory training

Time frame: 2003 – ongoing (NOP); 2001 – ongoing (KMR)



Introduction

'NOP-online' and 'KMR-dangerous substances in lab courses' are examples of how interactive databases can contribute to safer and more environmentally-friendly lab courses in chemistry studies.

The project team of NOP-online sought to provide a new kind of teaching platform that would be able to replace traditional concepts. Project coordination was provided by University of Regensburg. Pooling their experiences from their own teaching activities in lab courses, the colleagues concerned decided to create an interactive database design which would be suitable for various educational levels: teaching staff at the universities can find various types of required information. The whole learning platform can also be used by lab courses at school or in vocational training. The website was launched in 2003.

The KMR project was founded in 2001 by university experts and the Statutory Accident Insurance for the Public Sector of North Rhine-Westfalia. They defined the need for a sophisticated presentation covering safety issues concerning the handling of dangerous substances in lab courses. They also decided to create an online database in order to present the complex solutions to a broad circle of professors, students and practitioners.

Background

The website '**sustainability in the organic chemistry lab course (NOP-online)**' provides instructions for experiments in organic chemistry as well as information about the properties of the chemicals used including toxicological information. The fundamental idea of the website is the certainty that everybody concerned with chemistry, including future chemists, can contribute substantially to sustainable development and they have a special responsibility not only for their own health but also for the environment. Students have to be aware of the links between reactions and substances with the consumption of energy, resources, toxicology, safety aspects and environmental pollution. These are skills which graduates will need in their professional life.

The NOP-online project was intended for organic chemistry lab courses since they are obligatory in university curricula in chemistry, biochemistry, biology, pharmacy, physics, medicine, and some engineering studies. Typically these courses are still being carried out in a traditional manner: students learn basic laboratory techniques of synthesis and analysis as well as dealing with dangerous chemical substances. The efficiency of a reaction is generally only examined in terms of its stoichiometric yield². Students do not learn to evaluate the overall efficiency of a chemical transformation which is a direct measure of its sustainability. Procedures for improving efficiency and avoiding toxic substances are not taught in an explicit way.

Every student and professional working in labs should be aware of the fact that the handling of chemical substances always carries a potential risk for workers and the environment. Hence everybody who works in laboratories needs to be able to handle dangerous substances safely, to know how to obtain information on toxicology, and to be aware of the possible consequences and risks of one's work. This inclusion of the use, the knowledge and the interpretation of data of toxicology should be essential in

² **stoichiometric** (adv.) = relating to the quantitative relationship between reactants and products in a chemical reaction



chemistry studies at universities (for more information on the project see also: Ranke et al. 2004).

The website **'handling of carcinogenic, mutagenic and reproduction toxic substances in lab courses (KMR/CMR-dangerous substances in lab courses)'** can be seen as an instruction manual in case of exposure to these substances in university chemical lab courses. It is an online information platform which is freely accessible. This website resulted from a vigorous debate as to whether chemistry students should actually work with substances which can cause cancer, genetic alterations or teratogenesis in their lab courses and if so, how they should start to do it.

Three opinions were debated: the most radical opinion was to ban all CMR-dangerous substances from students' lab experiments whenever possible. Working techniques for low emission work should be demonstrated first by using non-toxic substances. Other opinions were aimed more at challenging and preparing students 'on-the-job', where responsibility and self-assuredness could be developed through training during lab courses in a real experimental environment. The whole discussion and its arguments with regard to practice and didactics are documented on the website. (Grumbach, Lehmann, Schween, 2001).

This discussion was the stimulus for T. Lehmann (FU Berlin), M. Schween (U Marburg) and H.J. Grumbach of the Statutory Accident Insurance for the Public Sector of North-Rhine Westfalia to create a sophisticated website that would demonstrate how to work safely in lab experiments, even with very hazardous substances, and also to provide didactic guidelines for teaching staff.

Aims and objectives

Both projects aim to provide students, as well as teaching staff, with readily accessible information concerning responsible and safe handling of chemicals and hazardous substances. Both projects are designed to work on an online platform which provides good-practice instructions.

The main concern of both databases differs slightly: the key aspect of the **'NOP-online'** project is sustainability and responsibility related to the environment as well as general safety issues. Its approach means that NOP-online contributes to the 'Green Chemistry Mission' which encourages chemical technologies that reduce or eliminate the use and generation of hazardous substances in design, manufacture, and use of chemical products. (See also: NOP-online 2005).

The project, **'KMR/CMR-dangerous substances in lab courses'**, pays attention to personal safety and health as well as didactic aspects. It is closely related to the German legislation on the safe handling of dangerous substances. It is mainly aimed at teaching staff in laboratory courses and can be used as guidance for the safe handling of CMR substances.

Scope

First example: NOP-online / Sustainability in organic chemistry lab courses

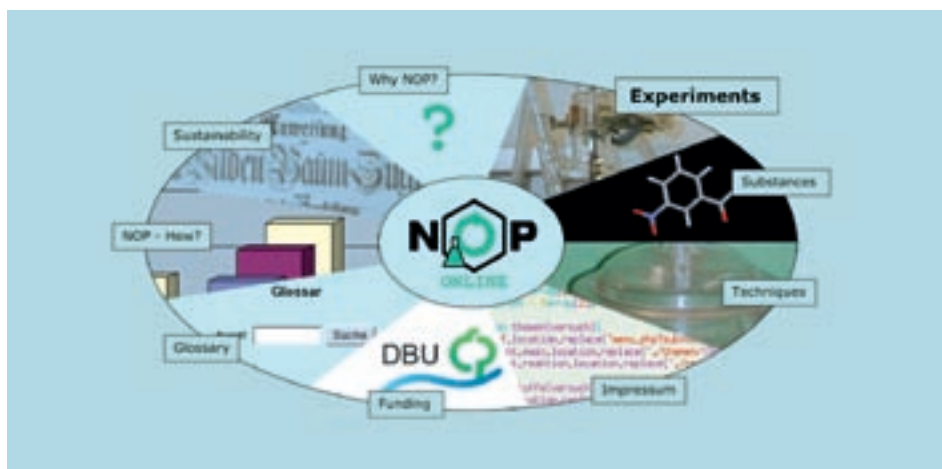
Funded by: Deutsche Bundesstiftung Umwelt (DBU / German Federal Environmental Foundation)

NOP-online provides a well-organised and easy to comprehend structure on the principal website. Information is clustered in different categories. The user can select between information on experiments, substances, and working techniques. He/she



can also obtain an overview of general aspects about the background of the NOP-project, the NOP-project team, and the idea of sustainability in chemistry studies.

Figure 1: NOP-online homepage



Screenshot taken from <http://www.oc-praktikum.de/index.php?page=entry&lang=en>

The principal item of the website is a collection of descriptions for experiments in organic chemistry. Experiments can be browsed by title, NOP-no, working technique, substance class, and reaction type. Keywords can be added via the search-string. Results are displayed in standard forms giving links to more precise and detailed information on operating schemes, substances, equipment, evaluation and analytics, and user comments.

In order to cover the broad variety of sustainability and toxicology issues, the project team mainstreamed some 100 different laboratory experiments in an online database. Detailed laboratory instructions, safety instructions and analyses instructions and further information on sustainability issues are given with every experiment description. The following illustration gives an impression of how the standard forms are used:

Figure 2: NOP-online standard form for experiment instructions

Acid catalyzed acetalisation of 3-nitrobenzaldehyde with ethanediol to the correspondent 1,3-dioxolane

Reaction type:	reaction of the carbonyl group in aldehydes, acetalisation
Substance classes:	aldehyde, acetal, alcohol, protecting group, acid catalyst
Techniques:	removal of water by azeotropic distillation, heating under reflux with Soxhlet extractor (for 10 mmol preparation), stirring with magnetic stir bar, evaporating with rotary evaporator, shaking out, extracting, recrystallizing, filtering, heating with oil bath
Assessment methods:	input analysis
Degree of difficulty:	Easy

Screen shot taken from webpage <http://www.oc-praktikum.de/en-experiment-2003>



Based on this overview, one can obtain a detailed description of the substances that must be used, and the substances which are produced within a chemical reaction, including information concerning their risk and safety. Information is also displayed about the availability of toxicological data of these substances. There is also important information with regard to directives and 'Technical Rules for Hazardous Substances (TRGS)'. Different colours indicate toxicity and eco-toxicity of the different substances, and if a particular substance has been thoroughly tested. Also, effect factors of the substances and side-products in regard to the TRGS 440 (Identification and evaluation of hazards from dangerous substances at the work place) are illustrated by different colours.

In addition to equipment and operating schemes, a final evaluation is presented to obtain a quick estimate for final classification of the reaction and the emerging chemical products. This evaluation takes into account economic values, including mass efficiency and energy efficiency and the acceptability of the toxicological risks for health and environment.

The website also gives background information on sustainable development including information on economic, ecological and social rules as well as views of federations and companies concerning sustainability in chemistry.

The website is under permanent development: users are invited to provide comments and to actively participate in the improvement of the page. All information is available in German, English, and Italian. Furthermore, the project team plans to add instructions in French, Greek, Indonesian, Portuguese, Russian, Spanish, and Turkish.

Second example: KMR/CMR-dangerous substances in lab courses

Funding/project co-ordination: initiative of representatives of the participating institutes who carried out the project as equal partners.

The basic idea of KMR is that safety and health in laboratories is closely connected to clear work instructions. The handling of dangerous substances requires in-depth knowledge of essential techniques and work methodology, as well as information on storage, disposal, and personal protective equipment. Thus, the KMR website deals with all these questions associated with the use of hazardous substances.

The information on the website is well-structured and set out in five chapters and is presented systematically, guided by a questionnaire (see examples below). All the information provided is, in addition, related to general good practice and safety instructions on the website of the institute for chemistry of the Freie Universität of Berlin. The five main topics of the KMR website are as follows:

1. Detection and identification of hazards

This chapter includes information about the application as well as the substitutability of chemicals with possible carcinogenic, mutagenic effects or toxic effects for reproduction. References related to the identification and classification of the toxic potential are presented including the recommendations of the 'Deutsche Forschungsgemeinschaft' (German Research Foundation, DFG). Explanations related to threshold limit values are listed. The relevant literature is also presented.

The whole identification and assessment process is systematically described. A table informs about all the risk factors that should be taken into account, properties of substances as well as additional aspects:



Figure 3: Table 'Risk factors: Handling of dangerous substances in lab experiments'

Organisational aspects: Work organisation, lab equipment, supervision by professor, safety instructions / guidance						
Individual abilities of the student: Conduct, knowledge, experience, comprehension, etc.						
Difficulty of working process: (Knowledge of) apparatus, (training in) working techniques						
Interaction of substances and working environment: Fugacity, reactivity with media						
Acute hazardous properties: Explosive or inflammable substances Acute toxicity, causticity, etc.						
Possible long term effects: Sensibilising substance CMR properties, etc.	1	2	3	4	5	6

The user is informed on how to collect and to categorise all the needed information on substances and on how to fill them in the documentation sheets. The website then also describes a four-step hazard assessment process based on a check list that can be downloaded. This check list also takes into account the properties of a substance, individual skills of the students, different kinds of experiments the substance can be used in, organisational circumstances, etc. The probability and possible seriousness of an accident can also be estimated.

An additional catalogue of questions guides the reader through the different aspects of use, properties and markings of CMR substances. Each question leads to further information and describes the essentials and the know-how in a thorough manner. The guiding questions are as followed:

Use:

- Do you use a hazardous substance with CMR characteristics in your lab?
- Substitutes (list with proposals for substitutes).
- Can the substance be substituted?
- The substance can be substituted (under the following conditions...).
- Is the CMR substance used repeatedly or frequently?

Properties, emphasising:

- How to recognise a CMR substance.
- Why a substance can be carcinogenic, mutagenic or reproduction toxic without being marked as such.
- When, and under which conditions, should the CMR potential of a substance be estimated.
- Why there can be a contradiction between the labelling and classifications of a substance.
- Whether carcinogenicity be measured.
- Categories of substances with carcinogenic or mutagenic potential.
- How thinning influences the risk of carcinogenic and mutagenic substances.
- Categorisation of potential (recommendations of German Research Foundation DFG):
 - of carcinogenic potentials/of mutagenic potentials/of reproduction toxic potential.
- Whether the substance is listed in the table of particularly hazardous substances of §15 GefStoffVO (Ordinance on Dangerous Substances)?



2. Possibilities for the prevention of hazards

Topics related to responsible guidance for lab courses intended for students were listed, and legal regulations were discussed. This included considerations concerning the use of appropriate personal protective equipment as well as appropriate buildings, structures and laboratory equipment. The teaching staff are instructed about how to adhere to threshold limit values, to minimize exposure (see the example below) and to collect all available information about hazardous substances (references were named).

3. Information related to good laboratory practice

This chapter offers numerous suggestions on how to organise lab courses including proper management by motivation. Examples for experiments which help in the learning of safe laboratory practice are presented. Additionally it provides advice on how to write laboratory user guides and lab course manuals. This includes questions concerning rooms, fumes, protective equipment, techniques, and handling of emergency situations, as well as the establishment of working conditions which avoid stress.

4. Discussion related to didactics

Statements are presented related to the question about whether students should start working with hazardous chemicals during lab courses in the university, and which is the best moment during education to start to handle these issues.

5. Practical experiences and sources of error

This chapter describes aspects of work hygiene. Possibilities for the disposal of substances with different chemical properties are discussed. Typical mistakes made when students pour or decant chemicals are named. Students and teachers were cautioned about stress as a possible origin of dangerous situations, and were instructed on how to prevent stress.

In addition to the structure described above, any item can be searched for using an integrated search-engine. In the future the website will be expanded to provide an open forum for discussion.

Problems faced

Neither of the project teams reported that there were any major problems during the development and implementation process.

Generally speaking, the most important challenge for both platforms, as for any internet-based information portal, is to keep it up-to-date with the relevant information: each change in European or national legislation may result in a substantial renewal of data. One example to be confronted will be the inclusion of the Globally Harmonised System of classification and labelling (GHS) into both platforms.

The KMR information platform is currently under reconstruction due to new legislation concerning the handling of dangerous substances. Nevertheless, the 2005 version can still be completely accessed online and its instructions can still be recommended for use. The new version will be launched as soon as the new decrees on laboratory safety are adopted.



Success factors

One key success factor can be seen in the comprehensible way in which both these information platforms provide good practice information. Both NOP-online and KMR used personal, practical teaching experiences in their development. Both are good examples of how teams of researchers can pool information and experience and share the overall burden by working together. Like this, both websites were able to be elaborated in a very comprehensive and user-friendly way.

The multilingual content of NOP-online allows the direct access to good practice information for users all around the world. This makes the platform highly attractive for direct use in other countries.

In the case of KMR, the platform also contains information on legal requirements, which is not something that can usually be said to be very popular with scientists and teaching staff. By collecting all relevant legal information, KMR contributes efficiently to a better understanding of legal demands and thus of questions of responsibility and liability.

Another key success factor of KMR is that the information on safe handling of CMR substances is not presented as stand-alone information but is embedded in general laboratory instructions of the university's website.

Evaluation of the measures

Databases such as these are not an end in themselves. Their existence does not mean that OSH has necessarily been successfully mainstreamed into chemistry education. They are a tool to support OSH education as part of the curriculum of chemistry teaching, specifically in this case to support training in laboratory safety. They are of limited value if they are purely stand-alone and not part of a broader education and training initiative. However, electronic databases can help to provide a consistent approach, make information widely available and make it widely accessible. To be most useful they need to include guidance for lecturers and trainers in their use as a teaching aid and resource.

Both websites are very useful since they provide ready to use information, which helps to improve safety during university lab courses. Students, as well as the teaching staff, become more aware concerning the handling of hazardous substances, and the resources permit access to all the necessary information and regulations.

NOP-online is used in organic chemistry lab courses in the Universities of Bremen and Regensburg. At both universities, the teaching staff are satisfied with the ease of access and ready-to-use information design.

At the university level, KMR is currently used in laboratory training sessions at the participating universities (Berlin, Bielefeld, Marburg, and Essen-Duisburg). In these universities, all participants in lab training sessions are given strict instruction about safety issues. The most important good practice information is collated into one document (Lehmann 2006), which is the most popular download from the KMR homepage.

The general success of both online information platforms cannot be measured in commercial terms because of their character as freely accessible online manuals. Nonetheless it can be quantified with the help of the log-in statistics of the



information platforms. These statistics are obtained from internal hits and hits automatically created from search engines:

- The KMR information platform is visited by more than one thousand external persons per month (August 2007).³ This shows a broad acceptance of the website and a good level of recognition among the target group.
- NOP-online counts in total some 10,000 hits per month and the project team plans a more exact evaluation: With the help of a questionnaire, the use of NOP at German universities will be estimated.

NOP was awarded the Literary Prize of the Foundation of the Chemical Industry 2007.

KMR was awarded the second place of 'Deutscher Gefahrstoffpreis' (German prize for good practice concerning dangerous substances) in 2002. Furthermore it has been evaluated positively by the State Bureau for Occupational, Sanitary and Technical Safety of Berlin (LaGeTSi 2002) and is recommended by the Statutory Accident Insurance for the Chemical Industry (BG Chemie).

Transferability

Due to their design as online information platforms both projects can be transferred easily. They are both good examples of how modern media can contribute to the improvement of the university's teaching standards. The online information design can be especially recommended for use by small countries where the market for very specific publications would be small.

The developers of the KMR project believe that it can be realised without any funding from third parties. Existing knowledge was being used which just had to be transferred into ready-to-use information, co-ordinated with the partners and put online. All the work was done by the project team on their own initiative. The costs for the website are relatively low and sponsored by the Statutory Accident Insurance for the Public Sector of North Rhine Westfalia.

Both websites are freely accessible to everyone. The information provided is easy to understand and can be adapted quickly to individual needs. KMR is further embedded in general good practice information for safety in laboratory courses provided by the University (FU) of Berlin.

Having multilingual content means that NOP-online already allows users in other countries direct access to good practice information. It is available in eight languages.

Further information:

NOP: <http://www.oc-praktikum.de/>

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³ Counter statistics: <http://userpage.chemie.fu-berlin.de/~tlehmann/zugriff.html>



KMR: <http://www.kmr-stoffe.de>

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INTEGRAL II, GERMANY

3.2.

Institute of Industrial Engineering and Ergonomics (IAW), RWTH Aachen University working as project leader with 15 academic institutes from 10 universities across Germany:

University of Flensburg; University of Bremen; Technical University of Berlin; University of Hanover; University of Braunschweig; IFA Dortmund; EID Essen; University of Siegen; University of Darmstadt; Technical University of Karlsruhe; Technical University of Munich.

Key points:

- open source online platform;
- teaching resource, framework for e-learning and e-publishing;
- modular, one module developed by each partner in a cooperative approach;
- network of practitioners, scientists, and students;
- mainstreaming ergonomics and OSH into university's curricula;
- interdisciplinary and interuniversity use to make common teaching material widely available;
- e-tutor support and technical advice hotline for instructors; and
- multilingual.



Key elements:

- e-learning;
- cross-disciplinary approach, inter-institutional approach;
- undergraduate studies; and
- industrial engineering and ergonomics offered in other courses.

Introduction

Industrial engineering and ergonomics options or modules, covering areas such as management, design, work organisation and human resource management, may be offered as part of various degree courses in German universities, including sciences, engineering, business studies and social science courses.

The project Integral II covered the development, testing and evaluation of an e-learning platform with industrial engineering and ergonomics content. Its purpose is to offer different learning modules to students of different disciplines and also to other interested parties. Fifteen institutes from German universities collaborated in the project to develop a method for teaching industrial engineering and ergonomics to a broad target group of students studying different disciplines. Fourteen different learning modules were integrated into an open-source learning-platform. While this design offered some financial advantages, its main advantages were that it provided opportunities to make improvements and modifications quickly to the design and usability during development and implementation.

Although the current multimedia learning system is specifically tailored to the field of industrial engineering and ergonomics, the central aim of the project was the development and testing of a concept that would be adaptable to other subject areas and teaching content. The use of user analysis, evaluation and feedback is an important part of this development process. The user clientele consists of the entire group of the internet users with an interest in work science, allowing comprehensive observation to be carried out.

Background

Various pressures in university teaching have made it essential to develop cost-effective and efficient teaching methods. Apart from budgetary constraints and the need to demonstrate results, challenges include: teaching large numbers of undergraduate students; facilitating the teaching of those first-year students who are less academic or motivated; and providing easy learning methods for students who have packed timetables and may also be working to finance their studies. The growing number of students in the field of engineering studies requires greater flexibility from professors as well as from students. In order to achieve high standards, new teaching methods such as e-learning and blended learning are increasingly being used.

Integral II is a follow-up project to Integral I, which laid the foundation for the network of geographically dispersed institutes and departments. In Integral I various tools and content for web-based collaborative research in the field of human-computer interaction (HCI) were created. The project produced a basic shared workspace with a range of opportunities for researchers and students to publish and download data, publications and prototypes for HCI research. The project highlighted the potential of e-learning and e-publishing in the field of industrial engineering and ergonomics.



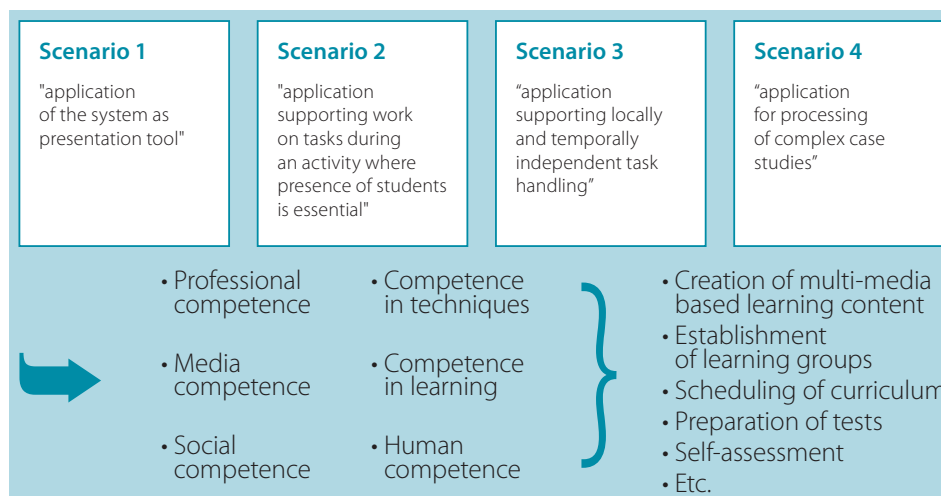
Aims and Objectives

The overall objective of the project Integral II was to develop, test and evaluate a multimedia e-learning solution. The multimedia e-learning system was specially tailored to the field of industrial engineering and ergonomics:

- development, testing and evaluation of a multimedia instructional system for industrial engineering and ergonomic contents;
- development of a general concept that could be transferred to other topics and contents;
- improved cross-linking of existing instructional contents;
- linking of research and teaching;
- good availability of the learning material (availability greater than 99%);
- integration of computer-supported cooperative work (CSCW) functionalities to support working groups; and
- generation of meta-knowledge about the organization of e-learning systems.

The idea behind Integral II has been to develop and to promote a nationwide network of researchers, practitioners and students in this diverse scientific discipline of industrial engineering and ergonomics, integrating methods and aspects from engineering, sociology, occupational and work psychology, medicine, pedagogy, economics and law.

Figure 1: Scenarios of application



Scope

Together with 14 different partners the IAW designed a learning and communication system for ergonomics, integrating methods and aspects from engineering, sociology, occupational and work psychology, medicine, pedagogy, economics and law, which were based on the ILIAS e-learning platform. Project funding of about 1.7 million euros over the whole period was provided by the German Federal Ministry for Education, Science, Research, and Technology (BMBF).

The 15 academic institutions from 10 universities that took part in the project covered a wide range of competencies, from software engineering and production planning, to psychological work analysis and ergonomics in design. The scope of partners was deliberately intended to be wide, both in geographical terms and in expertise, in order to show the variety of research in the field of industrial engineering and ergonomics.

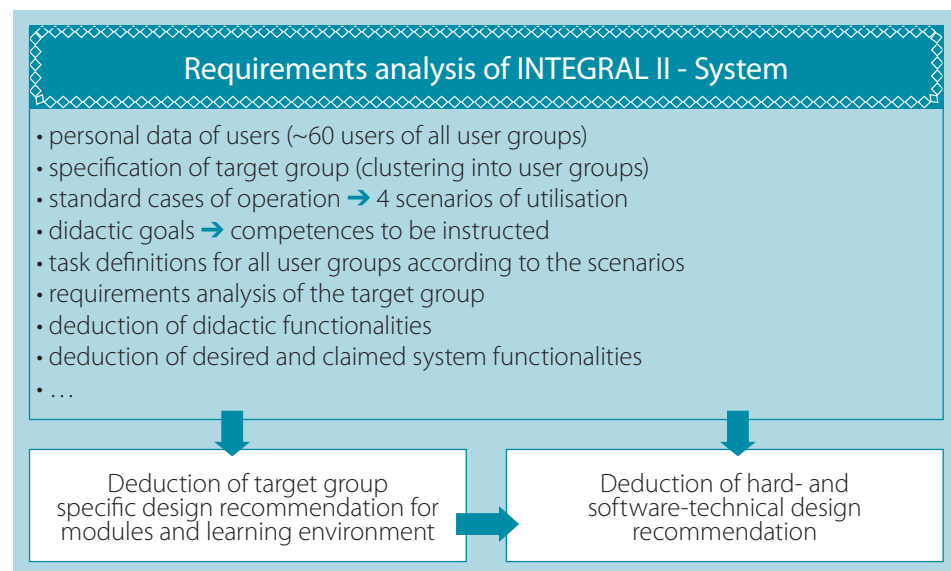


The initiators of Integral II were able to build on the previous project, Integral I. Here, important factors were the importance of establishing CSCW (computer-supported cooperative work) spaces and a clear distribution and assignment of responsibilities.

There has been a strong involvement of all users throughout the development and the implementation, i.e., students, teachers and the administrative areas. In order to achieve a user-centred design, a prior analysis was made of the requirements of teachers, students and administration. Based on these results an appropriate software solution, which could be adapted to the special research needs of the project, was selected. A survey was used to evaluate design recommendations as well as hardware and software specifications.

Figure 2 shows the boundaries of the survey, which were used to evaluate design recommendations as well as hardware and software specifications.

Figure 2: Requirement analysis



The organisational integration of the RWTH's e-learning concept was achieved through close consultation with the university administration and through the establishment of an e-learning consortium. This helped to ensure transparency and a high level of recognition at other institutes.

The most important modules in regard to safety and health at work are:

- **Work and health (Arbeit und Gesundheit)** This module shows examples of good workplace safety measures as well as the possibilities of individual health promotion. Parts of this module are also dedicated to aspects of mainstreaming occupational safety and workplace health promotion into general management. Relevant content is presented with the help of case studies.
- **Workplace ergonomics (Arbeitsplatzbeurteilung)** 'Ergo Scenes' is a 3-D simulation platform which provides different scenarios in a virtual-reality format. With the help of this software users are trained in good ergonomic workplace design.
- **Work organisation (Arbeitsstrukturierung)** Guidelines show how to integrate technical, organisational and personnel-related aspects into general management. The module can be considered as a help for orientation of a non-binding character. With a feedback form, practical experiences can be provided to the project team.

- **Design for all** Usability and product acceptance should already be focused on at the product design stage. Software for risk analyses allows control even in the concept phase.
- **Working environment – noise (Umgebungseinflüsse – Lärm)** This module shows how to assess risks from noise at work and how to deal with them.
- **Workplace risk assessment and OSH management (Gefährdungs und Belastungsbeurteilung)** How to carry out a workplace risk assessment correctly, what the most important risks at work are and how the risk assessment process can be integrated into OSH management systems.
- **Integrated health management (Integriertes Gesundheitsmanagement)** Concepts for integrated and interactive workplace health management are presented, covering collective and individual dimensions of health prevention measures.
- **Methodology of ergonomics (Methodensammlung der Arbeitswissenschaft)** Collection of methods which can help in finding the appropriate method to use for a particular research project on ergonomics.
- **Work load analyses (Methoden zur Analyse körperlicher Arbeit, Psychologische Arbeitsanalyseverfahren)** Computer-based tools show how to assess physical, psychological and psycho-social strains at work.
- **Software ergonomics, website usability and human-machine interfaces (Softwareergonomie, Benutzerfreundliche WWW-Angebote, Menschliche Informationsverarbeitung, Stellteile zur Steuerung von Kraftfahrzeugen)** are also of interest and are explained in various modules that cover different aspects of mechanical engineering, software engineering, and psychology.

Additional modules are dedicated to general aspects of management and ergonomics, such as project management, teamwork, process re-organisation, and time planning in production processes. A complete list of modules Integral II can be seen at <http://www.integral2.iaw.rwth-aachen.de>.

The main target group for Integral II are the teaching staff in the universities. Most of the modules have been integrated into the daily education and lectures provided by IAW. The concept allows the authors of modules to develop, publish and maintain their own lessons with simultaneous maintenance and organisation of the central system and a consistent form of appearance. User feedback can also be easily incorporated. A further advantage is that the system allows the exchange of learning material between the universities: specialists make their content available so it can then be used at different universities as part of their teaching.

A hotline for instructors was set up which can provide technical advice during the development and publication of course modules.

While teaching staff are the main target group for the project, students can also benefit from using the learning platform for self-study purposes. The decisions about the participation level of students were informed by student interviews carried out during mandatory training sessions and from feedback from student representatives regarding the desired level of support. This participation was then improved through the e-tutor concept. The e-tutor not only moderated discussions in the learning forums but also posed learning questions and answered questions within the scope of the apprenticeship programme. Feedback about ideas for improvement is actively encouraged.

The overall output is more than e-learning modules since it includes different topics. Relevant content is also presented with the help of virtual-reality software, guidelines, and checklists. A holistic concept specially tailored to Integral II, yet also suitable for other e-learning applications, has been developed.



In a follow-up project (Integral III), the intention is to extend the web platform in order to provide a dispersed but integrated e-learning platform for industrial engineering and ergonomics throughout Germany.

An example of the use of the Integral II

At RWTH Aachen Integral II modules are used in all curricula containing lectures of Industrial Engineering and Ergonomics I – III (IEE I-III)⁴, taught by staff from the co-ordinating institute IAW.

IEE I (Company Organisation) is a compulsory lecture in the diploma curricula of Mechanical Engineering (Dipl.-Ing., with major Production Engineering), Industrial Engineering and Management (Dipl.-Wirt.Ing) and elective in Business Administration (Dipl.), Industrial Education (Dipl.) and Psychologie (Dipl./Mag.). IEE II and III (Work, Technology, Ergonomics and Organisation Structures) are electives in all the above curricula.

With the new bachelor curricula the lectures will be incorporated into Quality-, Project-, Personnel-Management (compulsory for B.Sc. Mechanical Engineering), Industrial Engineering (compulsory for B.Sc. Industrial Engineering and B.Sc. Mechanical Engineering with major Production Engineering), Ergonomics (compulsory for B.A. Psychology), and Ergonomics / Human-Machine-Interface (elective for B.Sc. Industrial Engineering and B.Sc. Mechanical Engineering).

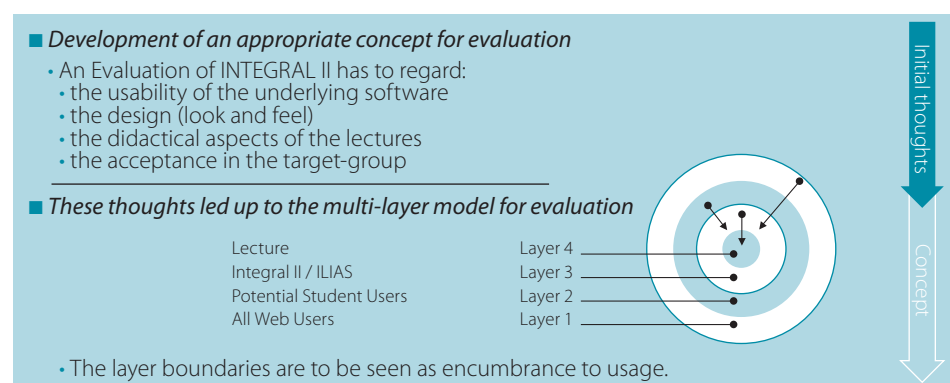
In the new bachelor curricula of Business Administration and Industrial Education, the lectures will keep their elective character.

Between 800 and 1200 students are taught annually with the help of the modules of Integral II at RWTH Aachen.

Results and evaluation

The evaluation covered usability, design (look and feel), didactical aspects of the lectures and acceptance by the target group. A multi-layer model for evaluation was formulated to describe the gap between the potential and actual users of the system. The boundaries of the layers are therefore to be seen as an encumbrance to usage. The users at different levels have to be informed about the resource. Web users are informed, for example, via search engines; students should be informed within their lectures dealing with related topics. Once users are given a login, they should be supported in using the system. Here on layer 2 and 3 the e-tutor concept has been introduced. Users with a login are a possible data source for the usability evaluation.

Figure 3: Evaluation design



4 Exception: Module 'Integrated Health Management' is not part of the lectures yet.



The users rated Integral II as successful: they were able to use the platform at their first attempt and without briefing, and were able to make use of the platform quickly. The users positively evaluated the organisation of the learning content and were of the opinion that the platform is suitable for systematic learning (Balasz et al., 2005).

Problems faced

The most significant difficulty with CSCL (computer-supported cooperative learning), besides problems such as the provision of group awareness and the support of structured cooperation (Pfister, H.-R.; Wessner, M.; Holmer, T.; Steinmetz, R., 1999), is the lack of social presence. This kind of presence might be needed not only in order to clarify questions but also to acquire social authority.

It is worth mentioning two further frequently encountered more psychological pitfalls of CSCL systems: first, social interaction in learning groups is taken for granted simply because CSCL environments allow it; second, social interaction in distributed learning groups is often restricted to cognitive aspects of learning; and ignores, or overlooks, the fact that social interaction is equally important for developing a learning community in a social space and necessary for open dialogues and reinforcement of social interaction (Kreijns, K.; Kirschner, P.A., 2002).

A further problem, with regard to the project phase, arose from the high number of partners and the geographical dispersion of these partner institutes. Coordination, cooperation and communication and thus the exchange of information was mainly conducted via e-mail. This led to intricate tuning processes regarding the design and the structure of the learning units, as well as regarding different user rights and access controls. The selection of the e-learning platform ILIAS imposed restrictions: there had to be several edition functions, so that not all of the desired functionalities could be converted. A more general problem is the ongoing updating of the online modules: especially in the field of OSH, new legislation represents a challenge for the developers of the website.

In summary:

- Many partners with a lot of different learning modules, layout and login procedures can make the platform confusing.
- There are always special demands on the functionality of a common platform and it is hard to satisfy everyone.
- The speed of development of different items can vary considerably so that the modules mostly need to be independent of each other. Updating the platform is a challenge for the project leader.
- Continuous support from the leading organization must be offered to achieve a uniform standard of quality.
- The arrangement and the definition of a uniform design and structure at an early stage is a hard but important step to achieve.

Success Factors

Success factors include:

- step-by-step development, building on a previous project;
- user-focused approach, including:
 - comprehensive analysis of user needs before decisions about software etc. were made
 - user testing and user feedback system
 - involvement of all users: students, teaching staff, administration;



- focus on usability as well as content;
- establishment of learning objectives;
- broad, open project to pool and share teaching resources across various partner universities;
- flexible method that can be used either independently from or with traditional lecturing;
- a system of learning modules in an open-source learning platform allowing easy modification during design and following implementation;
- user support for staff and students; and
- partnership approach with a clear allocation of responsibilities and close working with the university administration.

Transferability

The learning platform developed in this project can be, and is being, used without changes directly in university education. However, the possibility exists for students to prepare themselves for the examination and to receive feedback about their current performance by using the so-called 'self-check'.

Another possibility is the commercial use of the platform to provide on-the-job training. Minor changes regarding the accessibility and the licences for using different learning modules would be necessary. The software used allows the set-up of different logins with different rights and billing of the user.

As a special consideration towards foreign students, some of the learning modules are available in two languages (German and English, which ensures that almost the whole target group of students attending universities can be reached).

The centre for integrative teaching and learning concepts was founded based on the results and achievements of the Integral II project after project completion.

With the upcoming follow-up project Integral III, the platform will be updated in content and design, focusing on new possibilities of e-learning. Also, further studies will be addressed by broadening the range of offered modules. In general they could be integrated into all kinds of engineering studies (for example, electrical engineering) and studies where there is practical or business-oriented content.

Further information

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<http://www.integral2.iaw.rwth-aachen.de>

http://www.iaw.rwth-aachen.de/index.php?article_id=20&clang=0&projid=1&pstat=closed



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INTRODUCTION TO THE PRINCIPLES OF LABORATORY SAFETY — PREVENTION AND EMERGENCY RESPONSE — HANDLING BIOLOGICAL AND RADIOACTIVE SUBSTANCES, AUSTRIA

3.3.

University of Vienna

Key Points:

- laboratory safety, including radiation protection, biosafety, biosecurity, chemicals;
- aiming towards a compulsory course; and
- seminars and active learning methods using student experience.

Key elements:

- sciences – laboratory safety;
- undergraduate;
- voluntary course; and
- teaching methods – seminars, student experience.

Introduction

Biology students have to work with hazardous substances in laboratories or special workshops during courses which are part of their basic training. Furthermore, students often have to work in various laboratories which have different working methods when doing thesis work. Students therefore need to have a basic knowledge of industrial and laboratory safety before being briefed on the specific safety and job requirements of individual laboratories.

Background

The initiative for the seminars came from the Departments of Theoretical Biology and Evolutionary Biology, because they became aware that, despite the enormous amount of specialised knowledge and expertise that was being passed on to the students in the course of their training, they had hardly any knowledge of safety and health protection at work or of the relevant general statutory provisions pertaining to research.

The seminar entitled 'Introduction to the principles of laboratory safety' was the first of its kind held at the Faculty of Food Sciences. Its aim is to give students



a comprehensive overview of the specific hazards encountered in a biology/biochemistry laboratory. The urgent need for such training came about as a result of the increasing volume of regulations such as those pertaining to work with genetically engineered organisms.

Supplementary courses entitled 'Prevention and emergency response' and 'Handling biological and radioactive substances' were also prepared at the university's Faculty of Biology. These courses build on and supplement the basic course.

Aims and objectives

The main objectives of the seminars are to:

- raise students' awareness of the fact that safety and health protection (occupational safety) is an integral part of any research activity, and that these issues will have even greater significance in their future careers; and
- to familiarise students with basic aspects of safe work practices and provide them with a legal background.

The objectives of the entire course programme can be summarised as follows:

- development of a safety culture among students;
- demonstrating that the study of biology and scientific work entails some major hazards to the students' own health and to the health of others;
- developing recognition that safety and health protection is not inconvenience, but a self-evident necessity and the basis for any work;
- familiarising students with occupational safety issues and giving them an overview and an opportunity to acquire basic knowledge of all aspects of this theme prior to them starting working in a laboratory, i.e., even before the first chemistry internships;
- safety measures must become a matter of course and everyone – teachers, co-workers and students alike – must be able to identify themselves with these measures. To this end, it is necessary to provide a sound grounding and, above all, to have the science personnel set a good example;
- establishing compulsory introductory instruction in occupational and laboratory safety as part of the curriculum, which should take place each semester to provide students with basic knowledge, so that in subsequent training or safety briefings it can be assumed that the students have a certain level of basic knowledge. This can be viewed as the most ambitious objective; and
- establishing a course that can then be supplemented with advanced seminars required for specific areas of work, such as those involving radioactive or biological substances.

Scope

The seminars cover safe working practices in biological, biochemical and laboratories. While the main target group are students of the Biology Department, the seminars are also partly aimed at laboratory co-workers. The students are acquainted with basic themes such as hazard recognition, what to do in case of danger, prevention, personal safety equipment (review, selection criteria), dealing with chemicals (purchase, handling and disposal), protective facilities in the laboratory, fire safety facilities, markings, sources of information (for example, laws, safety data sheets, labels, hazard signs, laboratory regulations, apparatus description, documenting near-miss accidents, etc.) and with ways of dealing with the issues in practical terms. There are three courses, the detailed contents of which are given in the box.



Course 1: Introduction to the principles of laboratory safety:

- general laboratory safety;
- general occupational safety;
- fire safety; and
- work clothes, safety clothes.

Course 2: Prevention and emergency response:

- recognising dangers and hazards;
- approaches to prevention; and
- emergency response – first aid, fire fighting.

Course 3: Handling biological and radioactive substances:

- radiation protection (detector systems, decontamination, storage, SOP in case of accidents, etc., dosimeters, medical examinations, quantitative calculations, disposal, laboratory classes, permission and appropriation procedures, radiation protection officer, legal framework);
- Biosafety/ biosecurity (biological safety laboratories, safety banks, disinfection, sterilisation, genetically modified organisms, dual-use, legal framework);
- Chemicals (hazard groups, hazard symbols, safety and risk nomenclature, documentation, legal framework); and
- Practical part: laboratory inspections, analysis of apparatus and operating procedures with respect to aspects relevant to safety, risk assessment, drawing up SOPs.

The format and methodology is as follows:

- **knowledge transfer methods:** lecture section in combination with practical examples;
- **financing:** university lectureship;
- **duration:** Courses 1 and 3 are offered in blocks of two hours for each semester (15 weeks) and Course 2 runs for one hour per week. All courses are optional, non-mandatory courses and open to all interested students; and
- **examination:** at the end of the courses the students are examined using multiple-choice tests.

Results and evaluation

There was a very high level of interest and acceptance among both staff and students when the course programme was announced. However, at the end, only a limited number of people, approximately 10%, were actually interested. Indeed, they regarded even the one-hour class (15 seminar-hours per semester), which is not subject to the pressures of the curriculum, as being too long. Both undergraduates and staff regarded other, compulsory, subjects as being more important.

Problems faced

There is a feeling that the lack of importance given to safety and health in the past at the university is hindering the comprehensive implementation of the available courses. Since 'university autonomy' was introduced in 2002, the university's management has been increasing its efforts to have greater importance attached to safety and health protection in the student training programme and by the individual



chairs. Allowances need to be made for the fact that the university is still developing its safety culture.

The current situation in biological research can be summarised as follows:

- Although everyone appreciates the importance of safety measures, there are concerns that its importance should not be exaggerated and that doing so could compromise research. This blocks or hinders the development of safety culture in some departments, and the impact of the example being set for other staff and students is diminished.
- The responsibility for laboratory safety rests with the management of the institution. The costs of safety are competing with the general science budget for funding. There is a tendency for research to be seen as the first priority, followed by education and then occupational safety, provided that it does not interfere too much with research and education.

Success factors

Overall, the seminars are given very high approval ratings by the participants. The students participating in them are interested in expanding their knowledge beyond what is taught in the seminars, in order to gain a better understanding of the hazards involved in routine laboratory work. They show much more sensitivity in dealing with hazards, developing appropriate prevention strategies for working in a safe laboratory environment free from health hazards, as well as in the interests of research.

Success factors in terms of educational methods used included:

- combining theory with practical examples;
- lectures lightened up by inclusion of short films, brief tasks followed by discussion and demonstrations;
- reports of 'near miss' accidents by all participants;
- visits to laboratories and chemical storage facilities followed by discussion of relevant issues;
- regarding the demonstration: safety briefing and job familiarisation in a laboratory; and
- hands-on testing of safety equipment such as fire extinguishers and eye irrigators.

Greater success could be achieved through the use of brief staged scenes and incidents (see Technische Universität Berlin <http://userpage.chemie.fu-berlin.de/~tlehmann/unterweisung/>)

Transferability

These courses are suitable for training pupils, apprentices and students about how to work in a safe chemical laboratory environment, free from health hazards, and could be used in schools for subjects such as biology, physics or chemistry where there is laboratory work. By varying the emphasis on certain aspects, this general introduction to practical laboratory work could also be incorporated into training programmes for trainees in certain professions.

Further information

Course 1: Introduction to the principles of laboratory safety and Course 3: Handling biological and radioactive substances:

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RISK PREVENTION AND HEALTH PROTECTION IN ADULT EDUCATION - EDFORSA (EDUCATION FOR SAFETY), VARIOUS MEMBER STATES **3.4.**

Výzkumný ústav bezpečnosti práce (VÚBP)/ Occupational Safety Research Institute, The Czech Republic (lead organisation)

Project partners:

- Occupational Safety Research Institute (VÚBP), Prague, Czech Republic;
- BG Institute Work and Work and Health (BGAG), Dresden, Germany;
- Central Institute for Labour Protection (CIOP) Warsaw, Poland;
- National Institute for Industrial Environment and Risks (INERIS), Paris, France;
- Pmm research + consulting, Vienna, Austria;
- Preciosa, Jablonec nad Nisou, Czech Republic;
- Technical University of Crete, Greece;
- Technical University Ostrava, Czech Republic; and
- Transfer Slovensko, Bratislava, Slovakia

Key points:

- a transnational project partnership project;
- modular e-learning package for distance learning;
- aimed at postgraduate, adult education;
- harmonised course, based on the common requirements of the EU OSH directives, translated into various languages;
- wide range of target audiences from OSH specialists to the general public;
- a contribution to lifelong learning; and
- the use of the course by two Member State partners in university education.



Key elements:

- e-learning;
- postgraduate adult education; and
- general OSH training.

Introduction

The aim of the EDFORSA project was to open up training possibilities in the area of OSH through the development of a distance-learning course on occupational health and safety and risk prevention for the following target groups: specialists in the field of health and safety, managers and employers (especially from SMEs), employers and the general public. The project covered the development and testing of the e-learning course and its transformation into the national versions.

Background

The idea to develop an easily accessible and comprehensible adult education support tool in the form of an electronic course came from an increasing need for OSH training in adult education in many countries. A variety of institutions from all over Europe came together in a two-year project, supported by the European Commission's Leonardo da Vinci Programme, to develop an electronic OHS learning product.

The distance-learning form of the course bridges the gaps between training in the classroom setting and face-to-face tutoring. Open distance learning enables studying in an individual way (learning on demand). In addition, the use of an open distance course makes it possible to focus more on the candidate's individual learning process by providing more detailed, tailor-made exercises, information and feedback.

The modular structure of the final product enables it to fulfil different requirements for the various target groups, including different depth of study. The course is available in English and in all languages of the project partners, namely Czech, German, French, Greek, Polish and Slovak.

Aims and objectives

The objectives of EDFORSA are to provide an electronic self-study course for adults that:

- is based on the common European OSH prevention principles and directives;
- contains several learning levels for several target groups; and
- can be made accessible to a great number of interested people.

Scope

The modular training programme 'Risk prevention and health protection in adult education' was developed for a variety of end users. The project work was divided into the following integral work packages:

Start-up phase

The first task of the project was to create national reports on the situation of OHS in adult education of all project partners' countries. These surveys were reviewed and analysed as the basis for the development of the contents of the training programme. On that basis curricula for all five thematic modules were developed.



Creation of thematic modules:

In this working period the English version of the training programme was created. Within several months the contents of the thematic modules and additional materials were developed by the joint work of the project partners. Besides the focus on the OHS aspects, it was a challenge to integrate the pedagogical ideas and experiences of the several project partners' countries.

The following five modules were created:

Module 1 - Occupational safety and health management in an enterprise

Module 2 - Safety of technical equipment

Module 3 - Health protection and work hygiene

Module 4 - System of safety management and emergency planning

Module 5 - Emergency preparedness

E-Learning course creation and testing:

Following the creation of the content a company specialised in the development of e-learning products converted it into an electronic learning course product. This was followed by several test versions of the software.

Development of the national versions of the course:

After a phase of successful testing, the national versions of the training course were developed. This mainly comprised the translation of all the modules and materials from English into the several project partner languages. A second focus lay on the adaptation of general statements of the OHS content to the national situation, for example, to include references to special standards and regulations. In addition, hyperlinks to national information sources were placed as an amendment to the general information.

Project closure:

As all project partners had their own strategies and ideas for dissemination and usage of the training programme, it was agreed that, besides these individual activities, every partner had to carry out a national seminar to present EDFORSA to a wide audience of interested people. Further individual activities were, for example, placing the course on the internet (Germany, Czech Republic), the integration of the course into university education (Czech Republic, Crete), its presentation on expert forums, conferences, exhibitions in the field related to OHS and the distribution of the course on CD-ROM on request by every project partner.

Results

The following products have been developed during the EDFORSA project:

- National reports containing summarized information on the existing Occupational Health and Safety education activities in the partnership countries (in Czech Republic, Austria, France, Greece, Poland and Slovakia).
- A CD version of the course *Risk Prevention and Health Protection in Adult Education* in English and Czech, German, French, Greek, Polish, and Slovak. The course comprises the following five modules:

Module 1 - Occupational safety and health management in an enterprise



Module 2 - Safety of technical equipment

Module 3 - Health protection and work hygiene

Module 4 - System of safety management and emergency planning

Module 5 - Emergency preparedness.

- Users' guidebooks in the same languages.
- The English and German versions are available as internet versions. The German version is downloadable from the project website http://edforsa.vubp.cz/products_vysledky.php. A English demo version is available at <http://edforsa.vubp.cz/demoverion.htm>.
- CD versions of the course are available in Czech, German, French, Greek, Polish, and Slovak.
- A project website (<http://edforsa.vubp.cz>), providing all documents created within the project, for example, the national reports, links to the internet versions and details of how to obtain the CDs.

Problems faced

The tight time schedule of the project did not always match the partners' national work plans and the amount of work that had to be devoted to involvement in the project was in some cases underestimated. Furthermore, some uncertainties occurred among the project partners concerning the target groups of the programme and therefore the complexity of the contents.

Success factors

The project resulted in a product which teaches basic knowledge of OSH in several languages. The product has been adapted to various countries both in terms of language and content. As the programme consists of modules which are self-contained, all the modules can be taken out of the programme structure and studied individually. Furthermore, the programme provides the possibility of easily adding new modules on additional OSH topics.

Transferability

EDFORSA is freely transferable into other environments. It may be transferred in other languages. As it is module-based modules may be taken out of the whole course for learning and teaching in individual circumstances. A recommendation may be given to highlight up-dating procedures in order to observe the development of OSH directives and other developments in OHS.

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MANAGEMENT OF RISK IN MINING AND NATURAL ENVIRONMENT IN ACADEMIC EDUCATION AND RESEARCH, BULGARIA

3.5.

St. Ivan Rilsky University of mining and geology

Key points:

- education of mining and geology professionals at the St. Ivan Rilski University of Mining and Geology;
- occupational safety courses for all students;
- research on risk management in mining and geology; and
- lectures and exercises in real workplaces.

Introduction

The St. Ivan Rilski University of Mining and Geology in Bulgaria provides education in the field of mining and geology and other relevant areas such as: automation, mechanization, electrification, surveying, hydrogeology, drilling, oil and gas exploration, transport, utilization, ecology etc. During the education process at the university, students learn how to design, organise and carry out work processes in the field of mining and geology. Areas of interest regarding didactic and research work related to OSH include engineering safety, mining safety and rescue, fire safety, health and safety risk assessment and environmental issues.

Background

The exploration, mining and processing of mineral raw materials are recognised as high risk activities. Ensuring a safe and healthy working environment for miners, mineral processors and geologists is a major responsibility for mining engineers and mining science in general. Mining and geological companies in Bulgaria have been undergoing change, including companies being split up into smaller ones and changes in production methods and technology. As with all companies, the law on environmental protection and on safe and healthy working conditions requires mining and geology companies to ensure safety through risk assessment and management. As a result of the structural changes in Bulgarian industry, and in particular in mining and geological enterprises, a new approach towards risk management was needed in this sector.

Aims and Objectives

The university provides courses for students of all faculties, aimed at providing them with the necessary knowledge, skills and competences in the area of occupational safety and health for working in the field of mining.

Scope

The university's three faculties each cover subjects associated with high occupational risk:



- **Faculty of Geology** (exploration and prospecting of solid minerals, oil and gas, coal; participating in the mining of solid minerals, oil and gas and coal; the production, transportation and storage of oil and gas; drilling in the exploration of mineral resources; process, portable and thermomineral water; hydro- and engineering geological investigations for industrial, hydro-ameliorative and civil construction; geophysical investigations for exploration and mining of mineral resources; industrial, roadway and civil construction; geological measures related to environmental protection).
- **Faculty of Mining Technology** (underground and opencast mines, underground civil constructions, roadway and energy construction, blasting operations, ventilation systems, mine surveying and geodesic measurements for exploration of mines; for industrial and civil engineering, for regulation and land ownership, plants for processing of mineral resources and raw materials, investigations related to environmental issues).
- **Faculty of Mining Electromechanics** (assembly, adjustment, exploration and repair of devices and systems for automation, electricity and electric equipment; assembly, adjustment, exploration and repair of electrical machines and equipment, constructing machines and devices, mechanization for technological processes).

There are compulsory classes on issues related to the protection of workers for students at each of the university's faculties. For example, OSH issues included in the programme of the Geology Faculty are given below:

- **organisation of labour protection, labour law:** organisation and management in the field of work safety, legal basis for labour protection, normalisation, supervision of working conditions, supervisory bodies, OSH training, accidents at work and occupational diseases, occupational diseases classification, analysing accidents at work, OSH prevention, preventing accidents at work and occupational diseases;
- **healthy working conditions:** chemical and physical risks in the working environment, dangerous substances, dusts, microclimate, radiation, noise, vibration, light in workstations, occupational risk assessment, protection rules and means of avoiding exposure to risk factors;
- **safe working conditions:** safety rules related to electricity, influence of electricity on the human body, preventing explosions, risk assessment and management in the working environment of mining and geology sector; and
- **fire safety:** fires and fire prevention, rules for achieving protection against fires for the mining and geology sector.

The courses are broad in scope and cover the principles of OSH with special emphasis on the issues typical for the mining and geology sector. The whole course at the Geology Faculty consists of 30 hours of lectures and 15 hours of laboratory classes. Students also have the opportunity to take part in internships and work assignments in real workplaces.

The university carries out various research activities concerning occupational safety and health, and is involved in international cooperation which enables the exchange of knowledge and practical experiences. It organises international scientific sessions on the management of natural and technology-based risks which can include OSH topics. It also belongs to the European Network of Safety and Reliability of Industrial Products, Systems and Structures (SAFERELNET). These activities add to its resources and expertise for delivering OSH education.



Results and evaluation of the project

The university aims to develop correct attitudes towards OSH in students as well as developing their knowledge and competencies in all areas of work - design, organisation, management and control. Of particular importance is the development of students' competence in the areas of assessing occupational risks and designing work processes in accordance with OSH regulations in the industry, and in how to minimise OSH risks. Environmental safety is also covered. All courses at the university are subject to an assessment and quality control system (controls of lectures, approval of laboratories classes, final exam).

Problems faced:

- having the necessary highly qualified professional staff and educational infrastructure; and
- keeping courses up-to-date regarding changes in work processes in the sector and technological developments, but also in other aspects such as the economic health of the country, mineral market situation, or restructuring towards a market economy.

Success Factors

Having a highly qualified staff, well prepared teaching programmes and good laboratory facilities have all contributed to achieving the teaching goals and developing successful research programmes. The university believes that having a strong combination of education and research activities is important for the achievement of both activities. The teaching methods include both theory and practice (laboratories, work assignments, internships). As internships are a part of the education it is important that there is good cooperation with the relevant companies.

Transferability

The OSH education at the Bulgarian University is strongly focussed on the mining and geology sectors and other closely related areas. Experiences in OSH teaching gained by this institution could be successfully used by other universities with similar profiles.

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3.6. RISK EDUCATION IN ENGINEERING - DEVELOPMENT OF YEAR ONE MATERIALS, UNITED KINGDOM

University of Liverpool and Health and Safety Laboratory

Key points:

- pilot project to incorporate risk education into the curriculum of an undergraduate engineering degree course as a compulsory part of the course;
- partnership between one university department and the national OSH authority;
- based on the development of learning objectives;
- use of real-life case materials, an active learning approach and practical work;
- includes a tool to assess student' OSH awareness and evaluate the project;
- promotion of OSH in the final year of studies; and
- inclusion of OSH in core texts for the course.

Key elements:

- engineering courses;
- partnership with OSH Authority;
- active learning, case studies; and
- integration of OSH as compulsory part of course.

Introduction

The Health and Safety Laboratory (HSL), in association with the University of Liverpool, established a project to incorporate risk education into the curriculum of an undergraduate engineering degree course. Integrating risk education into the curriculum has involved defining risk education as a set of learning outcomes, and designing a tool to ascertain students' awareness of risk issues and key concepts. Teaching materials are being developed that use real accident case studies, student interaction and team-building exercises to enhance students' understanding of the concepts of hazard and risk.

Background

In the United Kingdom there is a need to educate undergraduates in aspects of risk relevant to their discipline, particularly those who will be working after graduation in safety-critical professions such as students in architecture and engineering. This need is increasingly recognised by various professional institutions and degree accrediting bodies. For example, in the UK Health and Safety Commission's (HSC) consultation exercise on OSH strategy ('Revitalising Health and Safety' (2000)) over a third of respondents said that it was important to cover health and safety issues in further and higher education. However, a report for the Health and Safety Executive (HSE) on the extent of risk education in undergraduate degree courses in engineering in the UK suggested that the uptake of risk education was in its infancy and had not yet been formally implemented in any comprehensive manner across degree courses. In addition, it was found that universities generally had many different interpretations of the accrediting bodies' guidelines for the content and extent of risk education (Lee,



1999). One of the major barriers for universities addressing risk education in a more comprehensive way is the lack of detailed prescription for risk education learning outcomes. The Health and Safety Executive therefore commissioned the Health and Safety Laboratory (HSL) together with the University of Liverpool to mainstream risk education into the curriculum of an undergraduate engineering degree course.

Aims and objectives

The general aims of the project were to:

- develop a set of risk education learning outcomes that would fulfil the requirements of the Health and Safety Executive and other relevant stakeholders, such as employers and the engineering institutions;
- describe how these learning outcomes could be integrated into an engineering undergraduate three and four-year curriculum;
- define a syllabus of risk education topics that would achieve the learning outcomes;
- develop suitable teaching materials that incorporated the risk topics;
- develop a questionnaire that could be used as a benchmark to ascertain the risk awareness of new students and evaluate the success of the taught syllabus; and
- consider what further work would be required to enable this approach to be promoted to other educational institutions on the basis of its successful implementation.

Scope

This project, to incorporate risk education into the curriculum of an undergraduate engineering degree course, coincided with and complemented changes within the Department of Engineering at the University of Liverpool. Over a five year period 2004-2008 the department planned to redesign radically the curricula for virtually all its programmes to ensure the knowledge and skills of their graduates would be up-to-date and relevant to engineering in the 21st century. This new batch of graduates were branded locally as 'Liverpool Engineers'. A key element of this revision has been to increase health and safety risk awareness.

Development of risk education syllabus

Drawing upon the existing professional requirements of the engineering institutions, relevant OSH legislation, and best practices described in relevant HSE publications and current academic courses, a set of risk education topics was developed for undergraduate engineering students and circulated to key stakeholders in HSE, academic and the engineering institutions for feedback, which was subsequently incorporated into a final template of topic areas (Lee, 1999). An outline of the syllabus is given in box 1.



Syllabus outline, Basic introduction, Aims and objectives (including expected student input and assessment), Definitions and terminology, Engineering as a 'safety critical' profession, Hazard and risk as part of everyday life, Fundamental concepts of safety, hazard, likelihood, probability and risk, Examples, Case Studies, Bibliography (including websites), Management of personal risk, How to control risks associated with the main hazards that a student is likely to come across during lab/project work and later in the workplace, Use of personal protective equipment and emergency procedures, Examples, Risk modelling and quantification, Hazard identification and preliminary hazard analysis, Treatment of uncertainties, Qualitative and quantitative risk assessment, Limitations and potential pitfalls of risk assessment, Failure modes and effect analysis, Fault and event trees, Human error, Assessing the consequences of a specified hazard, Acceptability and tolerability of risk, Cost benefit analysis, Examples, Case studies, Professional responsibilities including legal requirements, Legal framework, The Health and Safety at Work Act etc 1974, UK regulations and European directives, Legislation enforcement, Prescriptive versus goal setting philosophy, Professional engineering codes of conduct, Examples, Case studies, Management of risk, Safety culture and climate, Safety management systems, Examples, Safety in design process, Human and organisational factors including basic ergonomics and human error, Inherently safe design, Attitude to safer design, Use of best practice and standards, Examples, Risk reduction and control, Prevention, Mitigation and control strategies, Examples

Taking an integrated approach, health and safety has been embedded throughout various modules, together with some additional contact hours on the course that deal specifically with health and safety risks. The contact hours on health and safety that have been added so far are:

- 7 hours lectures (6 keynotes plus case studies) ;
- 3 hour lab; and
- 2 hours tutorial

A further 2 hours are being planned.

Development of learning outcomes

Learning outcomes were developed based on the syllabus. A distinction was made between awareness and understanding of risk concepts and application of this knowledge. Below is a summary of the desired outcomes upon successful completion of the risk education programme:

In terms of knowledge and understanding of risk concepts, students should be able to comprehend:

- the concepts of hazard, safety and risk as part of everyday life;
- the engineer's professional responsibilities for safety and managing risk (moral and legal obligations, and financial and human factors relating to safety);
- the principles of hazard identification and risk assessment relevant to the discipline;
- the methods of hazard identification and risk assessment (both qualitative and quantitative) relevant to the discipline, and how to apply them in familiar situations;
- the techniques for reducing and controlling risk, and how to apply them in familiar situations;
- potential exposure to hazards and risk in the workplace; and



- underlying causes of accidents and failures (through case studies).

In terms of practical application of the acquired knowledge, students should be able to:

- design simple engineering systems for safety accounting for uncertainties;
- perform a risk assessment using appropriate methods, avoiding some of the common pitfalls, and implement, where necessary, effective risk reduction measures;
- learn from documented failures and accidents the underlying hazard, safety and risk issues and relate this knowledge to their future professional responsibilities; and
- identify and control safety hazards to themselves and others in the course of work activities.

Development of undergraduate risk awareness questionnaire

An undergraduate risk awareness questionnaire was developed to assess students' understanding of the key concepts for each learning outcome. Its purpose was to evaluate the effectiveness of the programme in achieving the learning outcomes. The 50 multiple-choice questions covered the following risk topic areas:

- concepts of hazard, safety and risk as part of everyday life (12 questions);
- engineer's professional responsibilities (12 questions);
- principles of hazard identification and risk assessment (8 questions);
- techniques for reducing and controlling risks (6 questions);
- potential exposure to hazards and risk in the workplace (6 questions); and
- underlying causes of accidents and failures (6 questions).

The questionnaire was given to new entrants at the start and end of the 2004/05 academic year (a control group which would not be receiving any risk education in their coming year) and to new entrants at the start of the 2005/06 academic year (experimental group which would be receiving risk education in their coming year). An online version of the questionnaire was used for the second batch of students and a prize of a free course book was offered to the two highest scores to motivate students to complete the questionnaire. An essay type question on why engineering was regarded as a safety-critical profession was added at the end of the questionnaire.

Integration of risk education into the curriculum

Two year-1 modules, 'Mechanics of solids' (MECH102) and 'Design' (ENGG100), were selected to have some of the syllabus risk topics embedded into them and final-year projects on risk were set up.

Year 1 'Mechanics of solids' in the first semester

The module is about structural integrity and avoiding failures, was considered ideal for embedding some of the key risk concepts and issues. Through two case studies of engineering disasters, several key risk concepts were linked to stress analysis. Two BBC television Disaster Series films, the 'Challenger Space Shuttle' and 'Piper Alpha' (oil rig), were used as case studies. They both helped to illustrate how a wrong decision can lead to disaster and to get students to think outside the confines of theory to real issues that could affect them in their future professional life.



Safety issues were embedded in the lecture material and integrated with the theory rather than being added on as a separate topic. New PowerPoint slides were produced to enhance the presentation and enabled the material to be reviewed on the University's on-line virtual interactive teaching and learning (VITAL) system.

Complementary to the Mechanics of solids lectures is a laboratory exercise. It was designed based on the Port Ramsgate accident investigation with an aim to enable students to learn more about the accident investigation process, to appreciate what important lessons can be learned from engineering failures and that accidents generally have no single cause, and to learn about health and safety law through a case. The idea was inspired by a similar exercise run by the University of Sheffield.

The laboratory exercise is in two parts. In the first semester, students take on the role of the accident investigation team gathering evidence and data. In years 2 and 3, the information gathered will be used in deciding whether or not there is sufficient evidence to prosecute those parties responsible for the accident and preparing a case for prosecution and expert witness statements if there is a case. The laboratory exercise is carried out in small tutor groups of around 6 to 10 students.

The technical investigation is divided into 5 stages, namely recording the incident, design considerations, risk management, materials assessment and stress analysis. They will be tackled by a different group of students each week. Each group draws on findings from the previous group as would be done in real life investigation. The lecture material is also timed to synchronise with the particular stage in the investigation.

A worksheet has been prepared for each stage of the investigation to guide students through the tasks and assist them to record the important information. The worksheet also serves as students' technical note, on which they will be assessed, to be completed during the lab session (3 hours) and handed in at the end of the session before they leave. Worksheets for activities in year 2 and 3 are at the development stage.

A demonstrator is present during the laboratory session to facilitate the process, for example, by getting students to think and talk to each other, using icebreaker questions to help a quiet group to get started with their discussion.

There is a plan for formal training for subsequent years' demonstrators to ensure continuity and competency. Technical notes and support materials will be fine-tuned in the light of experience and feedback from lab demonstrators and students.

Year 1 'Design' in the second semester

A number of experts in the fields of professional responsibility, standards, human factors and inherent safety have been approached to give keynote lectures on the following topics:

- Professional Responsibilities by Graham Dalzell;
- Human Error by Graham King;
- Use of Codes and Standards by Martin Keay; and
- Inherent Safety by David W Edwards

The keynote lectures will be delivered to year 1 students taking Design in the second semester under the overall heading of professional practice. With the consent of the experts, the lectures will be recorded together with audience interaction, which can then be replayed in future years for new students. This may also be used to produce a video package that can be used by other academic institutions. In addition, materials



of keynote lectures will be developed into a booklet or incorporated into books as extra chapters by publishers of the essential text for students in the first year (HSE and DETR, 2000).

Final year undergraduate projects

Various final year undergraduate projects have been set up. For example, one is developing the use of the machinery safety demonstrator unit as a laboratory exercise, and two others involve analysing real-world accident data so as to reconstruct events leading up to the accident and identify causal factors. The former aims at giving students hands-on experience of safeguarding machinery and foreseeable ways for misuse, whereas the latter enables students to learn lessons from real-life accidents. Staff will be further encouraged to introduce more accident investigation / forensic type final year projects involving learning lessons from real-life accidents.

Essential text and library resources

The publishers of the essential text for students in the first year (HSE and DETR, 2000) supplied the books shrink-wrapped with the UK Engineering Council's 'Engineers and Risk Issues' code of professional practice. In addition, they agreed to shrink-wrap a booklet of material from the keynote lectures or even bind them into books as extra chapters.

A number of key textbooks, reports, and reference documents were reviewed as to their suitability for support material for the new risk syllabus and the development of educational material for lectures. Those that were identified as suitable were classified as recommended or background reading for students. Books which could not be found in the university library were purchased through a special fund for promoting course development and new topics. Multiple copies of key documents were ordered, and HSL provided some of these documents. Students were made aware of this resource in the opening lecture and encouraged to obtain a copy of the Engineering Council's more comprehensive guidelines on risk issues.

Liaison and promotional activities

Internal

Successful implementation of any new syllabus relies upon people who will help develop the materials and teach them, both in terms of their knowledge of the new topics and their motivation to deliver it in the face of many competing demands on the curriculum and resources. In view of that, internal promotion among staff within the engineering department is essential. This was kicked off with a presentation of the relevance of the project to staff and PhD students by a speaker from HSL, under the department's research seminar programme held on Wednesday afternoons. Staff will also be invited to the keynote lectures in the second semester that usefully coincide with the department's new research forum held on Friday afternoons.

External

One of the aims of the project is to promote this approach to other educational institutions. To do so, members of the team have been actively networking with other interested universities through a variety of ways, for example conference papers, posters, presentations and journal publications. External promotion continued through the Institution of Mechanical Engineers (IMechE) Safety and Reliability Group, the Safety and Reliability Society (SARS) and the University Engineering



Inter-Institutional Group (IIG). The project was also promoted in the Engineering Education Conference in 2006 (EE2006) on 'Innovation, good practice and research in engineering education'. In addition, a seminar on 'Risk education for engineers' was held in London at the headquarters of the IMechE in 2007.

Other

The project team has continued to liaise with the chair of the Engineering Inter-Institutional Group (IIG) on safety who is leading a project to develop a multimedia resource for universities. This project has produced an e-learning package 'Engineering a safer future', designed to form a basis for the teaching of health and safety risk management to young engineers. It incorporates video material to present real-life stories, a hazard-spotting exercise in a virtual environment, briefing materials and interactive tutorials, and exercises with feedback on the answers. A demonstration CD has been produced which contains a sample of e-learning material.

The two projects continue to complement one another very well. Liaison also continues with the British Standards Institution (BSI), which is developing educational materials.

Results and evaluation

There has been good anecdotal evidence, from the project leader's attendance at a selection of the laboratory exercises, that students are beginning to seriously consider risk issues. Student feedback has been positive. In general it has been noted that it is difficult for academics to convince students of OSH issues. Therefore it would be better to use OSH professionals to teach these issues – students seem to get more out of this teaching.

Problems faced

There was no formal testing of the validity of the risk awareness questionnaire due to time constraints. Using a reliable and valid questionnaire would be important because it would give more confidence to believe that the project, based on rigorous evaluation, is effective in achieving the learning outcomes.

The process was not without its difficulties, namely: promotion of the risk theme to other members of staff who did not view it as a priority; overcoming competing demands for time on the curriculum; gaining the support from other members of staff to allow development and implementation of new materials for inclusion in their modules; and remaining focused on the key objectives. Other drawbacks of the project are related to resources (time and money) available through the university and lack of expertise.

In general more help, additional funding and visiting lecturers would be needed if this programme were to be extended to other universities. The Health and Safety Laboratory and the University of Liverpool are also developing an e-learning format of the module for other universities to use.

Success factors

There are several factors leading to its success:

- It coincided with the time when the department was planning to reform its undergraduate programmes.



- It complemented the department's new direction of providing future Liverpool graduates with skills and expertise that are up-to-date and relevant to the needs of the modern industry.
- It was linked to the requirements of engineering professional associations.
- It used real case studies and active learning methods such as laboratory exercises and role play.
- Most importantly, despite some resistance, the project team managed to get the support of the members of staff in the department for the project.
- The project has also shown how essential the collaboration between academia and industry is in health and safety education.

Transferability

The practice could be easily transferred to other academic institutions, though the validity of the risk awareness questionnaire should be established without delay. As policies and legislation differ between countries, modifications may be needed if applied to other countries.

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3.7. TRANSFERRING THE RESULTS OF BUSINESS CASES AWARDS INITIATIVE TO BUSINESS AND ENGINEERING SCHOOLS, USA

US National Safety Council

Key points:

- It uses the results of an awards competition for business excellence in OSH, organised by an OSH NGO.
- The winning OSH business management cases are converted to business case studies for integration into business and engineering school curricula.
- Professors are encouraged to use the cases, to provide NSC with students' reports about the cases, and to share the cases with each other.
- The cases and supporting resources are designed to be similar in format to those used in top business schools.

Key elements:

- business studies, engineering;
- case studies and teaching aids, DVDs;
- voluntary; and
- initiative from outside OSH organisations.

Introduction

The US National Safety Council (NSC), with global partners, organise the Robert W. Campbell Award, an international award for business excellence. The award recognizes companies that have successfully integrated health, safety and environmental management into their overall business operations. These cases, which demonstrate health and safety, and economic productivity, are converted for use as resources for engineering and business schools, and to promote partnerships with business schools and cooperation among professors/lecturers.

Background

It appears to be a major challenge to get business school schools to cover OSH. For example, a study published by the UK's Health and Safety Executive (HSE) established a very limited coverage of occupational safety and health (OSH) in full-time Masters of Business Administration (MBA) courses in a sample of UK business schools (HSE 2007). The study found that the explicit occupational health and safety content of the eight MBAs was either non-existent or very limited. Many schools commented that there was a lack of well-documented and suitably-presented case studies appropriate for MBA teaching. The report suggested that the only practicable way to encourage consideration of OSH in MBA programmes would be the development of high-quality case-study materials that meet the needs of business schools. The problem is that there has been a lack of solid case studies examining the role OSH plays in corporate performance. The situation has been similar in the USA, and in 2004 the NSC introduced the Robert W. Campbell Award for business excellence, in integrating OSH into overall business operations, to support the provision of suitable case materials.



Aims and Objectives

The overall goal is that students should enter their profession embracing the values of safety, health and environmental (SHE) issues to businesses, to the workforce and to the world around us. The project has sought to:

- integrate SHE management into business and engineering school curricula, so that future generations of business leaders gain a deeper understanding and appreciation of the intrinsic value of SHE management to overall business success, internalising the value of SHE in business operations and practising it in their professional lives;
- provide resources in the form of solid case studies, examining the role SHE plays in corporate performance that will be acceptable for teaching on business course, and engineering course, curricula;
- use an award scheme for business excellence cases that demonstrate health and safety and economic productivity as an integral part of business performance to provide the real-case examples;
- promote partnerships with business schools and cooperation with professors so that the SHE messages can be internalised and to foster the sharing of success stories;
- encourage professors/lecturers to use the cases and to obtain reports from the students about the cases and encourage professors to share the cases; and
- promote SHE as a critical principle of business excellence.

Target groups include professors, lecturers, business educators, other education professionals, students and those who design and deliver educational programmes among others.

Scope

Background of the initiative

Initially the NSC tried to obtain case materials by inviting different companies to write case studies that documented in detail, and demonstrated clearly, the correlation between SHE and business performance. However, they soon realised that getting individual employees of a company to provide all the necessary details to explain clearly its system, organisation and performance would be an extremely difficult and time-consuming task. Therefore, in order to have a mechanism to give companies proper recognition and motivation for sharing their successes they created the Robert W. Campbell Award.

Robert W. Campbell Award

The international Robert W. Campbell Award for business excellence recognises companies that have successfully integrated health, safety and environmental management into their overall business operations. Launched in 2004 by the NSC and the ExxonMobil Corp. (via ExxonMobil Foundation), the Award is supported by a network of international partners interested in validating the efforts of businesses and fostering a spirit of cooperation around the globe. By recognising those companies dedicated to safety, health and environmental efforts – and sharing their successes – the Campbell Award strives to have an impact on the way workplaces integrate safety and health into their business functions.

The Award has four different goals: 1) to recognise companies that really invest in SHE and bring that into their core by completely integrating safety, health and



environmental management into their business operations; 2) to establish a process where it is possible to validate their efforts and measure the performance; 3) to use a rigorous review process, utilising an international panel of expert reviewers; and 4) to really foster the sharing of success stories. To achieve the fourth, and the most important goal, the NSC convert winning cases into business cases that can be used in business and engineering schools for the education of future engineers and business leaders.

Through the Robert W. Campbell Award, SHE is examined as an important part of a comprehensive management system. In other words, the Award is seeking more encompassing corporate systems of SHE and business management, rather than intervention-based efforts.

The case studies are evidence-based success stories in which an organisation conveys how its SHE management system has led to success in SHE and enhanced business productivity. These successes must be demonstrated through measurable SHE performance, productivity, and profitability. Therefore submissions also include documented performance metrics, including associated data, figures, and charts. These are not technical research papers, but rather practical narratives written for SHE and business professionals.

Companies applying for the Award undergo intense scrutiny by an international panel of SHE experts, business educators and corporate leaders, including peer reviewers from US university business schools. The reviewers are nominated by the 21 global partners and represent management, labour, academic, and government perspectives from the various regions of the world. The review process includes comprehensive evaluations and site visits to Award finalist organisations. Award recipients are recognized at the NSC Annual Congress and Expo where they are invited to present their success stories. The exemplary case studies are published on the NSC website and are made available for the global partners and other organisations to use.

Award recipients have included Noble Corporation, Johnson & Johnson, Alcan Inc. and DynMcDermott Petroleum Operations.

The case study from Noble Corporation – a Texas-based oil and gas drilling company – demonstrates how a company's commitment to SHE improved profitability in the highly dangerous industry of contract drilling and natural gas services. Throughout the case study, Noble offers measurable SHE achievements linked to productivity, profitability, competitive advantage, market value and other key business indicators.

The Johnson & Johnson case study looks at the company's long history of safety and health initiatives and analyses the company's return on its investment in those initiatives. For example, in 1979 the company developed 'Live for Life', an employee wellness programme intent on making Johnson & Johnson staff the "healthiest in the world." From 1979 to 1983, Johnson & Johnson reported that their hospitalization costs were one-third less that of companies that did not have similar programmes.

Montreal-based Alcan Inc. is one of the world's leading aluminium and packaging companies, with a workforce of 65,000 and operations in 61 countries. Alcan's innovative 'EHS First' system has delivered about \$43 million in savings while fostering a mindset and culture of believers and champions throughout the Company. EHS First is more than a system - it represents an attitude, a belief and an acceptance of responsibility and accountability to achieve world-class EHS performance at every Alcan facility.



DynMcDermott is a private New Orleans-based firm that manages the US Strategic Petroleum Reserve. It employs fewer than 600 workers. According to DynMcDermott, top performance and returns were achieved because of, not in spite of, its focus on the worker, the public and the environment. Since 2000, the SHE performance has met or exceeded 100% of DynMcDermott's performance targets.

By building up the cases NSC are also bringing big business theory into play to share safety, health and environmental knowledge, emerging trends and best practices with future business leaders.

Working with universities

Award-winning submissions are converted to business case studies for integration into business and engineering school curricula so that future generations of business leaders gain a deeper understanding and appreciation of the intrinsic value of SHE management to overall business success.

To do this the NSC started by making several cold calls and discussions with professors to understand their perception towards SHE. After this, the NSC contacted them again to get their insights on how SHE relates to business operations. Then the NSC identified some professors and started to involve them in application review, case writing, case presentation, case review, and case submission. The NSC found this to be a very humbling process. When working with safety and health-minded business leaders during the case writing process, the professors gained deeper understanding and appreciation of the intrinsic value of SHE as well as starting to internalise this value.

The case study from the first winner of the Campbell Award, Noble Corporation, was developed into a business school case study similar to those published by Harvard Business School. Through collaboration with Georgetown University's McDonough School of Business, the case study was written into a form that can be included in business and engineering classroom discussions and was incorporated into Georgetown's curriculum as well as several other business and engineering school curricula in North America.

The case study teaching materials were first introduced and piloted in a summer event for professors in Ontario, Canada, hosted by Canadian global partner Minerva. This provided the possibility for another review and obtaining feedback about the use of the case study. This pilot has been run annually since 2004. At the event 25-30 Business School professors could give feedback and discuss the use of the cases in the classroom.

Leading business schools are now moving to incorporate SHE into their business management curricula. Georgetown University's McDonough School of Business was among the first. "Evidence-based findings are powerful learning tools for business executives and business school students," says Brooks C. Holtom, assistant professor of business at Georgetown. The cases have been piloted and shared with over 50 universities in the US and Canada. However, the NSC do not have actual counts of schools that have incorporated the cases into their teaching and in what format or depth.

The top business school partners include, among others:

- the Wharton School at the University of Pennsylvania;
- McAfee School of Business Administration at Union University;



- Whittemore School of Business and Economics at the University of New Hampshire; and
- Georgetown University.

The Noble Corporation case has been converted into case study material. The Johnson & Johnson case has been piloted in the Whittemore School of Business and Economics at the University of New Hampshire and was found suitable for teaching. The drafts of a further two cases were made available in 2007.

The NSC has carried out activities to encourage business and engineering schools to use the cases. They work with professors, communicating with them to convince them of the value and importance of building OSH businesses cases into their programme. In addition to encouraging professors to use the cases, the NSC aims to get them to provide the NSC with the students' reports about the cases and to encourage professors to share the cases. Some professors have sent student reports.

Events are organised to promote the aims of this initiative. For example, on April 24, 2007, in Taipei, Taiwan, an event called 'Meeting with key business schools for integration of *Campbell Award Business Case Series* into curricula', was hosted by the Institute of Occupational Safety and Health, Taiwan.

In the future, the NSC wish to engage more business schools to incorporate the awarded cases studies into their courses. They planned to attend the Professor Forum in 2007 to engage more professors and get more feedback about how professors are going to use the cases, what part they are going to use etc. The NSC will also organise the Professor Panel in Germany, hosted by German global partner BG Chemie.

Outputs

The NSC have used the award to produce resources which include a DVD for use in business/engineering schools. The DVD includes a video prologue for professors, which introduces the background, goals and ideals of the Campbell Award and a set of class materials related to the Noble Corporation case. The class materials can be used in ways that the professors see fit to encourage their students to explore the topic. Teaching notes focus on students being encouraged to question and debate in order to make business decisions.

The DVD includes:

Two videos:

- Welcome to Noble Corporation; and
- Interview with Noble Corporation CEO, James Day.

Three documents:

- Project Windmill Business Case Study (pdf document);
- teaching notes; and
- Noble Corporation Project Windmill (PowerPoint presentation).

Teaching notes

Teaching notes have been designed to assist in stimulating debate as well as teaching. The teaching notes start with the list of following key learning points:

- oil and gas drilling industry is risky;
- Noble seeks to reduce risk through outstanding SHE management and rigorous operating discipline;



- reputation is a key asset;
- profit chain (causal framework);
- culture at Noble is a source of long-term competitive advantage;
- organisational change and Noble's dynamic '7S' organisational strategy -Strategy, Structure, Systems, Staffing, Skills, Style, Shared values. Company operations have been modified overtime - land to offshore to deepwater - so therefore some of its 7Ss strategy components had to change (systems, skills, staffing, etc.) while others stayed the same (shared values, style, structure) and that provided certainty and security during change; and
- excellent implementation of strategy leads to high shareholder value (superior stock returns)

After the learning points, the recommended case discussion development is presented. The structure for the Noble case is as follows:

1. Start the class by taking a vote:

- a. How many of you recommend that Noble acquire Neddrill?
- b. How many of you recommend against the acquisition?

2. For those of you recommending against the acquisition: arguments for this:

Be sure to allow those in favour of the acquisition to engage in this discussion. Simply get it started by asking those against it to outline their concerns.

Capture the main ideas for/against on the whiteboard/chalkboard in class.

3. After this discussion, are there any of you who want to change your vote?

- a. If so, what new ideas persuaded you?
- b. What arguments seemed most compelling?

4. Show the video 'Welcome to Noble' (7:72 minutes)

5. Use the PowerPoint presentation 'Noble Corporation - Project Windmill' to discuss the following:

- a. Noble's 7Ss - Strategy, Structure, Systems, Staffing, Skills, Style, Shared values.

Students learn how to use Noble's 7Ss to assess and analyse organisations. This will also lead to discussion for example, how SHE interacts with other business values and how significant a role SHE plays in companies' overall well-being and sustainability.

- b. Noble's results post-acquisition (1998-2004) and in comparison with competitors/ industry (1998-2004) in the following areas: SHE; operating results; profitability (return on capital); shareholder value (dividends, appreciation).

6. Show the video 'Interview with Noble Corporation CEO, James Day' (6:45 minutes)

7. How could the lessons learned from Noble be extended to other industries and organizations?

Finally, the notes include the recommended questions to guide student analysis, such as: "What are the risks inherent in the oil and gas drilling endeavour?"; "How



does Noble seek to reduce these risks?"; "How does the SHE culture at Noble create competitive advantage?" etc.

Professors may also use only part of the material, improvising and developing their own teaching notes. Some professors have successfully done this.

Results and evaluation

Through their partnerships with business schools, the NSC hope to influence current and future managers in their understanding of the role that safety, health and environmental concerns play in the productivity and sustainability of their organisations and to promote SHE as a critical principle of business excellence.

Formal evaluation is still under way, but the NSC have obtained feedback from professors and some professors have sent them student reports. The feedback from professors and from students has been very helpful and they have made useful recommendations by, for example, including key references in the teaching notes.

The case studies can be used both at the undergraduate and MBA level. However, undergraduates have felt that the Noble case is too challenging for them and that the Johnson & Johnson case would be more suitable for the undergraduate level. The Noble case was found especially suitable for engineering studies and these students have internalised health and safety messages well.

It is hoped that as more cases are added, there will be more variety in teaching and alternative cases for the lecturers.

NSC have subsequently worked in partnership with national OSH institute NIOSH and the Williams College of Business at Xavier University to develop a course for MBA students - 'Business Value of Safety and Health'. Many of the case studies used on the course come from the Robert W. Campbell Award (see snapshot 12 - Partnership to develop a business course).

Problems faced

The biggest problem in this initiative was to attract the support and commitment of the professors. Business school professors are the most difficult to convince about OSH. The professors run their own enterprises and they are independent thinkers. Therefore they had a long list of priority topics that are related to their own discipline.

Moreover, the professors also have pressure to publish to generate funding and to obtain recognition for academic credits. An additional problem was that they knew little about health and safety. However, health and safety is intuitive and easy to associate. Once the professors realised the inter-connectivity and the dynamics between health and safety and other business functions, they could see the large picture and understand how health and safety can impact on business excellence and sustainability.

The problem of convincing professors applies also to Europe. A recent study published by HSE (2007) showed that MBA staff tended to think that occupational health and safety was vitally important in major hazard industries but a bureaucratic, legalistic imposition for most other organisations. Even where they recognised that occupational health and safety was an important corporate goal, business educators had not fully made the link between safety management and the management skills taught on MBA programmes. They questioned the academic rigour of the subject, and did not perceive occupational health and safety as a topic worthy of inclusion in a postgraduate course.



Success Factors

High-quality cases to demonstrate the importance of integrating OSH into business management

In the UK HSE study (HSE 2007), the development of high-quality case study materials that meet the needs of business schools for the presentation of 'core' subjects was presented as essential. These case studies should incorporate more explicitly the challenges of occupational health and safety management. The objective would not be that MBA students graduated with a plethora of occupational health and safety facts and figures; rather that they left with a clear recognition that occupational health and safety should be managed with the same determination, and with the same insights, as any other key business objectives. The Robert W. Campbell Award produces exactly this sort of material.

A variety of cases

It is important to have a variety of relevant cases for teaching and that the cases are robust. The award has categories for enterprises with over 1,000 employees and under 1,000 employees. Awarded companies also differ in many other ways (by sector, industry etc.).

Rigorous assessment process involving partnership

To obtain top cases the award has to be widely promoted and the assessment process has to be rigorous. The 21 global partners cooperate in the promotion of the award, the comprehensive expert review process and disseminating the results. For example, they: host regional and national events to increase awareness of the award; mobilise national and/or regional businesses, universities, and the media in promoting the award; work with regional and area offices to promote participation in the award; identify potential applicants for the award, and promote and encourage qualified companies within their network to participate in the award; nominate candidates to serve on the international panel of reviewers; and disseminate the award's winning case studies and publicise their results.

Adherence to business school teaching format and flexible use of resources

The teaching resources based around the awarded cases were developed to follow the format used by top business schools. The resources offer flexibility as the professors can modify the materials if they wish. Introductory material for professors is brief and as such it suits busy professors well.

Strong link to real-life and practical approach

The initiative is strongly connected to real-life business and utilises a practical approach. Professors and students want real-life material that is formulated in business language terms and about business, not abstract information on OSH. The materials on DVD are clear, interesting, well designed and help to engage students in discussion.

Direct engagement of professors

NSC works directly with professors to 'sell' the relevance of OSH and the resources to them. In the first place they developed the resources in close cooperation with professors and they continue to promote their use through contact with individual



professors. They then encourage their feedback and for them to participate in the dissemination process by getting them in turn to share the OSH cases with colleagues.

Transferability

The winning case studies could also be used in teaching in business and engineering schools in EU countries. However, some amendments may be needed as materials may partly be specific to the US context in terms of policies and legislation.

As this award is international, EU companies and authorities could also apply to be global partners to mobilise universities and to disseminate the award's winning case studies and publicise their results. At the moment only one of the 21 global partners (BG Chemie, Germany) is European.

The results of awards that are already being run in some Member States could also be used in this way.

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MULTIMEDIA EDUCATIONAL PACKAGE ON OSH ISSUES, POLAND

3.8.

Central Institute for Labour Protection – National Research Institute (CIOP-PIB)

Key points:

- multimedia educational materials on OSH issues aimed at tertiary education: work knowledge – safety, health, ergonomics;
- materials available in two versions: for teachers and for those who want to study on their own; and
- the package is available on CDs (accompanied by special software and a manual), via the Internet (free of charge) and as printed textbooks (each of the eight textbooks is accompanied by a CD).

Introduction

The Central Institute for Labour Protection - National Research Institute (CIOP-PIB) conducts research and development work in the field of labour protection related to occupational safety, health and ergonomics. One of the tasks carried out by the Institute is the production of educational curricula and teaching aids for the national education system. In order to meet an identified need for up-to-date OSH resources for the tertiary level education, CIOP-PIB prepared a multimedia educational package, *Work knowledge – safety, health, ergonomics*.

Background

The increase in SMEs, the need for workplaces to comply with the new OSH legislation arising from EU directives, and a growing awareness about the importance of OSH, are among the reasons why the demand for OSH-educated graduates has increased in Poland, and why the importance of providing OSH education in general has increased.

In the Polish system of tertiary education the scope of educational programmes for particular faculties is defined by the Main Council of University Education and is ratified by the Minister of Science and Higher Education. In the last two decades Poland has experienced dynamic changes in university education. The development of non-public universities as well as the autonomy in creating educational programmes has resulted in differences in the programmes included in tertiary education as regards safety and health issues. Generally, occupational safety and health issues at universities are taught through:

- obligatory training sessions for the first-year students;
- obligatory lectures and tutorials on ergonomics, occupational safety and health, legal protection of labour etc.;
- the inclusion of OSH issues in the content of specialist subjects; and
- post-graduate studies in OSH at some technical universities.

Prior to the year 2000 the boards of universities and academies had expressed their concern about a lack of suitable didactic materials concerning OSH for use at



university level. The shortage of such materials was often the reason for the neglect or marginalization of OSH issues in teaching programmes. To solve the problem the Central Institute for Labour Protection in collaboration with university teachers developed model programmes of OSH education tailored to several university profiles: technical studies, human and social studies and medical studies. Taking advantage of modern technologies CIOP-PIB developed the resources as a multimedia educational package for tertiary education purposes.

The task was carried out within the framework of two long-term governmental programmes which are coordinated and conducted by the CIOP-PIB - *Safety and health protection of man in the working environment* and *Adjusting working conditions in Poland to the European Union Standard*.

Aims and objectives

- To provide high-quality didactic materials in the field of OSH to fulfil the needs identified by university boards;
- To develop user-friendly materials that could serve as a support for teachers, who are obliged to include OSH issues into the teaching programmes; and
- To maximise the use and flexibility of the resources and make them accessible to as many users as possible. A multimedia format was chosen and both printed textbooks and an electronic version of the package were developed.

Scope

In 2000 CIOP-PIB completed its works on the educational package aimed at tertiary education. This interactive multimedia educational tool entitled 'Work knowledge – safety, health, ergonomics' was designed to serve as a support for teachers as well as a source of OSH knowledge for self-learning students. The programme comprises a 60-hour course and is tailored to three education profiles: technology and extractive sciences, natural and medical sciences, and social sciences. The whole package is organised in eight independent thematic modules: *Ergonomics – basics*, *Legal protection of work*, *Anthropometrical and biomechanical factors*, *Physiological factors*, *Psychological and social factors*, *Risks related to dangerous and hazardous substances in the workplace*, *Diagnostics and design of anthropotechnical systems*, *Managing OSH*.

Each module is an active tool for supporting academic teachers and can also be used for self-study. The package contains text books, dictionaries, exercises and PowerPoint presentations available as traditional printed materials as well as a multimedia package. The materials are available on CD and via the internet. The multimedia version allows texts and presentations to be printed, the preparation of one's own presentations and the assessment of acquired knowledge. The materials are available to all universities. The multimedia version was also included in the system that supports distance learning in the 'Learning Space'. Through this system the CIOP conducts education via the Internet on 'Ergonomics and occupational safety' for students of technical universities.

The package provides an important tool for lecturers to use when covering OSH issues in their standard lectures within the teaching programme. The multimedia educational package is available in two versions – one for teachers that supports didactic process, the other for individual students that facilitates self-studying.

Each of the thematic modules includes the following elements:

- **Source text** combined with a drop-down index. The source text is composed of hierarchically-titled parts. It contains pictures, transparencies and tables, animations



that are activated by icons, links to bibliography and to dictionary terms defined in the particular thematic module;

- **Teacher's guide** – conspectus including documents on particular thematic modules – a general module card and a card with specific parts within the module. It includes exercises, tests, methodological hints, an index of relevant slides, bibliography, etc;
- **Dictionary** – covers terms introduced in the source text, with relevant definitions and links to a source text;
- **Set of slides** (pictures, tables, animations and text slides) that is connected to the source text, containing relevant links and combination of optional comments; and
- **Set of videos, video clips.**

The multimedia version of these materials is designed for conducting different training sessions which provide general knowledge on occupational safety and health, and to enable the preparation of didactic materials. The videos help to illustrate lectures, identify hazards at workplaces and conduct occupational risks assessment.

Results and evaluation

The growing demand for electronic multimedia didactic materials in Poland including in the OSH field and the relatively poor availability of such OSH materials in Poland was one of the factors that contributed to a successful welcome for the package.

The common availability of the multimedia educational materials as well as their transferability and possibility of using them during lectures, trainings etc. are positive factors that contribute to the growth of OSH awareness among students and among employers and employees. The package is regularly up-dated and modernised: in 2004-2006 a significant verification of the source material took place, and video clips and films were added.

The latest electronic version of the materials can be downloaded free of charge from the website of the Ministry of Science and Higher Education. An official letter was sent to all universities to present the OSH educational package and inviting them to include it in their teaching programmes. The expected outcome of the project is a greatly improved knowledge on occupational risks and constantly growing awareness of OSH issues among university graduates.

Problems faced

The multimedia form of education could come up against some obstacles relating to the programme's technical requirements. For example, not all the universities can provide a sufficient number of computers with the relevant software for the classes or sufficient internet access. Another possible problem in some public or non-public universities concerns the lack of well-prepared lecturers to teach about OSH issues.

Success Factors

It was important that the development arose out of a need identified by universities and that they were involved in the development process. It was developed to support a teaching process that was already taking place. It was important that the development was part of a larger strategy on OSH and OSH education development and that it was supported by the Ministry responsible for education.

The package comprises unique material approved by many specialists, which serves as a guarantee for quality and relevance.



The package has flexibility. It can be used both in e-learning systems and during standard lectures at universities. The division of the material into independent modules provides individual choice over the use of study themes and their sequence. Students can use this package for self-study and be sure that they do not miss anything from class.

The electronic version of the programme is free of charge, making it available to anyone who has access to a computer and the internet. Having it on the Ministry of Science and Higher Education website makes it openly available and provides easy access.

Transferability

Even though it was designed primarily for tertiary education environments, this resource can also be used by others, including institutions, companies and individuals. The scope of issues included in the package could be easily adapted to other environments, also in other countries. Obviously some legal requirements and solutions typical for Polish system would not be relevant elsewhere. Nevertheless the multimedia form, the methodology, as well as the layout of transparencies, tests, and the choice of terms in the dictionary could be transferred.

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3.9. LEARNING BY DOING, PORTUGAL

Department of Mechanical and Industrial Engineering (DEMI), Faculty of Sciences and Technology, New University of Lisbon (FCT/UNL)

Key points:

- experiential education;
- students encouraged to choose an OSH theme for course dissertation;
- practical work forms part of the assessment;
- students 'teach' students; and
- adoption of new OSH legislation with requirements for OSH competence provided the impetus for developing OSH courses



Key elements:

- engineering, chemistry, industrial courses;
- undergraduate and masters;
- postgraduate OSH courses for OSH technicians;
- lectures, active learning, student presentations, field visits, case studies;
- compulsory course for Industrial and Geological Engineering courses; and
- university-based specialist OSH teaching staff.

Introduction

DEMI (Department of Mechanical and Industrial Engineering) is part of the Faculty of Sciences and Technology in the New University of Lisbon (FCT/UNL) in Portugal. It provides OSH teaching programmes on engineering courses in other engineering disciplines as well as providing a stand-alone postgraduate OSH course for engineers. Their approach to the development of OSH knowledge and skills includes students performing an analysis of OSH interventions in real work environments and discussing the adopted methods and the expected results.

Background

DEMI became involved in OSH education at the end of the 1990s. The impetus for developing OSH courses came from the requirements of national OSH legislation, arising from European Directives, for competent persons to carry out certain OSH tasks. The legal requirements in Portugal for carrying out OSH functions in the workplace are in the *Decreto-Lei n° 441/91*.

Aims and objectives:

- to raise engineering graduates' awareness of safety and health issues;
- to generally provide the knowledge and develop the skills required to perform basic risk management and control activities; and
- to provide expert knowledge and develop the skills required to perform advanced risk management and control activities, for the Certified OSH Technicians.

Scope

The DEMI OSH teaching programmes includes:

- a curriculum designed to develop safety and health awareness in engineering undergraduates;
- a postgraduate course on OSH, which is accredited by the Portuguese Institute for Safety; Hygiene and Health at Work (ISHST); and
- a compulsory OSH course within the Master of Science in Industrial Engineering programme.

The targets of DEMI's OSH educational programme at undergraduate level are, among others, students of chemical, industrial, materials, mechanical and mining/geology engineering courses. OSH is a mandatory topic in industrial and mining/geology engineering and optional in the other engineering courses.

For the postgraduate level OSH course the target population is engineers, but the degree is also open to other professionals aiming to work as 'competent persons' on OSH and carry out OSH responsibilities within companies. In Portugal, the OSH competence in terms of level of study required and qualification is specified in law (*Decreto-Lei n° 110/2000*).



In the course on occupational safety and health for engineering undergraduates, besides the traditional classes, students are encouraged to carry out research in the field of OSH and to apply their knowledge to the analysis of real work situations. In an initial phase of the course, groups of students have to deliver scientific revision papers which are presented to the entire class and discussed. These papers must reflect different OSH issues.

During the practical classes the students must:

- apply different manual and computer-based calculation methods, for instance for the estimation of work accident statistics, for the risk assessment of manual materials handling, or for the definition of the number/type of light sources to adequately illuminate a workplace (considering the task performed);
- perform risk analysis on examples of real-world working situations that have been recorded on video; and
- use measuring equipment employed in the OSH assessment of the work environment, such as sound level meters, luxometers, hazardous substance detectors, explosive meters or accelerometers.

Students have to present reports with their findings and a critical analysis based on the Portuguese and EU legislation.

The programme includes field visits to companies and work sites.

The students are also encouraged to present their final course dissertation on OSH subjects. Final course dissertations on OSH have included:

- occupational noise evaluation;
- application of the safety and health pillar of the TPM methodology on an ice cream production line ; and
- risk analysis in a supermarket.

The postgraduate level programme on OSH expands the scope of subjects taught in the under graduate level. This is a one-year programme. Both the theoretical and the practical components are extended in duration and in depth.

The OSH postgraduate course is only completed after the discussion of a final report regarding the OSH activities developed during a period spent in companies, where the students work as trainees. Final reports regarding OSH have included:

- risk analysis in a pharmaceutical company;
- exposure to hand-vibration during the use of pneumatic and electrical tools; and
- accident prevention in a construction-sector company.

On successful completion, the student becomes a Health and Safety Qualified Professional (level 5 qualification).

Results

Because of the high market demand for OSH technicians, students are highly motivated, particularly regarding the postgraduate programme. For this programme, the high number of candidate students allows some level of selection, ensuring high-quality results. Some of the best course work done by the students has been published as papers and presented at OSH conferences.

Over the last five years over 100 students have completed the OSH postgraduate course and are working in the field. The feedback provided by the students on the quality control process shows that former students feel they are well prepared and



that the knowledge and skills acquired have direct application to the real-world situations that they face.

Problems faced

The postgraduate students often complain about the level of work required. The programme is taught in the evening, after work, and all the students are OSH professionals with responsibilities. They have four hours of classes per day, three days per week. The assessment is continuous, which requires students to balance daily study effort with professional activity at their companies.

Success factors

- Having OSH expertise on-site within an engineering department to provide the teaching.
- Linkage to a qualification. The course answers the need for the education of expert human resources, bridging a gap that was opened by changes in European and National legislation. The law precisely specifies the OSH studies a person must have to carry out OSH functions in the workplace and the undergraduate course module contributes towards this, and the postgraduate programme leads to the necessary qualification.
- Both OSH undergraduate courses and the postgraduate programme are oriented to real work situations, and are closely connected to the reality within companies and use many practical examples.

Transferability

The same approach could be used by other educational institutions.

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OVERVIEW OF THE INCLUSION OF OSH COURSES IN PORTUGUESE UNIVERSITIES, PORTUGAL

3.10.

Portuguese Universities

Key points:

- adoption of new OSH legislation with requirements for OSH competence provided impetus for developing OSH courses;
- widespread inclusion of OSH in engineering courses; and
- teaching methods of lectures combined with practical work.



Key elements:

- engineering courses;
- undergraduate modules;
- postgraduate OSH programme for OSH professionals; and
- active learning and case studies.

Introduction

Changes in European and National legislation regarding OSH and OSH competence raised the demand for people with knowledge and skills in OSH matters. The National legislation specified in more detail what the training requirements are to carry out certain OSH tasks (for example, to work as an OSH technician). Below is given a general overview of how OSH is included in Portuguese University programmes.

Background

The introduction of measures to encourage improvements in the safety and health of workers at work at European level in the 1989 European OSH 'Framework' Directive triggered the adoption of new national legislation. This led to the development of educational programmes to provide the education and training required for compliance with the new obligations.

Portuguese Universities contributed to this process by incorporating OSH courses into their undergraduate curricula. The challenge is to ensure that all engineering graduates have some OSH knowledge, even if they will not act as OSH technicians, because this will make the job of the OSH professional easier and help with the development of a safety culture in Portugal.

The Portuguese Universities also began a postgraduate programme on OSH, which leads to a Health and Safety Professional Qualification (Level 5). The curriculum is established by law (*Decreto-Lei nº 110/2000*).

Aims and objectives

- To offer education programmes that raise the awareness of safety and health issues and develop the necessary skills in students.
- To promote improvements in the safety and health of workers at work by having human resources with expertise in OSH activities.
- To support the provision of OSH training required by legislation.
- To promote OSH education for all engineering undergraduates, not just those who seek a professional career in OSH.

Scope

Following the legislative changes Portuguese Universities increased the courses they offered regarding OSH matters.

In Portugal there are around 25 Universities and 15 Polytechnic Institutes. Most of the engineering undergraduate curricula include modules/courses on OSH. These modules, some of which are compulsory and some optional, are aimed at raising awareness about the need for safe and healthy working conditions and providing students with the basic means to assess the workplace and implement solutions that reduce the risks. The teachers are OSH specialists, usually professors with a PhD in the OSH area.



In addition, there are at least four specific undergraduate programmes on OSH (*Instituto Piaget*⁵, *Instituto Superior de Educação e Ciências*⁶, *Instituto Superior de Línguas e Administração*⁷, *Instituto Superior da Maia*⁸), and one on Ergonomics⁹ (*Faculdade da Motricidade Humana*). These programmes provide advanced studies in OSH-related interventions.

Some engineering undergraduate programmes, like the ones offered by the *Universidade do Minho* (Minho University) and the *Universidade Nova de Lisboa* (The New University of Lisbon), combine both OSH and Ergonomics on their curricula. At postgraduate level there is a significant amount of OSH programmes on offer, ranging from Masters' courses to PhD programmes.

In general terms, the scope of the OSH undergraduate courses is to provide awareness and knowledge about OSH issues as well as to develop skills and provide practical working tools for the assessment of hazardous working conditions, and the implementation of preventive measures. The course does not lead to a recognised OSH qualification. It covers:

- work accidents – causes and prevention;
- organization of the safety in companies; and
- Portuguese and European legislation.

While the curricula of the OSH undergraduate courses vary in content and duration, common characteristics include the inclusion of:

- theoretical classes;
- practical classes, using software, solving problems and practical cases, and laboratory;
- visits to companies; and
- conferences presented by external OSH experts.

Most OSH laboratory equipment includes didactic and measuring equipment regarding:

- noise;
- luminance;
- thermal comfort;
- vibration;
- atmospheric contaminants;
- radiation;
- fire;
- electricity; and
- individual protection equipment.

According to the law, the curriculum of the Health and Safety Qualification Professional (level 5) has a minimal duration of 540 hours. It has two parts. The first, around 420 hours, should include the following fundamental contents:

- statistic and reliability;

5 <http://www.ipiaget.org/>

6 <http://www.universitas.pt/>

7 http://www.santarem.unisla.pt/index.php?option=com_content&task=view&id=126&Itemid=264

8 http://www.ismai.pt/NR/exeres/C5C68950-F543-4EF6-8F77-D93B7F81BF7C_frameless.htm

9 <http://www.fmh.utl.pt/>



- legislation;
- management organisation;
- management prevention;
- risk analysis and control;
- emergence organisation;
- occupational hygiene;
- safety;
- ergonomics;
- occupational psychology;
- information and communication technologies; and
- design and management training

The second part, around 120 hours, consists of practical work developed carried out in a company.

Results

The OSH courses and programmes provided by Portuguese universities are answering the need for education of expert human resources, bridging a gap that was opened up by changes in European and national legislation regarding the improvement in the safety and health of workers at work.

Currently there is still a difference between the supply and the demand of qualified OSH technicians. This means that the need for OSH education has not reached a steady state and that existing OSH technicians have good career opportunities.

Success factors

In order to ensure the quality of the education provided and of the qualifications acquired by the students, the courses that produce accredited OSH technicians have to be certified by the National Portuguese Institute for Safety, Hygiene and Health at Work (ISHST).

Current lack of personnel with the legally-required qualifications to carry out OSH functions motivates students to study OSH.

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'PROGRAMA UNIVERSITAS' FOR OCCUPATIONAL RISK PREVENTION, SPAIN

3.11.

University of Salamanca

Key points:

- information and dissemination in the form of campaigns aimed at students and recent graduates;
- a web-based portal approach with resources, news etc. to raise OSH awareness and convey information about best practices;
- CD given to all new graduates;
- aimed at all students and not course-specific;
- specialist masters' OSH course leading to official OSH technician qualification;
- new OSH legislation provided the impetus; and
- partnership approach to develop campaign programme.

Introduction

To comply with EU requirements new Spanish legislation regarding occupational risk prevention came into force at the end of 1995, and the legislation that governs the Prevention Services (RSP) was introduced at the beginning of 1997. Legislation covers the OSH competency and training needed to carry out certain OSH tasks and the related OSH qualifications and Senior Safety Technicians must now obtain their qualification by taking a recognised master's degree. The University of Salamanca is one example of a university that has developed such a master's course. At the same time, with the support of the Castilla y León regional authority, it has developed a programme aimed at all students based on an internet portal where the registered users have access to OSH-related materials and tools.

Background

The changes in European and National legislations regarding OSH raised the demand for human resources with the required knowledge and skills in OSH matters and created the opportunity for the University to develop its teaching in this area and obtain the support of other partners. National regulations for prevention services (*Real Decreto 39/1997*) set specific training requirements (hours and content) for conducting risk assessment activities and prevention actions. The regulation sets three competency levels with related functions:

- basic level functions – 30-50 hours of training;
- intermediate level functions – 300 hours of training; and
- higher level functions, corresponding to the preventive specialities and disciplines of industrial medicine, health and safety at work and applied ergonomics and psychosocial risks – 600 hours of training.

In order to perform the higher level functions, a person must have a university degree qualification and have completed a recognised course to become a senior safety



technician, which complies with the training specifications for content and hours of teaching set in the regulations. A similar approach of concrete training requirements established in legislation exists for personal to be able to carry out safety functions under construction safety legislation.

The University of Salamanca has developed a master's course to provide the accredited training for the higher level functions which leads to the qualification of senior OSH technician, while taking the opportunity to promote OSH and raise awareness about it more broadly among students.

Aims:

- To offer a master's course leading to an OSH technician qualification, compliant with national law.
- To promote a preventive culture among all university students and graduates.
- To develop and promote option course modules on OSH.
- To provide web access to materials to support the above.

Scope

Related to, but separate from, the master's course on occupational risk management course they were developing (see box), the University of Salamanca set up the University's Occupational Risk Prevention Programme (*Programa Universitat de Prevención de Riesgos Laborales*) with the support of the *Fundación General* and the *Dirección General de Trabajo y Prevención de Riesgos Laborales/Junta de Castilla y León*. The *Fundación Mapfre* was also involved. Mapfre is an insurance company. The university also used the European 'Safe Start' campaign to help gain support for the initiative and to help promote it.

The *Programa Universitat*, targeting the university's graduates and students, is based on an internet portal where the users have access to a network of resources that contain material relevant to the OSH campaign.

The activities within the programme to promote a culture of prevention have included the following:

- development of 'You'll work safely' - a hybrid resource for multimedia delivery. It includes a CD-ROM and a web portal (<http://www.prevencionuniversitas.com>); the CD-ROM has been handed out to recent graduates;
- development of 'You'll practise safely' - a diverse range of materials (files, flyers, cards etc.), particularly aimed at those required to do practical laboratory work as part of their course; and
- training and information seminars and courses. This includes optional OSH course modules which are worth two credits.

They have also collaborated with the University's Health and Labour Relations section.

The Internet portal (<http://www.prevencionuniversitas.com/>) is restricted to registered users. It provides access to a comprehensive range of documentation regarding safety and health at work at European, National and Regional level. This documentation includes, for instance, legislation, regulations and standards. The main contents were provided by the National Institute for Safety and Health at Work and by the Regional Occupational Risk Prevention Directorate, but also include information provided by other public and private entities.



The portal also announces events and makes available news and OSH-related magazines that can be accessed online or downloaded. These media documents are provided by different entities, for example, governmental, trade unions and insurance companies.

The portal offers links to sites where the users can find practical tools made available by other organisations. Some of these tools are free to download while others require some type of registration at the destination sites. Users also can find OSH-related employment offers via the website.

The university is also involved in vocational training: OSH Professionals' Regional Forum for Prevention.

OSH Official Postgraduate Courses

Master in Occupational Risk Management

Master in Construction Safety Management

PROGRAMME STRUCTURE (60 ECTS credits)

- Common part (Obligatory and common subjects established in national regulations and other complementary matters) (43.5 ECTS credits):

Fundamentals of the Techniques for Improving Working Conditions 2 ECTS credits

Safety at Work 7 ECTS credits

Industrial Health 7 ECTS credits

Occupational Medicine 2 ECTS credits

Applied Erg, and Psych. 4.5 ECTS credits

Other activities on the subject of the Prevention of Risks at Work (Training and Communication, Information and Negotiation Techniques) 3 ECTS credits

Management of the Prevention of Risks at Work 6 ECTS credits

Legal scope of prevention 6 ECTS credits

Similar techniques and complementary subjects 6 ECTS credits

- Specialisation (Safety at work-generic- or Construction safety at work) including performance of preventive activities in working environment (16.5 ECTS credits)

More information available at http://www.dguv.de/bgag/de/veranstaltungen/tundi/2007/_dokumente/cordero.pdf presentation at Training and Innovation Conference, Dresden July 2007.

Results

While no substitute for in-course OSH modules, the use of an internet portal is a convenient way of making OSH information and tools generally available to university students. In this case the resources are available to all students and graduates, at the same time as having them available as a resource for the optional OSH modules and laboratory safety training.



Success factors

- New legislation requiring OSH technicians to require a university-level Masters degree in OSH provided opportunities for other, broader initiatives.
- Partnership – again with the legislative requirements providing an opening to raise the issue with partners about a broader approach and the opportunity to create this inter-institutional project. The European Campaign ‘Safe Start’ was also used to attract support.
- The University has OSH expertise onsite.
- The use of information systems technologies is growing in number and variety of applications and is a convenient way to reach people, especially at university level, both for conveying information and also to make available e-learning programmes.

Transferability

The same approach could be used by other educational institutions.

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Additional information

Learning about OSH: a seminar on occupational health and safety and education, 4-5 March 2002.

<http://osha.europa.eu/en/topics/osheducation/proceedings/19spainuniversityeduc.ppt>

http://europe.osha.eu.int/publications/reports/310/learningosh_en.pdf

Training and Innovation Conference, Dresden July 2007 http://www.dguv.de/iag/de/veranstaltungen/tundi/2007/_dokumente/alvarez.pdf



CHEMICAL ENGINEERING STUDENTS TEACH EACH OTHER OSH, FRANCE

3.12.

Ecole nationale supérieure de chimie de Rennes (ENSCR)

Key points:

- a compulsory part of chemical engineering courses;
- students are creators and players in their own occupational health and safety training. The approach is applied to a whole class;
- the teaching method has evolved with each academic year so as to improve it and adapt to students' needs as well as possible;
- a project approach using real case studies;
- results placed on a CD-ROM and there is also complementary online information; and
- partnership with health insurance fund and national OSH institute.

Key elements:

- chemical engineering;
- compulsory;
- student participation;
- real case studies;
- partnership; and
- online information.

Introduction

At the chemical engineering school *Ecole nationale supérieure de chimie de Rennes* (ENSCR) the students themselves give the lectures on basic occupational and industrial risk management knowledge that forms part of the course. The method has proved effective and popular for the acquisition of knowledge by the future engineers.

Background

A member of the Gay-Lussac Federation (FGL)¹⁰ and the *Conférence des grandes écoles*, the ENSCR is a chemical engineering school which aims to provide engineers with training that takes into account risk management through to occupational health. Instruction in safety and industrial risk management has always formed part of the graduates' training, being viewed as essential for engineers. However it became apparent that training methods needed to be changed to increase the students' active participation in the OSH learning process.

For its part, the Occupational Risks Department of the regional health insurance fund (CRAM) for Brittany has been working for many years in partnership with the higher education system (engineering schools, universities, etc.) to enable learning, as far

¹⁰ The FGL is a society formed of all the chemistry and chemical engineering schools in France.



upstream as possible, of the fundamentals of occupational risk prevention by future corporate executives.

Aims and Objectives:

- To initiate future engineers, during their course at *Ecole nationale supérieure de chimie de Rennes*, in OSH and the prevention culture.
- To introduce active learning and participative methods.
- To relate the learning to real-work situations.

Scope

The project began in 1997. At the instigation of the *Conférence des Grandes Écoles* and the *Commission du Titre d'Ingénieur*, the ENSCR began thinking. The content of the training course had to be organised to increase the students' involvement.

By agreement with the consulting engineers of the CRAM fund, the school committed itself to a project instruction method based on case studies. The programme was begun with second-year students. They had acquired basic knowledge in their training course as engineers and were preparing to choose their specialist training programmes. In the first year of the engineering training cycle they had already experienced group working, under the responsibility of a project manager.

With the help of the CRAM fund, the school selects topics that can be seen in enterprises. Examples include: paints and substitute products; core treatment of wood and new derivative products; the polyester industry; glycol ethers; the OHS manual; the food processing industry; and design of workplaces, etc., with a total of more than fifty memoranda and case studies.

For each case to be studied, a group of students is formed. It has the task of investigating the issues in the light of the legislation and studying the risks related to the product and the trade. Once the case study has been written, the quality of the report is assessed by the school's Director of Industrial Relations, in cooperation with the consulting engineers and technicians of the CRAM fund. Then the students present their report to the entire class followed immediately by a debriefing session coordinated by a representative of the CRAM.

Students were enthusiastic about the project from the beginning. It enabled them to work differently, take initiatives, leave the school to meet the partners, in particular the CRAM, and become familiar with the industrial environment, enterprise safety managers and the CHSCTs (committees for health, safety and working conditions). However some disadvantages of the scheme soon became apparent: the difficulty of finding new study subjects; and students' investment only in their own research despite the reports given to the whole class. So to ensure the continuity of these teaching measures, they had to evolve.

A new instruction module needed to be established, that would be as comprehensive as possible, coherent and not take up too much space in the already dense second-year programme. Therefore, with the help of national institute INRS¹¹, a training programme over a cycle of 18 hours is being worked out, to provide the necessary basic knowledge of work-related risks.

¹¹ Since 1996, the French national research and safety institute INRS has encouraged the establishment of thematic networks bringing together the representatives of engineering schools, CRAM funds, other institutions and enterprises.



From 2002 on, twelve project task forces have taken over responsibility for the twelve sections of the programme. They review the content of each course, draw up a paper document and change the examples, always in conjunction with the CRAM and INRS.

In 2003 a new element was added: online publication of the courses on the school's intranet. Allowance had to be made for changes in learning materials and techniques, in particular with the support of information and communication technologies applied to education. In parallel to this online publication, the students still provide lectures. A hard-copy document submitted to each student enables them to follow the course and retain the essential aspects of each section. An evaluation questionnaire is used to check the knowledge acquired.

The project then continued in 2006: students worked on making the presentations uniform and took part in outings to illustrate the lectures, always under the supervision of the CRAM engineers and technicians. Each graduate can now receive an updated CD-ROM containing, in addition to the courses and examples, relevant bibliographic information and links to useful websites.

At the CRAM fund for Brittany, their commitment to the project has been reinforced in the medium-term guidelines for 2005-2007, with a view to providing skills transfer to resource teachers to relay occupational health and safety instruction to the students.

Results and evaluation

Active student participation in their own training appears to be a very appropriate education method for occupational health and safety.

The successful implementation of this approach is the result of a partnership between various stakeholders, in a spirit of cooperation, especially between the ENSCR and the CRAM fund.

In addition to the strong involvement of the engineering students already mentioned, they have expressed high levels of satisfaction on completion of their projects. The subject interests them and they enjoy it.

Problems faced

At the end of the first year of the experiment, it became apparent that a number of aspects should be altered to be able to sustain the initiative, in particular: difficulty of finding new study subjects, students' investment only in their own research despite the reporting to the whole class. The instruction module was therefore changed to tackle these issues and ensure that the initiative could be continued in the following years.

Success factors

The key factors in the success of this project are as follows:

- the approach is applied to a whole class: every engineering graduate from the ENSCR will have been trained to identify the human, social, economic and legal issues involved in OSH within the enterprise, and to take this aspect into account when managing activities and leading projects;
- the teaching method evolved with each academic year so as to improve and adapt it to students' needs as much as possible; and
- the extensive cooperation between the School and the CRAM fund ensured the success of this initiative.



Transferability

This initiative could be applied in other higher education courses, in engineering schools and universities. It could be applied to students studying subjects other than chemical engineering.

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More information : Travail et Sécurité, N° 09-05, p. 20-22

Pictures : ©Yves Cousson / INRS

3.13. ARCHITECTURAL AND ENGINEERING STUDENTS DESIGN PROJECTS TOGETHER, FRANCE

INRS

Key points:

- multinational students promote multinational learning;
- promotes working together and interdisciplinary collaboration between architectural and engineering students;
- promotes taking account of OSH at the design stage;
- students design own work area;
- full-scale mock-ups are entered into a competition; and
- students are motivated through a competition.

Key elements:

- architects and engineering;
- practical work;
- partnership; and
- real work situations.

Introduction

In 2007, for the third consecutive year, architectural and engineering students were brought together to work for two weeks on the design and production of models of work areas, taking into account comfort, health and occupational risk prevention. In 2007, for the first time since it started, the educational experience was opened to Swedish, Romanian and Brazilian students. As in previous years, and despite the linguistic challenges, the projects showed that the programme had successfully



promoted cooperation between student architects and engineers to design work areas in which safety is factored into projects from the start.

Background

As part of the initiatives over the years by French national research and safety institute INRS to improve the incorporation of occupational risk prevention into the courses provided by schools of architectural, an innovative experiment was initiated. The concept is as follows: for two weeks, around twenty architectural and engineering students, coming from two disciplines which have different cultures, work together on projects for the design of work areas that take into account comfort, health and occupational risk prevention. These designs are then transformed into full-scale mock-ups, which are appraised by a jury consisting of representatives of the professions, the OHS organisations and enterprises.

Aims and Objectives

The objectives of this initiative are to:

- raise architectural and engineering students' awareness of occupational risk prevention and develop their OSH knowledge, especially regarding the design of projects for work areas;
- develop students' ability to take account of health, comfort and occupational risk prevention in project designs for work areas from the very start of projects;
- develop students' understanding and ability regarding interdisciplinary working on projects in order to take into account health, comfort and occupational risk prevention; and
- show students that skills in factoring in occupational risks into projects in the field of design and work equipment are relevant to their career plans.

Scope

This is a partnership project. The initiators, *UTC de Compiègne* and architectural school *Ecole nationale supérieure d'architecture de Clermont Ferrand (ENSACF)* are working with INRS and the Auvergne regional health insurance fund (CRAM).

The architectural and engineering students from the two schools take part in an exercise that is designed to lead them through a joint project for the design of work areas taking into account, from the outset, the concepts of health, comfort and occupational risk prevention. This interdisciplinary approach aims at making future architects and engineers who, in their professional lives, could be designing and building factories and offices, aware of the importance of working together to reduce, as far upstream as possible, the risks to workers.

Each year a specific work area is chosen. The first programme, in 2005, focused on healthcare laboratories, while the following year the focus was on the meat industry. In 2007, the wood processing industry was chosen by the project partners.

Taking the example of the topic for 2007, the wood processing industry, the focus of the exercise goes far beyond just looking at particular risks, such as machinery risks, which are obvious in the woodworking industry. The students were asked to consider work situations as a whole: postures, product flows, movements, processes, lighting, chemical products, noise, dust, etc. Their proposals for improvements had to take into account these numerous factors and assess their impact on work activity in general.



The first two years that the programme was run it was restricted to students of French schools (*UTC de Compiègne* and the schools of architecture of Clermont Ferrand, Toulouse, Grenoble and Paris Malaquais). The 2007 session was opened to engineering and architectural students from Romanian institutions (Cluj-Napoca University and Poly Bucharest) and Swedish institutions (Chalmers University). In addition four Brazilians took part in the students' work. They were already working in their country as consultants and had been sent to France as part of their vocational training by the Parana State Federation of Industry. A total of 34 students took part in 2007.

Firstly the students receive OSH briefings and instruction and then undertake site visits. They then form project groups to work on safety design solutions. Finally full-scale mock-ups are made of the solutions, which are then assessed. There are therefore several stages to this student activity, and the example of 2007 is used to show how it works in more detail:

The students were brought together for the first time on the premises of architectural school ENSACE, *Ecole nationale supérieure d'architecture de Clermont-Ferrand*. This first meeting provided the opportunity to describe the programme in detail and explain the importance of occupational risk prevention as of the building and equipment design stage, in particular by showing the film 'Frequently asked questions, architects' answers'.

On the second day, the students visited two wood-processing businesses in the Cantal region that had been selected by CRAM Auvergne. One had 50 employees, the other 200. For a full day they were the subject of observation and analysis by the students, who had been provided by the project partners beforehand with initial knowledge of the reference fields, note-taking and the measures required for initial analysis of work stations and work situations.

On the third day, after various brainstorming meetings in sub-groups, a number of subjects emerged relating to what had been observed in the enterprises. They were then grouped together to form several themes. Based on this, the students were broken down into six groups – multidisciplinary and multicultural - each having chosen a particular project:

- **The 'flow' group:** working on a system for transport parts at ceiling height so as to free up space on the ground and thereby increase worker safety and comfort.
- **The 'noise' group:** enclosure of noisy machines, taking into account the problem of dust.
- **The 'dust' group:** system for humidification of the atmosphere around dust-emitting machines so as to collect the particulates and remove them under the floor by a water flow.
- **The 'multi-purpose structure' group:** construction of a structure at ceiling height to facilitate flexibility and maintenance while improving workers' health and comfort.
- **The 'work area' group:** setting up of an area to facilitate handling and increase safety.
- **The 'social area' group:** development of a movable, foldable 'box' in which the workers can be isolated from their work area during their breaks.

Again supported by the instructors and representatives of the INRS and CRAM Auvergne, they became familiar with the formulation of objectives regarding health and comfort at work, as well as with the importance of working out a test protocol. At the end of the first week the projects, still on paper, were presented to an advisory jury consisting of instructors and OSH experts and were modified where necessary.



The next stage was the production of full-scale models. The infrastructure and equipment of the large workshops of Isle-d'Abeau (a structure made available to the teachers, researchers and students to enable them to perform educational and technological experiments in the areas of construction, building and residential areas) enables the students to produce models so as to assess better the advantages and defects of their designs. Transferred from Clermont-Ferrand to Villefontaine, the students first became acquainted with the tools of the large workshops. Using wood and cardboard as base materials, they then built their full-scale models and, on the following evening, were able to test them by simulating their use in relation to specific work situations which take into account, for example, maintenance, the sound or atmospheric environment and, of course, the work at the work station. There they were able to observe for themselves that certain improvements had to be made before presenting their projects to the jury the next day.

The jury was very impressed by the quality of the work presented. Some proposals already existed in the industry, but other, more original proposals could have been, with some more detailed work, usefully implemented. However, this was not the aim of this workshop seminar. Its purpose was educational: to develop an understanding of the need for cooperation between engineers and architects on projects for the design of work areas that factor in health, comfort and occupational risk prevention.

Results and evaluation

Since the programme started in 2005, students have shown great interest in this initiative which raises their awareness of risk prevention. In 2007, despite linguistic challenges, it was felt that the projects produced were the best so far, with the multinational working seeming to have contributed to this outcome.

In the longer-term the objective is to be able to organise not only seminars such as this one over fifteen days, but also real research and development projects carried out over several years. In the meantime, this workshop seminar concept is due to be continued, and in 2008 it was planned to be held in Sweden.

Success Factors

The main key to the success of this initiative is the extensive involvement and organisation by all those involved, both the engineering and architectural schools and the CRAM and INRS, but also the students themselves. The highly interactive nature of this initiative is also undoubtedly a major factor in its success. It does rely on the schools having the OSH support and commitment of the CRAM and INRS and their active participation.

Transferability

This action could be transposed to other countries, and to other engineering and architectural schools. The concept is also applicable in other disciplines.

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3.14. THE LACOBUS CONTEST: ALLOWING FOR OSH IN RESTORATION WORK FROM THE DESIGN STAGE ONWARDS, FRANCE

INRS

Key points:

- a design contest giving an award each year to the best architectural restoration training project; with OSH being part of the requirements;
- architectural students from three different schools (Spain, France, Germany); and
- allowance for occupational health and safety at the structure and design stage.

Key elements:

- architecture;
- project work; and
- partnership.

Introduction

The Lacobus contest makes an award each year to the best architectural restoration training project presented by the students from three schools of architecture in France, Spain and Germany. Since 2003, at the initiative of French national research and safety institute INRS, the contest has included making allowances for health and safety from the design stage onwards.

Background

Every year since 1994 the Ecole Nationale d'Architecture de Clermont-Ferrand (ENSACF) and the faculties of architecture of La Coruña (Spain) and Regensburg (Germany) have held a design contest among their final-year students. The task: to design a project related to renovation.

Aims and Objectives

The aims of this contest are to:

- raise the awareness of student architects regarding the concepts of functionality and risk prevention; and
- develop students' knowledge and practical skills by involving them in real-world, practical situations.

Scope

Students present a renovation project design that includes occupational safety and health aspects, as well as certain research aspects and the design materials. While all designs must take OSH into account, the contest awards also include a separate award for risk prevention.

For example, in 2007 the work was on two schools located in a square in La Coruña that also required urban renovation. As in the previous four years the contest required



the presentation of a specific workplace layout (drawing, cross sections, elevation and perspective views) meeting the objectives of the *Application Prévention* plan of the INRS to allow for occupational risk prevention from the workplace design stage. Accordingly, six research aspects considered as design materials were submitted to the students, with the obligation to treat at least three of them. In order of importance, these aspects were functionality, building maintenance, flows (routing and circuits for people and equipment), natural lighting, noise, natural ventilation and thermal environments.

On June 1, 2007 the 33 students selected presented their 17 proposals to an international jury consisting of teachers, architects and OSH experts. It was hard to choose the prize-winners. For this reason the two representatives of the INRS and the CRAM Auvergne insurance fund decided to award their special risk prevention, occupational health and safety prize to a team from each of the three schools. For the French school, the prize was awarded to the design by two female students. Proposing the construction of a library on ten levels, they designed a cafeteria organised according to user traffic, with a service passageway for cleaning the outside windows for the safety of maintenance personnel, closed reading areas to reduce noise, and ventilation and heating enhanced by facades incorporating a self-supporting steel cladding.

Several other projects emphasised the use of natural light, with, for example, large openings on the facades or even, for one of them, the installation of power-operated sunshades. Another, again, inspired by a system in use on the Sears Tower in Chicago, proposed automatic cleaning with a scraper moving along a rail. In any case, all the designs took into account the concepts of comfort and occupational risk prevention.

Since the INRS and the CRAM Auvergne fund became involved in the design contest they have found that the best architectural designs are those which also best take into account occupational safety and health concepts. The overall first prize has always been awarded to a project that was also favoured by the OHS experts. In 2007, it was won by a German student, who should now be able to apply risk prevention rules when he begins his working life. In the Lacobus 2008 design contest candidates presented their design proposals to the Regensburg faculty of architecture for the renovation of a heritage space in the Auvergne region chosen by the ENSACF teachers.

Results and evaluation

By comparison with the previous years, the progress achieved in 2007 was considerable. By taking into account the future use of the renovation projects, the schools had the opportunity to include the health and safety in their teaching programme. This shows the importance for future architects of having been made aware of the concepts of utility and risk prevention during their studies especially through the use of practical projects.

The fact that the awarded projects are also those which take account of OSH needs best demonstrates that students are learning the OSH lesson and it also demonstrates to the students that best practice in OSH is indeed part and parcel of design excellence.



Success Factors

- The dedication of the schools and students has made the success of this contest possible.
- The competition creates motivation.
- OSH is made a part of real design tasks.
- OSH has been integrated into an existing activity, rather than making it a new activity.
- There is a strong partnership approach.

Transferability

This design contest could be easily transferred to other schools of architecture, irrespective of the country.

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3.15. OSH COURSES IN TALLINN UNIVERSITY OF TECHNOLOGY, ESTONIA

Tallinn University of Technology

Key points:

- OSH integrated into engineering and medical courses;
- teaching provided by OSH department in the university;
- OSH teaching for all engineering students; and
- ergonomics and OSH teaching for economics students.

Key elements:

- medical students;
- engineering, electronics and technical courses; and
- OSH department in university.

Background

Tallinn University of Technology began teaching occupational safety in 1967-1969 and the department of occupational safety was founded in 1971. It became the Department of Work Environment and Safety in 2000 and is a part of the Economics Faculty. The range of courses it offers has been growing.



The students of the Department of Work Environment and Safety come from different companies, both from Estonia and from other countries. Five years ago the Department provided only one course for all students: 'Risk and safety science'. New courses continue to be introduced and at present there are ten different courses. The courses it provides include a master diploma course for engineers, compulsory OSH classes to medical students, and a course for economics students. If the students of the department want a certain course, the teachers must provide it, which can result in a high work load for the department's teaching staff.

Aims and objectives

- To train company staff in safety management.
- To provide OSH training to medical students.
- To make a variety of courses available for different students.

Scope

There are seven lecturers in the Department of Work Environment and Safety. They teach 32 hours of lectures in one semester. In addition, students carry out 16 hours of practical work in the laboratory.

The topics of the lectures in the Department of Work Environment and Safety are:

For engineers: legislation of both Estonian and the European Union, risk assessment, risk management, Occupational safety, Occupational hygiene, Fire safety.

These studies are part of a Master of Arts diploma in Risk and Safety Science. The diploma is for engineering students when they have been taught the basics of occupational health and safety.

For economic students: the department provides more ergonomics teaching for the economics students than for the engineering students, because they are more interested in office work, and omits the fire safety lectures. The course is 'Ergonomics for economic students'.

The teachers of the Department of Work Environment and Safety provide the following voluntary courses for all students in the Technical University of Tallinn. These included 6-10 hours of lectures:

- A. Risk and safety sciences
- B. Working environment and ergonomics
- C. Economics of occupational safety and health
- D. Macro ergonomics

In the autumn of 2007 a course for occupational hygienists started.

With the faculty of natural sciences there is a compulsory course for medical students covering physical, chemical and social risks. The course includes lifting of patients, noise, vibration, and explosions.

A separate course is arranged for older work environment specialists. While the participants have a different background, they also have experience of working life. The course is given in Estonian. The companies of the specialists pay for the course participation.



The Department of Work Environment and Safety provides a course concerning the risk analysis of major accidents. This specialist course is for qualified civil engineers only. The course is arranged together with the Ministry of Internal Affairs. There have been two catastrophes in Estonia during the independence period: the sinking of an Estonian ship and the drowning of 17 soldiers. The special course started after these catastrophes.

In addition, there is co-operation with the Ministry of Internal Affairs. The main topic of co-operation is regulation of crisis situations. For example, one area of cooperation is management of social risks: violence, psychology, the situation of women.

The Department of Work Environment and Safety has awarded most of its Master of Arts degrees to students from the Faculty of Economics with an interest in ergonomics. However, some students have come from the Faculty of Chemistry and the Faculty of Mechanics, choosing safety as the topic of their diploma work.

The department gives some international courses in English on working environment and safety. Another topic is the economics of occupational safety. In 2006-7 there were 10 students from other countries: China, Germany, France and Finland. They are required to have passed an entry test for the course for the Master of Arts level. In the Faculty of Economics there are also courses on economics in Russian for students who speak only Russian.

Several different teaching methods are used by the Department of Working Environment and Safety. In addition to lectures, for example, CD-ROMs and films are used. The department has films about noise, the disaster of the oil rig Piper Alpha, and risk assessment, made in England. Some films are also in Finnish.

For most courses there is an examination at the end of the course. This guarantees the level of learning and the students go through the learning material. For some courses the teachers give only an evaluation.

Problems faced

It is felt that the importance of OSH is not sufficiently recognised by the authorities and that the university hierarchy does not fully appreciate the value of OSH teaching and favours the more technical departments. This contributes to a funding problem, for example, for the purchase of equipment. The department provides some technical OSH services to companies in order to generate some funding. There is also a lack of teaching materials in Estonian. The teachers of the department have themselves made brochures for students. These brochures are based on foreign textbooks.

Students increasingly take occupational safety more seriously. They are interested in laboratories and measures. On the other hand, students are drawn more to subjects where they can use computers such as chemistry and gene technology.

At present many companies select an existing engineer to be safety manager or give this additional task to someone from personnel and send them on a course, rather than employing safety specialists.



Success factors

The future for OSH training in Estonia is looking bright. The Department of Working Environment and Safety has made a suggestion about its own learning programme. Teaching is given on both Bachelor's and Master's levels based on engineering background. Also experience from work life is recommended. Teaching is becoming more internet-based. Students make practical use of measurement equipment and methods.

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A COMPUTER-BASED LEARNING ENVIRONMENT FOR OSH, FINLAND

3.16.

Tampere University of Technology, Institute of Occupational Safety Engineering

Key points:

- e-learning course;
- divided into topics. Each topic has three parts: dialogue, theory and study work/ exercises and an online test;
- best used in combination with teacher-led discussions;
- instructions for tutors in the use of the resources;
- used voluntarily to support a basic OSH course for engineering students; and
- customisable as students can set individual learning objectives.

Key elements:

- e-learning; and
- non-discipline related.

Introduction

The first Finnish computer-based learning environment for OSH, TYVE, was developed. The target groups for this introductory OSH course were universities, polytechnic institutes and Open University students. TYVE is also freely accessible on the Internet.



Background

The teaching of safety issues has been largely dependent on the teacher's own interests and ability to teach these issues. It has also been assumed that university and polytechnic institute students are unlikely to be directly affected by safety issues in their future careers. However, the opposite actually is the case – after graduation they may well work in posts that have health and safety responsibilities, or in posts where their decisions could have health and safety consequences. Or they may come to run their own company. Therefore all future workers, not just those entering manual trades, need adequate skills and knowledge on occupational safety issues.

The development of safety proficiency requires skills and knowledge development, but there was no existing learning environment for occupational safety in Finland. A survey on OSH training in Finnish schools showed that teachers needed new learning materials (Salminen and Palukka, 2007). As no online resources for learning about OSH at this level existed, the Ministry of Education initiated the TYVE-project.

Aims and objectives

The aim of the TYVE project was to develop a computer-based learning environment for OSH. The target groups were universities, polytechnic institutes and Open University students. The target group of the learning environment was students with no prior knowledge about OSH. The material was to be made freely available over the Internet.

Scope of the project

The project developed the first open, Internet-based learning material for OSH in Finland. The learning material does not seek to provide a complete basic OSH course. The material is recommended for use in combination with one on one interaction between student and teacher or in a study group between students. Thus the TYVE-material is comparable to a textbook in traditional learning, but with new possibilities enabled by the computer-based environment.

The TYVE programme includes 12 topics:

1. Introduction
2. Occupational instruction and guidance
3. Occupational accidents
4. Safety responsibilities
5. Risk assessment
6. Safety management
7. Occupational safety legislation
8. Overall safety
9. Ergonomics
10. Mental wellbeing
11. Occupational hygiene
12. Corporation safety.

Learning objectives and work contract

Before starting the course students are recommended to set their learning objectives with the aim of becoming oriented with TYVE and so that their existing knowledge is taken into account in their use of the learning materials. The introduction includes preliminary information and an initiation to the workplace. The students of the



Technical University of Tampere have to create a written work contract, which is sometimes a novel concept for young students.

Animated dialogue, theory and study work

Each topic is divided into three parts: an animated dialogue, theory and brief study work. Figure 1 shows an animated dialogue related to an occupational accident. The gender roles were turned around in the animation: a female technology student and a male sociology student are holding a discussion. The dialogue is connected with the everyday work life, for example the investigation of accidents and questions related to the investigation. After the dialogue, a concise theory section of the topic in question is presented. Each topic concludes with a brief exercise.

Another example of the lectures is safety responsibilities. The animated dialogue links the division of responsibilities at the workplace. The theory part includes the responsibilities of each party according to Finnish legislation. In the exercise, students learn the tasks of the safety manager and the safety representative.

Testing

In order to become acquainted with the lectures, students can test their knowledge with a test consisting of nine questions. The questions for each test are randomly selected from the question bank included in the programme. The questions cover all topics.

Glossary

The TYVE- programme includes safety dictionary in which the most important terms are defined. This helps the students to correctly learn the fundamental definitions.

Links

In the learning environment there is also a short list of the most important links referring to occupational safety in Finland. These are, for example, safety authorities, the Finnish Institute of Occupational Health and the Occupational Health Centre. Some private consulting companies are also mentioned.

Teachers' instructions

Depending on the objectives of the course, it is recommended that the course is used in combination with some teacher-led instructions as well as exercises. The TYVE programme includes an instruction page for teachers. It includes a short introduction to the programme and information on how the material could be used and how it could be linked to face-to-face discussions.

Use on the safety engineering course

In the Tampere University of Technology, the TYVE programme is used on a voluntary basis by students of safety engineering during the basic course of safety and health at work. In addition to working through the TYVE programme, extra tasks are given to the students. There is also face-to-face interaction with the teacher and other students. The TYVE programme is an alternative to the traditional course with lectures.

Available to all

TYVE has been made freely available on the internet for anyone to access.



Results and evaluation

At the Tampere University of Technology the programme was tested in two ways: by asking the students to evaluate the learning environment in a questionnaire and by comparing the exam results between groups using TYVE and the groups attending teacher-led instruction. The exam grades were found to be similar in both groups, which indicate that the learning environment could successfully be used in basic training of safety issues.

Problems faced

During the development of the TYVE programme, there were some small technical problems. They were due to compromises between the technical application and the net connections of the students' laptops. Students of architecture and information technology participated in the design and testing process. In the test phase some technical and organisational improvements were undertaken, for example, the start icons did not open immediately.

Success factors

Student feedback about TYVE has mostly been positive. One student analysed the programme for his/her Master's thesis. Students were found to be enthusiastic and positive about the programme. The results indicated that TYVE provides a good opportunity and an alternative way to study safety issues. In particular, Open University students reported that the TYVE programme was useful because the learning environment did not depend on time and space. Most of the Open University students are working full-time while they are taking the course. Thus they can use the programme after work, for example, in their own homes.

Transferability

The TYVE programme has been designed so that it can also be used in workplaces, for example, for self-study. The learning environment can be used to provide an overall view of OSH issues. The programme can be used to update OSH knowledge at the workplace.

The vocational schools in Finland use the principle of permeability, where work tasks and safety issues related to them are taught at the same time. The TYVE programme has been designed to integrate theoretical issues into practical working life through the dialogues.

At present, the TYVE programme is available only in Finnish, although the authors of the programme would be willing to translate it into English. TYVE has been developed for the Finnish OSH context and would need to be partly modified, for example, with regards to references to legislative requirements, to be applicable to different countries. On the other hand, it is possible to go through these issues in teacher-led education.

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OSH INSTITUTE PROVIDES TRAINING IN UNIVERSITIES AND TECHNICAL PROFESSIONAL SCHOOLS, GREECE

3.17.

ELINYAE Western Greece regional department (Ioannina)

Key points:

- regional OSH institute programme which mainly involves training within vocational schools about OSH, but also includes teaching university chemistry students (new undergraduates and postgraduates);
- programme funded by the Regional OSH institution, who provide the teaching free of charge;
- training given to professors and students;
- programmes customised according to students' needs, with professors' involvement;
- training provided on the university campus and during normal study times, in order to facilitate attendance; and
- participatory training methods and showing real work situations using audiovisual means.

Key elements:

- chemistry students;
- participatory learning; and
- voluntary.



Introduction

This programme of the regional OSH institute provides basic theoretical and practical OSH training in local vocational schools and universities.

Background

OSH training in technical schools and universities is not as developed in Greece as in some other Member States. If training is provided it usually consists of one-off OSH classes that are not compulsory. For that reason, the Ioannina (Western Greece) regional branch of the Hellenic Institute for Occupational Health and Safety (ELINYAE) began to provide basic theoretical and practical OSH training, free of charge, in the local university and technical schools.

Aims and objectives

The aim of the project was to provide students in universities and technical professional schools with the basic theoretical and practical knowledge necessary for accident prevention before they enter the labour market.

Scope of the project

This ongoing programme began in April 2004 on a pilot basis. Initially university professors attended the training course along with their students. The professors' training triggered new OSH training initiatives for more technical specialities. A total of three hours of training is held for each speciality. Each year a new programme is organised depending on the specific demands of the technical schools.

The programme covers two target groups:

- University students (new undergraduate students and postgraduate chemistry students at the University of Ioannina) where training concerns safety in chemistry labs; and
- First and second-year technical school students from schools in Ioannina and Arta.

Technical-school student training covers the following specialities: mechanical, electrical, plumbers, information technology and computer networks, beauticians, hairdressers, technical works, agronomy and health and child care services, etc. The syllabus has a common core that includes basic legislation concerning employers' and employees' duties and then for each speciality specific risks and OSH protection measures are presented. Increasingly, technical schools from other cities are applying for these courses. The curricula have been developed to meet the needs of each technical department through collaboration with the heads of the relevant departments in the technical schools.

ELINYAE staff carry out the training at the universities and technical schools and have been given time within the normal student timetable in order to maximise attendance.

Results and evaluation of the project

By the end of academic year 2005/6 around 1,000 students had received training. The programme was evaluated positively; a survey of chemistry students who took the course showed that 87 percent of them were very satisfied with the course. The demand for these training courses is high and increasing every year. For example, the number of students taking the course tripled between 2004 and 2006.



Success factors:

- funded by the Regional OSH institution, which provided the teaching;
- curricula developed with professors and customised to the needs of each department;
- programmed to take place at the school/university and during students' normal study time; and
- participatory training methods and use of real work situations.

Transferability of the project

Transferability would depend on having an OSH authority with the remit and resources to provide training. The customised training methodology used in this project could be transferred to other countries.

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**KAUNAS UNIVERSITY OF MEDICINE PROGRAMME
RELATED TO OSH, LITHUANIA**

3.18.

Kaunas University of Medicine, Faculty of Public Health, Department of Environmental and Occupational Medicine

Key points:

- education of public health professionals;
- occupational safety fundamentals course for students of the Faculty of Public Health; and
- knowledge/skills and competence outcomes: legal provisions and requirements concerning OSH, risk prevention etc.; practical skills in occupational risk assessment.

Introduction

A course on the fundamentals of occupational health and safety, carried out as a part of the education process at the Faculty of Public Health.

Background

Kaunas University of Medicine is the largest institution of medical education, training and research in Lithuania. It participates in international projects and is also a World Health Organization (WHO) collaborating centre for research and training. The Faculty of Public Health is a fully accredited member of the Association of Schools of Public



Health in the European Region (ASPHER). One of the main tasks of the faculty is to ensure that public health professionals receive high quality training. This includes ensuring that these future professionals have basic knowledge and skills concerning OSH.

Aims and Objectives

The aim of the course of occupational safety fundamentals is to provide basic knowledge, skills and competencies in the area of occupational and fire safety. It covers legal provisions and requirements for the working environment, protection principles and methods and ways to reduce occupational risk. The programme takes into account the regulations and requirements regarding risk assessment and includes the use of suitable protective equipment.

Scope

Course content, structure and duration

The course of occupational safety fundamentals, carried out by professional staff of the Faculty of Public Health, targets the B.Sc. students of the faculty during one semester of their education. The content of the programme covers basic OSH subjects:

- accident losses;
- liabilities and safety legislation, workers compensation, OSH Legal Acts;
- management and its responsibilities for safety;
- hazards and their control;
- promoting safe practices;
- appraising plant safety;
- planning for emergencies;
- 'Human – Machine – Environment' system;
- organisational and technical means;
- collective and personal protective means, acceleration;
- falls, falling objects and other impacts, mechanical injuries;
- heat and temperature;
- pressure hazards;
- electrical hazards;
- lightning safety;
- fires and fire suppression;
- explosions and explosives;
- hazards of toxic materials;
- radiation, vibration and noise;
- essential safety and health requirements for technological processes, workstations, work equipment and work process;
- potentially dangerous equipment and dangerous works; and
- accident investigations.

The structure of the didactic activities consists of lectures, seminars, practical work and individual work. The lectures for students are divided into 20 units. The diversity of methods used includes individual and group work, case studies, brainstorming sessions, individual studies, and preparing group reports.



Learning objectives

Knowledge/skills: The acquisition of knowledge concerning basic occupational safety and fire safety: legal provisions and requirements in order to protect workers against occupational risks or to reduce these kinds of risks; general requirements for workstations; work equipment and work conditions; protection principles; and means to avoid exposure to dangerous factors.

Competencies: The acquisition of the ability to assess the risk at workstations and to choose the suitable protective equipment to avoid exposure to dangerous factors.

Assessment

The student's knowledge and skills are assessed during the study of each subject and on its completion. For the course on occupational safety fundamentals, quizzes and personal written work with presentation are used as the means of evaluation. Additionally, there is a requirement for attendance, which is obligatory.

Competence of teachers

The qualifications of the professional staff are crucial. Thus, in order to ensure high educational quality, the teachers are regularly certified, certain curricula and synopses are evaluated, and instructors improve their knowledge and skills by taking special educational and teaching courses. In addition, new education technologies are being implemented.

Results and evaluation

The course is an established part of the curriculum. The whole course, including the OSH module, has been externally assessed as meeting high standards. It is important for the university that their courses meet European and international standards. An alumni organisation was established in 2003, which is going to play an active role in the quality assurance at the faculty.

Problems faced

As mentioned above, it is crucial to have teachers with the necessary skills and expertise. It is also a challenge to have good teaching resources. To complement existing resources e-learning is being developed.

Success factors

The teaching expertise is available within the university and the course is compulsory. It is important for the university to be recognised as having achieved high teaching standards that meet European and international standards. This also means that there is support for high standards in the area of OSH education. OSH is seen to be an essential part of the teaching programme.

Transferability

The general approach and the majority of elements of the programme could be implemented by other tertiary educational institutions, although it would have to be adapted to the different legal contexts etc.



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3.19. AWARENESS-RAISING ABOUT SAFETY WITH STUDENTS AND PROFESSORS IN ARCHITECTURE, BELGIUM

Société Européenne pour la Formation, le Management et l'Expertise de Projets (SEFMEP)

Ecole d'architecture de la Cambre

Key points:

- awareness-raising of students and teachers about OSH during the final year of architecture studies;
- integration of a practical component;
- application in the compulsory architectural work of students; and
- extension planned to other years of the academic degree course.

Key elements:

- architecture;
- real work situations; and
- compulsory.

Introduction

A project to provide multi-disciplinary, participative OSH training for students and their professors.

Background

Two main reasons lie behind this project. On the one hand it is well known that the construction is a sector with many risks and a high accident rate. Architects play an important role in the construction process and should therefore be aware of OSH issues and legislative requirements and their role in the process. On the other hand, legislation and regulation are not sufficient to guarantee a safe and healthy working environment. In addition to the legislation, it is fundamental to have the correct behaviour and attitude. Adoption of OSH-minded behaviour is greatly influenced by education and assimilation of information that starts early on, i.e. during school education and university studies. On construction sites, the coordination concerning OSH is of high importance and architects play a key role in this respect.



Aims and objectives

The objectives of this training are to:

- raise the knowledge and awareness of final-year students and teachers of architectural studies about the OSH aspects and responsibilities of their discipline; and
- provide students with practical skills.

Scope

Together with the direction of the *Institut Supérieur d'Architecture La Cambre* in Brussels, SEFMEP initiated and supported a project to develop and introduce training on risk prevention and establish this as on-going training for students and professors. The training was provided by professional coordinators working in the construction field. The legislation concerning safety and health at temporary or mobile workplaces served as a basis for introducing taking this action.

The methodology used in this training project is a general, participative and multi-disciplinary approach that favours collective responses to OSH issues. About 120 hours were devoted to OSH during the lessons and around 40 people (students and teachers) can be included.

The training was based on six aspects:

- the legislation and responsibilities in prevention issues;
- sector-related risks and risk assessment;
- management of prevention issues before the works start;
- coordination of construction projects and coordination of the implementation of construction projects: tasks of the coordinator, integration of prevention into the concept, instruments and tools of coordination, the European guide for good practices in coordination;
- ergonomics in construction; and
- quality and safety: the auto-audit of safety.

The theoretical training was followed by a visit to a construction site, where participants observe the work on a real construction site. Afterwards, they carried out for themselves certain building and civil engineering work similar to that done on the school's construction site, such as driving a crane tower, a hydraulic shovel, paving work, covering roofs, etc. The courses were given by trainers from SEFMEP and, on the school's construction site, instructors from FOREM guided the participants.

Participants received written documents and brochures and CD-ROMs on risks in the construction sector and their prevention, published by various sources, such as the Federal Ministry of Labour and the European Federation for Construction Workers.

At the beginning of the training, the students had to fill out a questionnaire which was intended to evaluate any deficits concerning their perception of risks with regards to the different themes covered in the training. The final step was a test on the knowledge acquired, based on the conceptual architectural work that final-year architecture students should make. The goal was to integrate several aspects of safety and health into the project.

After the training was completed, the participants prepared a written evaluation of the project and discussed the content and organisation of the training. They also had the opportunity to submit questions to SEFMEP by mail; in that way students' knowledge was checked one month after the training.



Results and evaluation

- The new knowledge stimulated students to reflect on risks and safety. Participants began to look in a different way at the work on a construction site. They were keen and receptive learners (see also success factors).
- Questions still remain, especially in the perception of the differences between the functions of the architect and the safety and health coordinator.
- This basic training was meant for final-year students and their teachers. The aim is to integrate a similar but extended training into earlier years of the degree course.

Through this project *La Cambre* seeks involvement with the European network 'FOCUS' regarding training and accreditation concerning safety and health in the construction industry and the AIFC, an inter-university association for the training of the safety and health coordinators which organises courses.

Problems faced

- The time spent on the construction site for observation was considered to be too short and the number of practical exercises too limited. Only some professions and activities could be observed, there was not enough time to consider all of them.
- Lack of professional experience of the young workers. This makes it difficult for them to realise the importance of the risks and the 'best techniques' since they have no experience yet with the possible outcomes of risks and therefore the importance of 'best techniques'. They are not yet aware of 'professional norms'.
- Young workers are less critical about the subjects and issues taught. This means that there is less debate and discussion about the information that is transferred.

Success factors

- Incorporation of a practical approach directly related to the future work:
 - time spent on training sites; and
 - use of the construction school, with real equipment.
- Architecture students are quite receptive to risk education and OSH training for a number of reasons:
 - interest in the practical aspects of their future working environment and future careers;
 - interest in human and social aspects of the profession of architect; and
 - awareness and interest in architectural ergonomics.
- Availability of expert trainers;
- Partnership approach; and
- Legal requirements on architects that underpin the need for the training.

Transferability

The project could be transferred to other schools and other countries. In the latter case, the section on legislation would need to be adapted to the transfer country.



Further information

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INTEGRATION OF OSH AT THE FACULTY OF METALLURGY, SLOVAK REPUBLIC

3.20.

Technical University of Kosice, Faculty of Metallurgy, Department of Integrated Management

Key points:

- undergraduate engineering and metallurgy course;
- compulsory OSH module;
- integrated into the course when the new course was developed; and
- close contact with industry and the OSH authority.

Key elements:

- undergraduate;
- engineering;
- metallurgy;
- postgraduate;
- OSH management;
- environmental management;
- quality management; and
- risk assessment.

Introduction

A course on occupational safety and health is running within the study programme of integrated management systems (quality, environmental and safety management systems) at the Integrated Management Department of the Faculty of Metallurgy of the Technical University of Kosice. The programme consists of three levels:

- Level I - Bachelor's (B.Sc) degree: Integrated Management Systems
- Level II - Master's (Eng.) degree: Integrated Management Systems
- Level III - Postgraduate (Ph.D) courses: Production Quality Engineering



Graduates from this programme, are Bachelor (B.Sc), certified engineer (Dipl-Ing) or Ph.D, and find work at various levels in the management of organisations. This can also involve OSH management.

For its educational approach in the field of metallurgy, the Department of Integrated Management makes use of its wide research activities. The research work being carried out in the Department has close links with industry and scientific institutions in Slovakia and abroad.

Background

Slovakia's OSH policy strategy, OSH policy programme implementation and OSH national programme stress the importance of integrating OSH into the curricula of university. These documents formed the starting point for several research projects that emphasised the need to mainstreaming OSH in education, not only in university education but also as a part of lifelong learning.

The proctor of the Technical University, the dean of the Faculty of Metallurgy and the head of the Integrated Management Department were the main people who supported the idea of integrating OSH into academic studies.

Aims and Objectives

The major aims of the study programme are:

- to prepare future managers so that they are aware of requirements regarding EU and Slovak legislation;
- to incorporate specific OSH issues that are of specific importance for this profession into certain study domains;
- to raise OSH awareness among students and hence to contribute to raising awareness in the Slovak Republic as a whole;
- to enhance theoretical and practical collaboration with industry in the field of OSH (EU and Slovak strategy);and
- to collaborate actively with the national labour inspectorate.

Scope

A new department and new courses were established, with OSH integrated into the programme from the beginning:

The Department of Integrated Management was created in September 2003. The following year the study programmes for levels I and II (Integrated management systems), and level III (Production quality engineering) were officially approved. In these study programmes OSH management is a compulsory subject in the third year of the first level and the second year of the second level and the management of dangerous activities is a compulsory subject in the second year of the second level. In the academic year 2006/2007 the first 28 students graduated with a Bachelor's degree (level I).

The textbook for the production quality course was created in collaboration with other Slovak universities (funded by a KEGA grant Integrated management 3/4276/06). In order to arrange the courses regarding OSH management and management of dangerous activities, a close collaboration was needed with the industry and there have been positive experiences with excursions to chemical and metallurgy enterprises (Lovelock, Chemo Stressed, US Steel, etc.).



Students participate at the conference organised every year by the Faculty of Metallurgy, where they present their results in the research field.

In the near future the department will also integrate OSH into the following studies:

- waste processing and recycling; and
- metallurgy of metals.

Results and evaluation

Since the first students graduated only in 2007, it is too early to assess the project, but there are a number of positive signs:

- An increasing number of applications are being received at the Department of Integrated Management.
- Enterprises and employers show a growing interest in graduates of the study programme. In addition, some high-level executives are studying at level III of the programme.
- Experiences with collaborating companies have been positive.
- PhD students are being attracted to the field of OSH.
- The Department is building its reputation, through research, publications, participation in conferences, including in the OSH field.

Problems faced

- Having sufficient numbers of academic staff to cover the increasing number of students.

Success Factors

- The support from BUGH Wuppertal and the work and commitment of the proctor of the university were crucial. The proctor emphasised the necessity of creating an OSH study programme within the new courses.
- Planning to have OSH in the course from the very beginning. It is not just an add-on.
- The practical focus on industry and collaboration with industry
- The diploma provides students with the opportunity to work in various enterprises, making it attractive to students
- The department has developed a reputation as being a good partner in international projects and with the Slovak authorities. It is seen as an important contributor to the development of OSH in Slovakia and also as it has the visible support of the OSH national authority this enhances the reputation of the department among industry and students.
- The departmental staff take part in seminars and conferences organised at companies to present the study programme and research outcomes. This promotes the programme and the OSH aspects.

Transferability

The approach taken here to incorporate OSH into new courses when they are first developed is relevant anywhere.



Further information

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3.21. INTEGRATION OF OSH AT THE FACULTY OF MECHANICAL ENGINEERING OF THE TECHNICAL UNIVERSITY OF KOSICE, SLOVAK REPUBLIC

Technical University of Kosice, Faculty of Mechanical Engineering, Safety and Quality Department

Key points:

- partnership to help establish the course;
- combined study programme 'Quality Production and Safety of Technical Systems';
- use of OSH legal requirements and other change processes to introduce the programme;
- improved risk assessment awareness; and
- OSH technician course and OSH teaching in other courses.

Key elements:

- bachelor and postgraduate; and
- engineering.

Introduction

A study programme on OSH is run at the Safety and Quality Department of the Mechanical Faculty of the Technical University of Kosice. Level I is at Bachelor level, Level II is an Engineering and Ph.D course and Level III relates to the fields of production quality, safety of technical systems (STS) and OSH. The Department also offers subjects which are included in the study programme of the Faculty of Metallurgy.

The study programme takes into account the Slovak Republic's legislation and the EU OSH Directives and their process of harmonisation. Substantial attention is paid to the process of risk assessment and its specific tools.

Course work for students includes solving concrete problems in existing plants or organisations (for example, hotel services, health centres). Students who complete this field at Bachelor-level (BSc), or as certified engineers (Dipl-Ing), or at Ph.D level are then qualified to work as safety technicians according to OSH legal requirements.



Background

The study programme Safety of technical systems and occupational safety and health (STS and OSH) was inaugurated in 1993 in the Department of Transport Equipments and Logistics. The proctor of the university was the instigator and promoter of the idea to implement safety topics into academic studies. He spent two years in BUGH Wuppertal studying the area in detail.

The fact that Slovakia was preparing OSH legislation based on the European principles (Directive 89/391/EEC) combined with changes taking place at the university provided the opportunity for the introduction of the programme. Combining the OSH programme with a programme on production quality complied with new industrial and social requirements resulting from the political changes that took place in Slovakia in 1992.

In 1993 the Faculty of Mechanical Engineering offered a full accreditation of the combined study programme *Quality production and safety of technical systems*. The new Department of Safety and Quality was created in 2001, offering two full study programmes - *Safety of technical systems and OSH*, and *Engineering production quality*. Between 1993 and 2007 256 students finished the STS and OSH Master's programme.

Aims and Objectives

The main aims of the STS and OSH programme are:

- to prepare technical staff to meet the requirements of EU and Slovak legislation; and
- to increase the number of students with skills in the domain of OSH.

Broader aims of having the OSH programme in the Department are:

- to enhance theoretical and practical collaboration with industry in the field of OSH (EU and Slovak strategy);
- to be a partner of excellence for the new EU FP (Frame Programme) - programmes and activities in OSH.
- to intensify OSH research activities each year by more than 5%;
- to increase the number of research articles in technical magazines by 10% each year;
- to collaborate with the National Labour Inspectorate to organise an International Conference within the frame of the European Week for Safety and Health at Work; and
- to improve risk assessment awareness in the Slovak republic.

Scope

The Faculty of Mechanical Engineering has 11 Departments, and around a quarter of them have included OSH in their study programme. In most cases, students attend a course called *Safety at work* arranged over a half-year term. A similar situation exists in the other faculties of the Technical University of Kosice.

The comprehensive OSH study is only available at the Department of Safety and Quality of Production. The graduates also obtain the OSH technician certificate (as defined in the OSH Act).

Course contents: The OSH programme at the Department of Production Safety and Quality includes the following courses:



- safety at work in production technologies;
- risk management;
- OSH legislation;
- integrated management systems;
- safety of technical systems;
- major hazard accident prevention;
- economical aspects of OSH;
- maintenance management systems (RCM, TPM, RBI);
- transport of dangerous substance;
- emergency systems; and
- fire prevention.

Teaching methods: The basic teaching methods in OSH subjects are used, namely:

- lectures and practical exercises; and
- final year projects (development of individual theses)

For some of the topics, students have to undertake independent practical exercises or projects in which they have to carry out practical tasks, for example, assessing the risks related to a certain job, development of safety management, or presenting some issues of job OSH training. Students also spend one week on practical visits in companies during the last part of their study.

The basis of each of the OSH courses is:

- prevention procedures;
- hazard identification;
- risk evaluation;
- prevention measures solutions;
- legislation base;
- good practice;
- emergency measures;
- system approach; and
- management procedures, etc.

Results and evaluation

Concrete outcomes of the project are the following:

- A department oriented in the field of STS and OSH has been established.
- Over 250 students have been prepared for work in the OSH area.
- A professional research location with scientists has been built.
- The professional expertise of the department's staff has increased (specialists for major risk assessment, internal OSH auditors).
- International and national collaboration at a professional level (conferences, workshops, projects) has been established.
- More than 50 practical projects in the industry have been successfully implemented.
- Over 90% of the theses were conducted as practical projects on OSH problems in industry.
- A professional place and the development of a good reputation for the Department as a partner for industry and the national OSH authority has been created.



- Five books and also many articles have been published.
- Safety problems are being solved in industry, the needs of the students are being fulfilled and there is a growing interest of students in the programme.

Problems faced

Problems have included:

- insufficient funding for staffing and to develop texts; and
- there is a high interest in the courses but this is not reflected in the number of staff: more assistant lecturer posts are needed to meet the demand.

Success factors:

- the initiative of the proctor of the university in spotting the need for the OSH programme and his commitment and dedication in getting it established;
- the support from BUGH Wuppertal;
- the opportunity afforded by legislative and social changes;
- OSH technician requirements specified in legislation;
- combined theoretical and practical approach to teaching; and
- an integrated approach to develop the competence of a whole department and its collaborative initiatives in the field of OSH.

Transferability

To implement an OSH study programme at universities and at high schools it is necessary:

- to ensure good management with clearly identified goals (for example, the chemical sector supporting the study programme with subjects explaining hazards of chemical substances and risk assessment tools);
- to monitor the requirements of the EU directives with regard to OSH and the new EU strategy;
- to stress how important it is in life to monitor hazards and integrated risk management principles as a tool for effective management;
- to pay attention to the needs of the industry and other organisations; and
- to create an attractive workplace for young and productive people.

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TEACHING OSH IN CONSTRUCTION ENGINEERING AND ARCHITECTURE STUDIES: COOPERATION WITH STATUTORY INSURANCE ORGANISATIONS AND THE LABOUR INSPECTORATE, GERMANY

3.22.

University of Applied Sciences Mainz, Institute for Construction Operation and Management (Institut für Baubetrieb)

in cooperation with:

- Statutory Accident Insurance for the Construction Sector (BG Bau);
- Statutory Accident Insurance for the Service and Business Administration Sector (Verwaltungs BG); and
- Labour Inspectorate of Rhineland-Palatinate.

Key points:

- compulsory in students majoring in construction site management, voluntary in other courses;
- leads towards the OSH qualification needed by site health and safety coordinators;
- tailored to German construction site legislative requirements; and
- cooperation between university and statutory insurance company.

Key elements:

- civil engineering, construction, architecture; and
- compulsory and voluntary.

Introduction

The University for Applied Sciences (Fachhochschule) Mainz provides lectures on OSH issues of construction sites for construction engineering students and architecture students. These lectures are included in the curricula of the bachelor programmes (B.Eng., B.A.) and taught among the main subjects between the third and sixth semester. The courses 'occupational safety at construction sites' and 'construction site co-ordinator' are compulsory subjects for students of the major degree 'construction site management' and are optional for other students of construction engineering and architecture.

Both courses enable the students to gain an additional qualification which enables them to function as safety and health coordinators at construction sites after completing between two and five years of work experience (depending on the size of the construction site) in planning, construction surveillance or construction site management.

Background

Construction is a high risk sector. There is a need to raise awareness about safety management on construction sites among people who have a responsibility:



architects, construction engineers, and other graduates who enter the civil engineering field to act as safety-critical professionals.

European / German legislative context

To help tackle the problem the EU has introduced measures such as Directive 57/92 EEC on the safety and health of construction sites and the Member States have implemented the corresponding national legislation. In Germany the directive is implemented through the decree on safety and health at construction sites (*Baustellenverordnung*) and the rules on occupational safety at construction sites (*Regeln zum Arbeitsschutz auf Baustellen – RAB*).

RAB 30 obliges the client to nominate a coordinator responsible for safety and health for the construction site (*SiGe-Koordinator / safety and health coordinator*). The requirements for being safety and health coordinator are:

- a university degree (B.Eng./B.A. or M.Eng./M.A.) in construction engineering, civil engineering or architecture, or equivalent qualification (for example, master craftsman);
- an additional qualification in the field of occupational safety and health with special regard to construction works;
- between two to five years (depending to the size of the construction site) of work experience in planning, construction site management or supervision; and
- that the above requirements are fulfilled sequentially by the person who will be appointed as a safety and health co-ordinator.

The function of the safety and health coordinator on the construction site is of increasing importance: today companies tend to specialise in single tasks. Hence the movement of workers between different contracting partners is a problem, especially on larger construction sites where as many as 100 contracting partners have to be supervised.

Aims and objectives:

- to run a course for construction engineering and architect students, to qualify them according to legal requirements for construction site safety responsibilities;
- to promote OSH awareness and OSH culture among students;
- to develop the students' practical OSH skills and knowledge; and
- to promote OSH on other engineering courses and encourage students to chose the OSH option.

Scope

Studies: Bachelor of Engineering (B.Eng.) in Construction / Civil Engineering (210 ECTS Credits), Bachelor of Arts (B.A.) in Architecture (210 ECTS), Bachelor / Master of Arts (B.A. / M.A.) in Facility Management (180 / 120 ECTS).

Elective lessons for future safety and health co-ordinators. The University of Applied Sciences Mainz offers different modules with regard to safety and health. Modules 1 and 2 are compulsory for students of Construction / Civil engineering and International construction engineering (both Bachelor in Engineering, B.Eng.) who choose construction operation and management as a major subject. They are elective for students of civil engineering (B.Eng.) and architecture (B.A.) or other majors (for example, construction, or planning and environment). In addition, modules 1 and 2 are also elective for students in the Faculty of Management (B.Eng. / M.Eng.).



Both modules must be completed in order to obtain the qualification to be able to act as a safety and health coordinator in construction work.

Cooperation partners for these lessons are the Statutory Accidents Insurances for the construction sector (BG Bau) and for the service and business administration sector (Verwaltungs BG) as well as the Labour Inspectorate of Rhineland-Palatinate. See the box at the end for further information about the overall strategy and activities of BG Bau in the field of university education.

Module 1: Occupational Safety at Construction Sites (Arbeitssicherheit):

- organised jointly by a faculty professor, staff from the statutory accident insurance organisation BG Bau and staff from the Labour Inspectorate;
- content: 6 ECTS credits (60 hours lectures / seminars in groups of 25 students and video presentation, 120 hours self-study);
- studies: construction / civil engineering, and international construction engineering (B.Eng.): compulsory for students majoring in construction operation, optional for other students; architecture (B.A.) and facility management (B.A. / M.A.): optional; and
- exam: 120 min (compulsory) and written text (optional).

This module presents the basic information of the work of safety experts (*Sicherheitsfachkraft / SiFa*) and safety engineers (*Sicherheitsingenieur*). The teaching is based around the requirements of the RAB30 construction safety rules which define the qualification standards for construction site safety and health co-ordinators (*SiGe-Koordinator*). The learning and skills outcomes for students are: to be able to identify hazards; to be able to assess risks; and to be able to take adequate measures regarding OSH during planning, construction and building maintenance. With the input of the experts from BG Bau and the Labour Inspectorate, the latest practical examples are used to demonstrate good practice.

Module 1 content. This covers legislation; safety of work devices and tools; dangerous substances management; transport and handling of loads; hazard identification; risk assessment; working under water; safety of construction machines; surveillance and advice; prevention of accidents (especially. falls from scaffolding); economic dimension of accidents and occupational diseases; and legal responsibility of construction site managers.

Module 2: Construction Site Co-ordinator (Baukoordinator):

- run by a professor from the faculty and staff from the statutory accident insurance organisation Verwaltungs BG;
- content: 6 ECTS credits (60 hours lectures in groups of 25 students and case studies, 120 hours self-study);
- studies: construction / civil engineering, and international construction engineering (B.Eng.): compulsory for students majoring in construction operation, optional for other students; architecture (B.A.) and facility management (B.A. / M.A.): optional; and
- exam: 120 min (compulsory) and written text (optional).

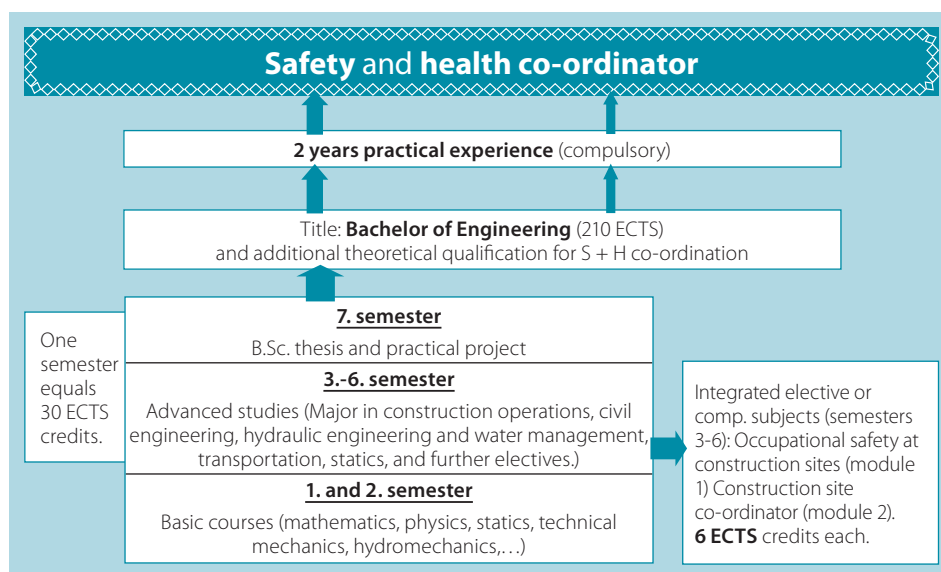
The students are introduced to the basics of organisation and safety issues for construction engineers (SiGe / safety and health plan, RAB31). This knowledge is indispensable for construction site management especially where the complexity of the work flow can lead to an elevated level of risk. Students will be able to take care of



complex safety issues on construction sites. They will plan and carry out occupational health and safety measures on construction sites.

Module 2 content. This covers planning and implementing construction works: legislation; duties in the planning phase; duties during the implementation; creating a safety and health plan for construction sites (SiGe-plan); prevention of accidents at work and occupational diseases; emergency plans; evacuation plans; setting up a guidance for construction site workers; identifying workplaces where there are elevated risks; documentation; and legal responsibility. Both modules are integrated in the course cycle of the second and third academic years. Beforehand, all students must have completed a construction site internship. The curriculum of the Bachelor of Engineering can be described as follows (example of construction / civil engineering):

Figure 1: Curriculum of B.Eng. in construction / civil engineering



Further elective subjects with safety aspects

In addition, two further modules are offered as optional courses for construction and civil engineers. These courses partially cover safety aspects in the form of good working techniques for concrete constructions (module 3) and underground construction works (module 4).

Module 3: *Construction Engineering (Ingenieurbautechnik):*

- arranged by a faculty professor;
- content: 4 ECTS credits (60 hours lecture, 60 hours self-study);
- studies: construction / civil engineering (compulsory course for students of construction operation and management, elective for other students); and
- exam: 120 min or written text.

The students learn all the basic principles of construction techniques which are essential knowledge for site coordinating engineers. Core elements of the lessons are static and include construction of scaffolding and concrete formwork constructions.

Module 4: *'Special foundation works and underground construction' (Spezialtiefbau, Tunnelbau):*

- arranged by a faculty professor and a staff member from the statutory accident insurance organisation BG Bau;



- content: 4 ECTS credits (60 hours lecture, 60 hours self-study);
- studies: bachelor in construction / civil engineering (compulsory course for students of construction operation and management, optional for other students); and
- exam: 120 min or written text.

In this module, essential techniques of underground and tunnel construction works and their supervision are presented to the students. The core elements are static and include construction of foundations, excavation pits, sheet piling, diaphragm walls, bored piles, injections, and vault safety.

Problems faced

The overall guidelines (*Rahmenrichtlinien*) for accrediting construction / civil engineering and architecture studies in German universities issued by ASIIN do not include occupational safety and health as a compulsory component. This means that universities' studies can be accredited without offering any teaching containing any work-safety related issues. Furthermore, the extent to which OSH is included in the curriculum depends on each university and on each professor.

One very particular problem can be observed among students and professors of architecture. It seems that mainstreaming OSH into their studies may not always be well received by students, who consider themselves as being artists and planners.

For these reasons, the most important modules 1 and 2 were not able to be offered until autumn 2000. The current situation can be described as a result of permanent lobbying and thorough the endeavours of the faculty, especially one very committed professor.

Success factors:

- The commitment of a key university professor and the OSH institutions to the courses and the extension of OSH teaching into other areas.
- The cooperation between the university, the Labour Inspectorate and the statutory accident insurance companies ensures that expert teaching staff is available and the offered courses are very relevant to real working and management practice.
- The legal requirement regarding the OSH qualifications of site managers provides a strong motivating factor for compulsory study of the relevant OSH elements.
- The offered lessons not only provide students with an additional qualification, but can also be highly recommended, as they give a good insight into practical management aspects.

Results and evaluation

Currently some 50 students are taught annually at FH Mainz in occupational safety at construction sites (*Arbeitsicherheit*) and construction site co-ordinator (Baukoordinator) and about 300 completed the training from 2000-2007. About 70% of them are students of construction/ civil engineering, 10% architecture students, and another 20% prospective facility managers. Some 50 of them also decided to write their final thesis (Bachelor Diploma) in one of these subjects.

Positive feedback has been obtained from the students, who claim that the qualification provides them with advantages in the labour market for working in the field of safety and health co-ordination. Employers are also satisfied that this training is being provided at university level: not only do they save costs for vocational



training, students majoring in construction operation and management can also help in ensuring buildings are ready on time and within the anticipated budget.

The Labour Inspectorate of Rhineland-Palatinate, as well as the statutory accident insurance organisation BG Bau, has welcomed these measures because students are confronted at an early stage of their studies with safety relevant aspects in an appropriate way.

The theoretical qualification for safety and health co-ordinators at FH Mainz, *Institut für Baubetrieb*, is accredited by ASIIN (agency for accreditation for engineering and science studies).

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BG Bau (Statutory Accident Insurance for the construction sector): initiatives for teaching safety and risk management in civil engineering studies in German universities

What is provided?

Since 1970 the statutory accident insurance organisation for the construction sector - BG Bau - has been involved in teaching OSH in tertiary education. At present, experts of the BG Bau teach safety and health for construction sites at 54 universities and universities of applied sciences (FH) in Germany. The target group is typically students of construction engineering, civil engineering and architecture in bachelor or master programmes.

BG Bau offers different modules which can be mainstreamed into study programmes, depending on the desires of each particular university. In most cases, the teaching activities are also undertaken by experts in statutory accident insurance. This can be described as the key success factor regarding why some estimated 80% of students of construction / civil engineering can be offered lessons in occupational safety and health. BG Bau profits by the activities since it is one way to cut the costs of work place accidents.

The most common module offered is based on RAB 30, the regulation defining the qualification standards for construction sites coordinators. Students taught the requirements set in RAB 30 can gain an optional qualification as a construction site coordinator after two years of practice at construction sites. Depending on the timeframe, additional practical group work can be offered by the BG Bau experts. Lectures can also be complemented with computer-based media (CD-Rom), video presentations or further e-learning tools.



Geographical coverage of this system of teaching OSH in civil engineering can be said to be nationwide. However, the standard of the classes and the number of lessons is not consistent at all universities: the German Federal States (*Länder*) has a degree of control over cultural and educational policy in Germany. Furthermore universities are mostly autonomous and able to decide on issues of science and teaching standards independently, though they may be guided by the overall accreditation guidelines (see the example of FH Mainz). Due to these facts, the teaching offered by the BG Bau may vary at the different universities depending on the content and teaching hours / ECTS credits:

- Lessons can be compulsory or elective.
- They can be part of bachelors' programmes as well as of masters' programmes.
- They can range from two hours lectures per week for one semester, up to four hours per week during one year (lectures and work groups).
- Usually the lectures are embedded in the activities in lessons of *Baubetrieb* (construction site management / construction operation).

Success factors

The success of the measures often depends on the personal commitment of the dean of the faculty and the interest of the teaching staff in OSH. It should be viewed as a part of the general management of an enterprise: safety and health at work can contribute effectively to company profit but it requires dedication on the part of the management. BG Bau has noted that those companies that employ management representatives, who have been taught OSH at university have a more systematic approach to safety and health relevant issues.

Participating universities:

Universities and Technical Universities: U Bochum, TU Braunschweig, TU Darmstadt, TU Dresden, TU Leipzig, TU München, U Hannover, U Kassel, U Lüneburg, U Stuttgart, U Rostock, U Nürnberg, U Wuppertal, U Hamburg.

Universities of Applied Sciences: FH Augsburg, TFH Berlin, FH Biberach, FH Bielefeld, FH Bochum, FH Bremen, FH Coburg, FH Deggendorf, FH Lübeck-Eckernförde, FH Erfurt, TFH Stuttgart, FH Hannover-Nienburg, FH Hildesheim-Holzminen, FH Kaiserslautern, FH Koblenz, FH Lausitz, FH Leipzig, FH Lippe-Höxter-Detmold, FH Mainz, FH Minden, FH München, FH Neubrandenburg, FH Buxtehude, FH Nürnberg, FH Oldenburg, FH Regensburg, FH Rosenheim, FH Stuttgart, FH Wiesbaden, FH Wismar, FH Würzburg, FH Zittau-Görlitz, FH Aachen, FH Kaiserslautern, FH Münster, FH Trier, FH Darmstadt.

Other facilities: University of the Military Services Neubiberg, Technical Academy (TAS) Kaiserslautern, University of Cooperative Education (BA) Sachsen.



Further information:

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PROMOTING SAFETY CULTURE AT DIT – A STEP CLOSER TO THE REAL WORLD, IRELAND

3.23.

Dublin Institute of Technology (DIT)

Key points:

- technical institute that provides vocational training as well as university degree courses and postgraduate activities;
- combined approach that targets both staff and students;
- initiative by the institute's safety team (part of DIT's administration, ensuring that the institute complies with OSH regulations, not an academic department);
- holistic approach aimed at maintaining safety and promoting a safety culture in the institute and which includes training; and
- wide consultation, including consultation with the students' union and their participation in safety meetings.

Key elements:

- all courses;
- training by in-house safety team concerned with legal compliance; and
- multimedia and interactive training.

Introduction

Universities and colleges in Ireland have to comply with OSH legislation, which requires them to prevent risks to their own staff and to third parties including students. In assisting the Dublin Institute of Technology (DIT) to meet its legal obligations, its safety team has sought, at the same time, to promote a safety culture among students with the aim that they will take this away with them to their future workplaces.



Background

The Dublin Institute of Technology is one of Ireland's largest and most innovative third-level institutions, with a population of 22,000 students and approximately 2,000 staff members. DIT offers over 300 different programmes from apprenticeship right through to postgraduate level. DIT's campus sites are currently located in over 40 buildings around the city centre.

DIT's safety management system has been in existence since 2002. The health and safety team has recently been developed to include three occupational health officers, who have been assigned to and based at various locations throughout DIT.

Aims and objectives

The aim of DIT's initiative is to prepare young people (both students and staff members) for the health and safety aspects of working life, which may be in DIT itself, or in future workplaces. In particular, the objectives of the initiative include:

- to promote risk awareness as an integral part of education;
- to promote positive health and safety culture and to maintain professional standards;
- to improve safety behaviour and attitudes;
- to enhance open communication and consultation through education, guidance, advice, information and training; and
- to improve the university's OSH performance and compliance by adding the dimension of student involvement.

Scope

Training programmes

The training efforts of the safety team range from providing safety inductions for apprentices to manual handling training for staff members. Safety induction programmes for students and staff members are developed by the health and safety team in consultation with various internal departments, lecturers, technical officers, staff training and development office, students union office and external consultants (if required). Consultation with the students' union office is important to ensure that the safety programmes are relevant to the lives and interests of students.

Safety induction programmes are also delivered by members of the health and safety team and consist of either a PowerPoint or interactive presentation. All packages are tailored towards the target audience but a typical package includes the following information: health and safety law and responsibilities; safety contacts and representatives; DIT procedures and policies relating to smoking, incident reporting, hazard reporting, first-aid, etc; safety statements; fire safety; personal protective equipment; risk assessments relating to pregnancy and disability; and communication and consultation.

Safety induction programmes are supplemented by a number of other health and safety items and activities:

- student and staff handbooks;
- safety wallet cards and safety booklets;
- plasma screen in main reception areas with safety information;
- health and safety website;
- safe work practice sheets;



- safety notice boards on each campus;
- monthly health and safety newsletter;
- exhibitions and open days (safety week, safety quiz and competitions);
- participation of staff and student representatives at campus safety team meetings;
- toolbox talks on relevant topics – for example, safety in workshops, kitchens and laboratories; and
- health and safety training – for example, fire safety, manual handling, first-aid.

Organisation, consultation and participation

The organisation of the safety induction programme requires a great deal of liaising between the health and safety team and various departments, schools, and the staff training and development office within DIT. The students' union is consulted to ensure that the safety induction programme is relevant and interesting to the lives of students. For example, they developed 'Safe Sam', a cartoon-based scrolling induction programme, as an additional medium to relay important safety information to students.

Communication and consultation between these parties ensures that, in addition to DIT's general health and safety policies and procedures, any specific health and safety information is also provided. Good lines of communication are essential to ensure the smooth running of the induction programme for both the course providers, who are usually the occupational health officers, and the course attendees. Induction meetings are held, induction timetables scheduled, attendance lists maintained and certificates of course completion are awarded for a number of safety courses. For courses with a set number of places, course attendees are requested to fill in course evaluation forms. This allows the health and safety team to review the contents of the courses, make improvements if necessary, and ultimately deliver a selection of high-quality courses and inductions.

Occupational health training for staff and students

Occupational health officers are available from Monday to Friday, from 9.00 a.m. to 5.00 p.m.

They provide confidential advice and support to staff members and students of all ages on any issue affecting their health, safety and well being.

Results and evaluation

This initiative is just one of a number of initiatives that DIT has implemented, and intends to implement as it strives for excellence in health and safety, as well as at increasing the well-being of people at work. The health and safety team feels that by developing and implementing a safety induction programme for both staff members and students at DIT they are taking a proactive step towards creating more safety conscious individuals for tomorrow's workforce.

Problems faced:

- securing sufficient resources to implement the programme.

Success factors:

- commitment of the DIT senior management to OSH;
- holistic approach – covering staff and students, with legal compliance requirements extended to promoting a safety culture among both groups;



- consultation and communication with teaching departments; and
- involving the students' union in the prevention and safety promotion process, for example, involving them in safety meetings.

Transferability

Transferable elements of this case include:

- the approach of the organisation's safety unit carrying out health and safety training in an approach that covers both staff and students; and
- involvement of the body that represents students (in this case the Students' Union) through consultation and active participation in safety meetings.

Further information

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3.24. TEACHING OSH AND ERGONOMICS AT BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS (BME), HUNGARY

Budapest University of Technology and Economics (BME) Faculty of Economic and Social Sciences, Department of Ergonomics and Psychology

Key points:

- OSH and ergonomics integrated into various different degree courses offered across the university;
- includes a compulsory module in the business studies course;
- theoretical and active learning methods, including project work and use of case studies;
- use of own accident, near-miss experiences;
- SOL method (Safety through Organisation Learning - a safety-related event analysis method developed at the Berlin University of Technology); and
- possibility for students to choose an OSH theme for diploma thesis.



Key elements

- technology and economics courses;
- undergraduate and MBA;
- optional and compulsory OSH teaching; and
- theoretical and active learning.

Introduction

An academic department within the university is able to provide OSH and ergonomics teaching in other departments, including on the MBA business studies course. Others have found it particularly challenging to mainstream OSH into business courses, although OSH is a matter of concern for the business and financial management of organisations.

Background

The Department of Ergonomics and Psychology is part of the Faculty of Economics and Social Sciences in the Budapest University of Technology and Economics. There are staff with OSH expertise among those working in the department.

Aims and objectives

To provide OSH and ergonomics teaching to students in a variety of degree courses throughout the university teaching programme.

Scope

Since 1996, the Department of Ergonomics and Psychology has been providing various modules containing OSH and OSH-related issues, which are integrated into various curricula in the university. The character and content of the modules differ. Some are an inherent part of a curriculum, while others are optional and interdisciplinary. Some examples are given below.

- Curriculum: Industrial Design Engineering and Technical Management, B.Sc.
Subject: Product safety (2 ECTS credits)
Character: Compulsory

Product safety is taught through two lectures per week with the emphasis on the theoretical background. It includes evaluation and analysis methods as well as selected case studies. Lectures are accompanied by practical case studies, which means that each student has to select a case (accident, incident or near miss) related to product usage that happened to him/her or close acquaintances. Personal experiences are considered to be essential. The student has to analyse the case, identify root causes and PSFs (Performance Shaping Factors), and finally come up with a documented redesign idea that hopefully can avoid any future occurrences of accidents/incidents of the same type. The industrial design engineering students have to produce a well-documented redesign concept, while the technical management students have to give a public presentation of the results of their analysis.



- Curriculum: Psychology, B.Sc. (in co-operation with Roland Eötvös University, Budapest, Faculty of Psychology)
 Subject: Safety at work (2 ECTS credits)
 Character: Compulsory

The subject 'Safety at work' for psychology students emphasises the psychological (cognitive, attention-related or emotional) background mechanisms of human error that have to be taken into account in designing safe products. The target group of this subject are psychology students in the Roland Eötvös University, Budapest.

- Curriculum: Master of Business Administration, MBA
 Module: Safety culture in companies (integrated within psychology lectures)
 Character: Compulsory

This module aims at raising the awareness of students of business administration to the advantages, possibilities and measures related to companies' ethics and safety culture. It is embedded into the general psychology classes of the MBA curriculum. It is not a full module, being only a two-hour block integrated into the 'Psychology' subject although it is compulsory.

- Curricula: Engineering Studies, B.Sc. (various)
 Subject: Ergonomics (2 ECTS credits)
 Character: Optional

Classes in ergonomics are offered to students from various engineering study courses. The teaching provides a broad overview of ergonomics in general. Safety aspects, such as risk assessment, office environment evaluation, industrial workplace assessment, and human-computer interaction are just some of the topics included. Even though the subject is elective only, it is quite popular among student engineers. Over a thousand students (out of about 10.000 students) chose ergonomics in term autumn / winter 2007.

Embedding safety classes into compulsory subjects helps to make students appreciate safety aspects at work. The popularity of the elective classes in ergonomics shows that students are interested in workplace and machine-design aspects. Some also chose safety issues for their diploma thesis: this one-year project allows them to explore their chosen subject in greater depth

Analysis of real events

Throughout the last ten years the departmental head and his colleagues have collected a number of event analyses and redesign concepts that they use for teaching purposes: During the 'product safety' lectures – and from the materials put on the university website - the students are provided with several different event analyses and redesign concepts. These include event trees and fault trees, human reliability analysis, survival analysis, control chart method, reliability and error rate functions. For ICT products specifically: cognitive walkthrough, heuristic assessment, GOMS analysis, design guideline review, empirical usability testing, etc. Each student has his/her own 'event analysis and redesign' task, which is usually based on a minor real incident/accident – or near miss – which actually happened to him/her while interacting with a simple consumer product (such as a gas/electric cooker, microwave oven, electric toaster, sewing machine, lawnmower, chainsaw, hair drier, deep fat fryer, etc.). The students have to:

- reconstruct the chain of elementary events (first without any interpretation, simply to list pure facts) and identify the consequences;



- establish reasonable possible causal relationships based on a carefully selected method (for example, fault trees), to identify root causes and immediate causes and the related PSF (Performance Shaping Factors) if possible; and
- carry out an effective redesign that would prevent this or a similar types of incident/accident from occurring in the future.

The learning and development outcomes that the students achieve include:

- correct choice of analysis methods;
- ability to conduct an in-depth analysis;
- correct identification of root causes of problems (both technical or human/behavioural); and
- making a redesign of a high technical quality.

Problems faced

Problems included:

- The time available is too short to cover all relevant topics related to ergonomics and psycho-social factors.
- 2 ECTS credits per subject is equal to two hours of lectures per week which means that professors have to concentrate on core areas.

Success factors

Success factors of the teaching methods include:

- use of real-life case studies and students' own experiences; and
- focus on skills development not simply on theoretical learning.

Success factors for achieving OSH teaching in these courses include:

- having OSH experts that can provide the teaching based within the university;
- with regard to the teaching in the MBA, the close proximity of the department with the OSH expertise to the department providing the MBA, and the existence of teaching links. Firstly, they are both in the same faculty. Secondly, psychology is part of the MBA course, and as the OSH expertise is within the ergonomics and psychology department it is straightforward to include OSH as a part of the psychology teaching; and
- students receiving credits for the courses.

Transferability

This case includes a compulsory course which has OSH elements incorporated into an MBA programme. Business studies courses are probably the greatest challenge for mainstreaming OSH into university education. This case shows that it can be achieved. No doubt the close relationship described above between the department providing the OSH teaching and the department providing the MBA course facilitated this process.



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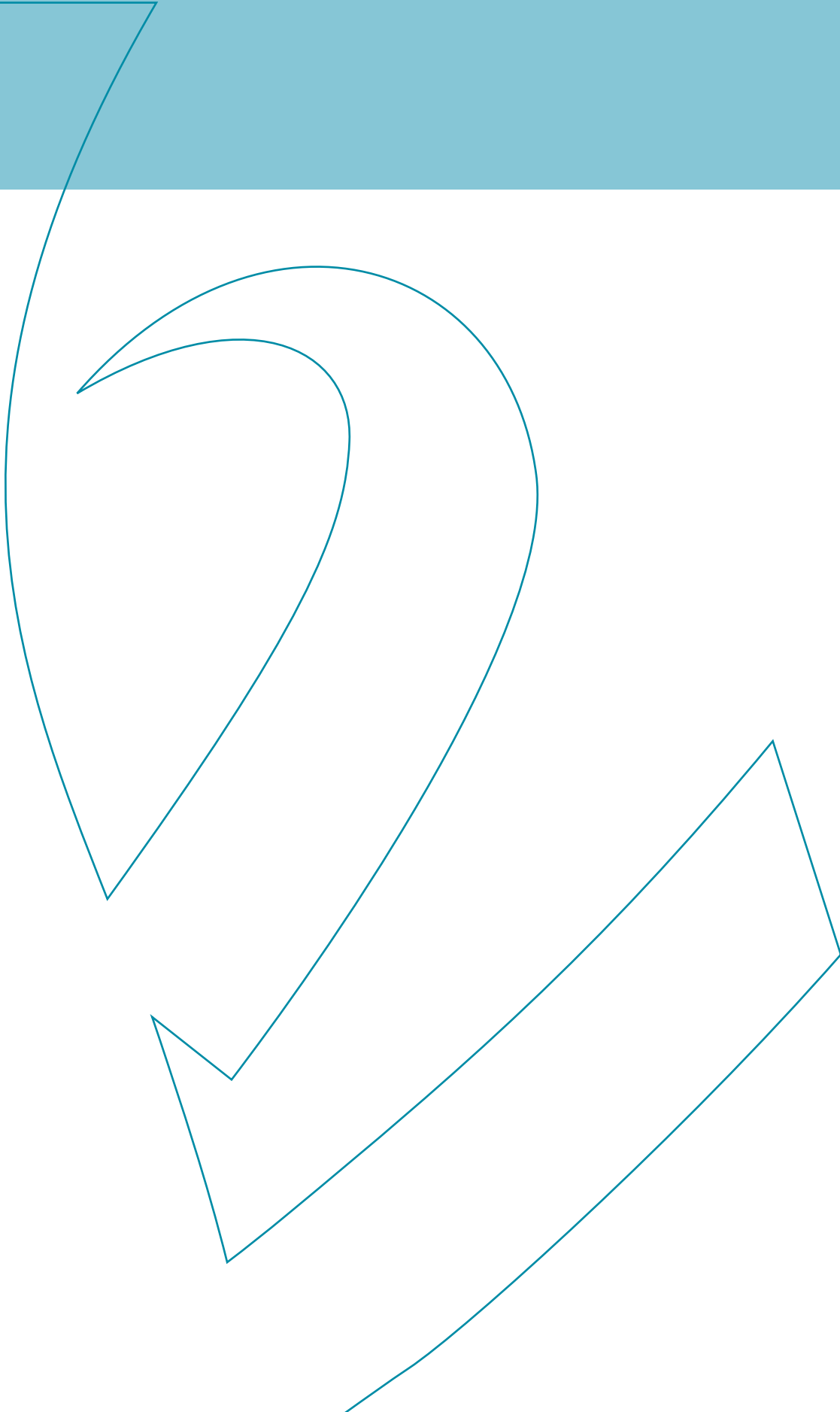
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4.

SNAPSHOTS



This section of the report contains the main findings of 12 additional examples, presented in brief as 'snapshots'.

4.1. IMPROVING OVERALL OCCUPATIONAL HEALTH AND SAFETY AT UNIVERSITY CAMPUS INCLUDING SAFETY AWARENESS OF STUDENTS, DENMARK

Lead organisation

Aarhus School of Business

<http://www.asb.dk/>

Aims

In Aarhus, the focus lies on: conducting research and providing research-based education complying with the highest international standards; interdisciplinary research programmes; cooperation and sharing of knowledge with companies.

Key elements:

- close cooperation with the business community and sharing of knowledge with companies;
- inclusion of working environment matters in various aspects of its teaching and other academic work; and
- giving importance to staff and student working/learning environment.

4.2. RISK IN TECHNICAL SYSTEMS, SWEDEN

Lead organisation

Royal Institute of Technology, Division of Safety Research

Aim

The aim of the course is to open up a safety course to all students, including those who cannot attend the lectures. This is an improvement for students who are also in full-time employment.

Key elements:

- four radio programmes;
- six television programmes;
- one textbook; and
- radio and television programmes are available over the internet.



RISK ASSESSMENT FOR WORK STRESS, UK

4.3.

Lead organisation

Institute of Work, Health and Organisations, University of Nottingham

Aim

The aim of this postgraduate module is to cover the core professional skills required of occupational psychologists and occupational health psychologists undertaking risk assessments for work stress.

Key elements

- The module covers the core professional skills required for undertaking risk assessments for work stress.
- Students focus on issues of work design and management.
- The module considers systems-level rather than individual-level solutions, and is framed within current European and UK health and safety legislation.

PROFESSIONAL STUDIES IN ELECTRONIC ENGINEERING AND ELECTRONIC AND COMPUTER ENGINEERING, IRELAND

4.4.

Lead organisation

Electronic Engineering, Faculty of Engineering, The National University of Ireland, Galway

Aim

The aim of this module is to cover health and safety topics in an electronic engineering course.

Key elements

- The third-year module covers topics such as ethics, continued professional development (CPD), communications, health and safety and contribution to society.
- As part of this module, the university students are credited academically for their contribution to the delivery of a course of laboratory exercises on electronics for second-level students studying physics for the 'Leaving Certificate'
- It includes assessment on background preparation, delivery of taught elements, demonstration of equipment/procedures and adherence to health and safety guidelines and supervision.



4.5. E-LEARNING FOR MEDICAL STUDENTS, CZECH REPUBLIC

Lead organisation

Nemocnice General Teaching Hospital (*Vsobecná fakultní nemocnice*)

Aims

To develop an OSH training programme for medical students that would:

- satisfy legislative requirements for providing workers and students with the necessary information before they start practical work at the teaching hospital; and
- be comprehensive and attractive to young people, ensuring good learning outcomes.

Key elements

- OSH training is available through e-learning for medical school students attending the teaching hospital to learn safe work practices.
- The general teaching hospital in Prague provides professional training for students in various nursing and medical schools. The hospital organises basic OSH and fire protection training courses for students.
- The training is delivered to the students when they begin their practical work at the hospital, and is related to the tasks that students are expected to perform and to their workstations.
- Previously, the course was conducted using a traditional lecture format by a staff member trained at the local OSH and Fire Protection Department (the authorised OSH officer). The OSH and Fire Protection Department, with the support of the Computer Department designed a new e-learning course to train the staff and students being instructed in hospital.
- E-learning provides interactive training and the student has to provide suggestions of practical solutions to specific problems.
- Part I is the main part of the training and meets legislative in relation to local OSH policies and practices. Part II is supplementary and includes a folder containing more detailed information in relation to both OSH and fire protection and materials that can be used independently of the training courses by an employee or student.
- In the main part of the training (part A), basic and general information is provided electronically (e-learning). Specific information related to work or a workplace, such as methods of evacuation (part B), is provided via lectures that are delivered by a manager or an officer authorised by the manager (authorised OSH officer).
- There are plans to include a simulation of practical situations such as a fire in the programme.

Further information

'A safe start for young workers in practice', 2007: <http://osha.europa.eu/publications/reports/GPB06>



PREPARING NEW PHARMACEUTICAL WORKERS: IN-HOUSE AND WITH EDUCATION ESTABLISHMENTS, LATVIA

4.6.

Lead organisation

Grindeks

Aims

Education and training is needed both for specialists and production workers in the pharmaceutical industry. They need this information both on entering the workplace and in their prior education. The company wanted to:

- promote the development of relevant university and vocational training and education; and
- ensure that it had suitable arrangements in place for new workers and students on work placements or students who are involved in research projects.

Key elements:

- safety arrangements, training and mentoring for new employees;
- partnerships with schools, universities and relevant ministries to improve the knowledge and practical skills of schoolchildren, students and young workers in occupational health and safety, and environmental protection;
- work with various educational establishments setting up cooperation agreements and arranging activities with them to promote the development of relevant university and vocational training and education;
- cooperation with the Education Ministry and Science and applying for funds from education programmes;
- at the university level, includes cooperation with science, chemistry and medical departments. Activities include: lectures on control methods for the working environment control methods, reading and supervision, as well as study tours to the company;
- work placements to help students gain practical experience during their studies. Acquiring knowledge and skills about OSH and environmental safety is made an integral part of the placements; and
- students frequently write their diploma thesis on OSH issues that are related to their work placement.

Further information

'A safe start for young workers in practice', 2007: <http://osha.europa.eu/publications/reports/GPB06>



4.7. SAFE START IN THE PHARMACEUTICAL SECTOR, POLAND

Lead organisation

GlaxoSmithKline Pharmaceuticals S.A.Poznan

Aims:

- to improve safety culture through activities in the educational sector; and
- to promote the safety of young employees and students on work placements.

Key elements

- **Student placements:** the company has students involved in unpaid training, paid apprenticeships and students carrying out research on grants. The company ensures that learning about high standards of health and safety forms an important part of the student's overall experience. They gain experience of working in a safety conscious environment – one that is designed for safety and that is operated for safety. They learn to follow safety procedures and to use personnel protective equipment which helps them to develop safe work practices and good habits for their future working life
- **Educational visits to the company:** the company receives visits to their premises by university and other students in higher education and from schools. Learning about working standards and safety at the company forms a part of these visits.

Further information

'A safe start for young workers in practice', 2007: <http://osha.europa.eu/publications/reports/GPB06>



OCCUPATIONAL SAFETY AND ERGONOMICS IN ACADEMIC EDUCATION IN POLAND

4.8.

Lead organisation

Labour Protection Council, Poland

Aim

A review of OSH education at the tertiary level

Key elements:

- an evaluation of OSH education at the tertiary level in 2004/2005 in Poland;
- a wide set of data obtained, concerning Polish universities, economy and business studies, art, technological, agriculture and medical/health care academic courses;
- OSH elements integrated into academic studies: safety management, occupational risk assessment, occupational hygiene, occupational physiology, ergonomics, mining safety and others; and
- various didactic methods and activities: regular lectures, workshops and other forms of training.



4.9. TOMORROW'S DOCTORS – PUTTING OSH ON THE GRADUATE MEDICAL SYLLABUS, UK

Lead organisation

Health and Safety Commission's (HSC's) Health Services Advisory Committee (HSAC)

Aims:

- to ensure that doctors receive basic information about occupational safety and health during their undergraduate training;
- to persuade the General Medical Council (GMC) — which regulates the professional conduct of doctors, as well as undergraduate and postgraduate education — that OSH awareness should be a part of undergraduate medical training; and
- to produce guidance on what OSH topics should be included in the undergraduate medical syllabus.

Key elements:

- initiative made under the context of the UK OSH strategy to include risk education in education at all levels and to raise awareness of OSH in key professions such as medical staff;
- sensitivity to competing demands on the undergraduate syllabus and that the medical schools would not accept a prescriptive approach, but could welcome outcome-based guidance;
- involving occupational health physicians and safety managers working in the medical schools, finding some sympathetic doctors and some good practice examples;
- taking opportunities - acting when GMC were planning revisions to 'Tomorrow's doctor'; linking to the Government initiative on clinical risk management; and using young doctors' OSH concerns, for example, about stress, blood-borne diseases etc;
- making contact with the heads of medical schools first, to agree on the approach and to avoid problems or hostility from the outset. Then contact was made with the GMC Education Committee, involving the sympathetic doctors from the medical schools;
- an agreement by the GMC to add OSH objectives to 'Tomorrow's doctor'. A joint working group between HSAC and the Council for medical schools was set up to draft the objectives for GMC and to outline the guidance for medical schools; and
- developing the detailed guidance for medical schools (for example, what are the common health risks?).

Further information

Agency seminar on mainstreaming OSH into education, 2002,
<http://osha.europa.eu/en/publications/reports/310> pp 30-32



4.10.

A SPEAKERS' INVITATION, UK

Lead organisations

Health and Safety Executive/ Leeds Metropolitan University

Aims:

- introduce students to a broader debate on OSH;
- examination of the role of those working on OSH in companies;
- examination of strategic thinking on OSH; and to
- encourage students, not only in knowing what the law requires, but in using this knowledge in a common sense, proportionate and meaningful way that leads to real health and safety improvements being achieved.

Key elements

- top ranking person in UK Health and Safety Executive invited to speak;
- initiative of the university; and
- speaking to students studying for an OSH diploma, but approach could be used in other contexts (the same speaker has also spoken to construction management undergraduate students).

Further information

'Knowing the rules is one thing - making a real difference is something else', speech by Judith Hackitt CBE, HSE Chair to students at Leeds Met University

<http://www.hse.gov.uk/aboutus/speeches/transcripts/leedsmet300309.htm>



4.11. AN OSH AUTHORITY'S ACTIVITIES TO MAINSTREAM OSH INTO THIRD-LEVEL EDUCATION, IRELAND

Lead organisation

Health and Safety Authority (HSA)

Aims

- Mainstreaming OSH into third-level education in a practical and credible way.

The HSA has developed a long-term strategy to mainstream or embed OSH into education at all levels, including third-level education. This strategy includes developing curriculum support and resources for educators, developing best practice in the education sector and working in synergy with like-minded organisations. They have found the same experiences as others regarding university-level education, which include: the challenge of developing competence in lectures to deliver OSH education and their reluctance to embark on it, gaining access to the third level, university autonomy which creates the need to deal with individual universities and makes it harder to influence their curricula, resources and curriculum capacity. They are conscious that they should not approach universities about the incorporation of OSH without having something credible to propose, and that they need to build a relationship first - they cannot just present them with an OSH module. However, opportunities may be presented for embedding OSH when programmatic reviews take place and new courses are being developed.

Key elements

- They are carrying out their own research to understand the needs and what could be done, which will be available in 2010, in order to map and plan activities and to start from a credible base.
- Their focus is on construction, architecture, engineering, design and agriculture.
- They have run a small competition for construction courses, working with the construction industry committee.
- To provide curriculum support they have produced some case studies and an e-newsletter for the third level. This is part of their 'chase safety' senior-cycle programme.
- E-learning is being developed for construction-related courses. It is focused on risk management. Access to it is free and it provides self-directed, self-paced learning.
- Along with other levels of education, they will support universities to develop their own OSH management systems, but also threaten them with more enforcement inspections. They work with the Ministry of Education and Science regarding the development of appropriate OSH management systems.
- The universities state that they seek to provide what industry wants, but currently industry is asking for the development of 'soft' skills such as communication and team-working abilities rather than technical skills such as OSH. So HSA will look for ways of embedding OSH in the development of such 'soft' skills.
- For secondary-level students and beyond they are also developing software games and linking them to social networking sites.
- They will work with the Irish Association of Universities when they have the results of their research and something credible to discuss.

Further information

The education section of the HSA website: <http://www.hsa.ie/eng/Education/>



PARTNERSHIP TO DEVELOP A BUSINESS COURSE, USA 4.12.

Lead organisations

National Institute for Occupational Safety and Health (NIOSH)
Williams College of Business, Xavier University
National Safety Council

Aims:

- to make the business case for occupational and environmental safety and health (OEHS) through a course for MBA students entitled 'Business Value of Safety and Health'; and
- to teach the next generation of executives that workers are a critical asset for a company in today's competitive marketplace and, therefore, investing in their safety and health is more than the right thing to do, it is also the smart thing to do.

Key elements

- Partnership between NIOSH, NSC and the Williams College of Business at Xavier University in Cincinnati, Ohio.
- The course addresses how companies can evaluate OEHS interventions and programmes in order to choose and implement the most cost-effective ones that will both improve occupational safety and health for workers and support the business objectives of the company. This type of approach can guide decision making and point to appropriate actions such as initiatives for long-term planning and operations management, among others.
- The course includes real-world cases from companies that have incorporated OEHS into their respective business models. Many of the cases come from the National Safety Council's Robert W. Campbell Award for Safety/Health and Environment Business Case Studies (See case 3.7)
- The first course was held January to May, 2009 as a business administration elective in the MBA program at Xavier. The course was well received by the students, who noted the value of such an applied and holistic approach to managing a company.
- Based on the success of the first course Xavier created a new Centre for Excellence in the Business of Health and Safety within an existing Centre for Entrepreneurship and Innovation.
- Long term aims for the NIOSH, NSC, and Xavier partnership include encouraging the development of sound, effective, and collaborative research by safety and health professionals, businesses, and economic scholars and promoting the transfer and workplace implementation of research findings on effective occupational injury and illness prevention strategies and technologies.
- Future plans include Xavier and NIOSH co-sponsoring a conference entitled 'Economics of Sustainability – Health, Safety, and the Environment Conference: October 27–29, 2010.'
- NIOSH hopes to partner with additional colleges and universities to teach these important concepts to the next generation of business leaders. NIOSH is also hoping to partner with institutions that train others who affect the holistic approach to safety and health, such as engineers, architects, environmental scientists, as well as safety and health professionals.



Further information

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Xavier University, USA

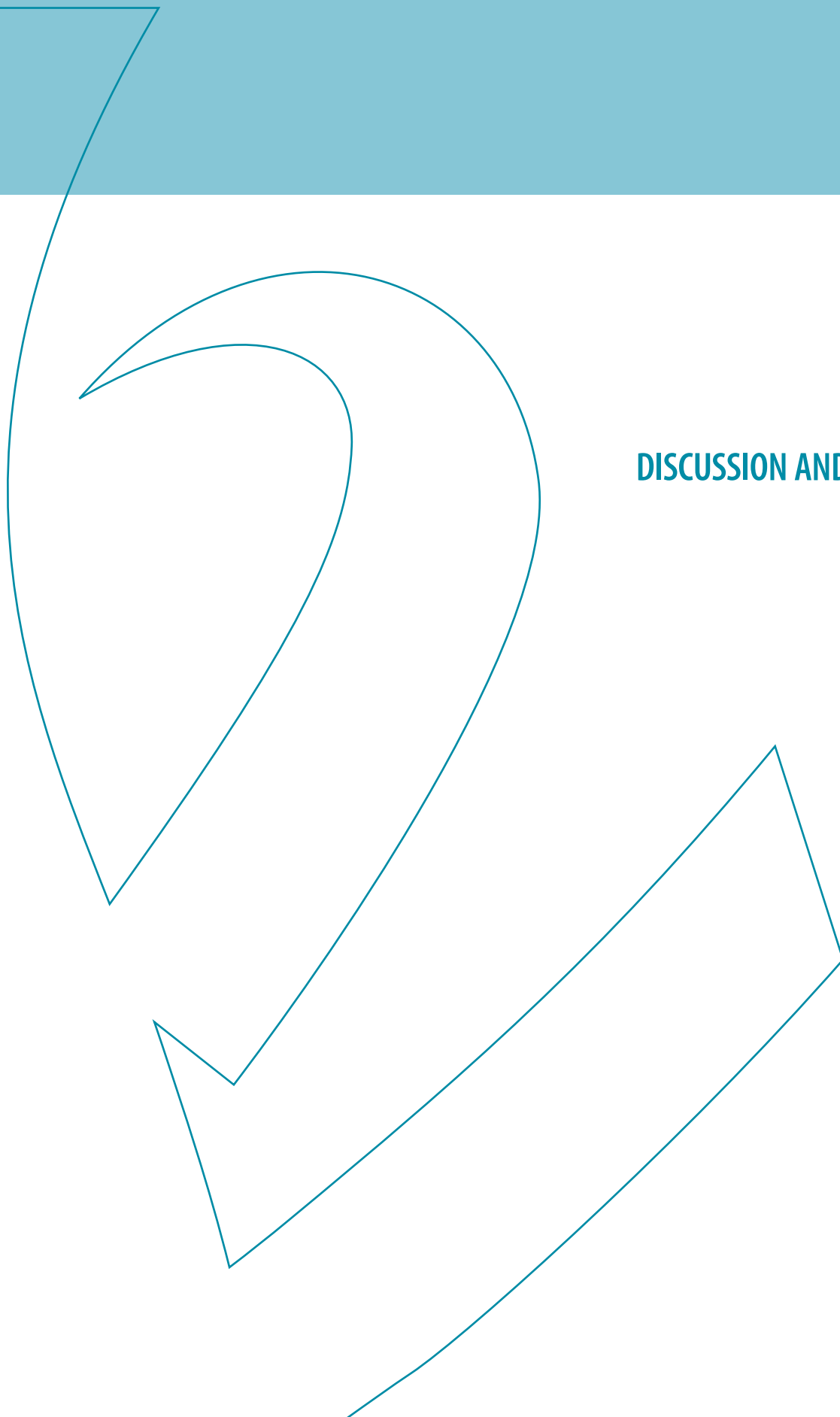
Dr. Mei-Li Lin National Safety Council, USA

http://www.cdc.gov/niosh/blog/nsb092109_businesscase.html



5.

DISCUSSION AND CONCLUSIONS



Discussion of the cases

Broad range of cases

The examples of mainstreaming or embedding occupational health and safety into university education presented in this report cover a broad range of cases. They mainly relate to undergraduate students, although they may include elements for postgraduate students as well. Health and safety is integrated into differing subjects such as chemistry, engineering, architecture, psychology, business administration and industrial courses. Some of the cases address all courses and students, following a transversal approach. In addition, the learning methods used varied widely from traditional lectures, to computer-based learning, to active learning using real-life case material. One of the cases followed a holistic approach that targets both staff and students.

The examples of integrating OSH into courses are more likely to come from technical universities, but there are also examples of courses provided in general universities (for example, University of Vienna, Austria). The cases were mostly developed inside the university (for example Salamanca University, Spain), but others were developed in the cooperation with research institutes (such as The Central Institute for Labour Protection, Poland) or with support from safety authorities (such as University of Liverpool and Health and Safety Laboratory, UK).

Compulsory versus elective modules

Learning about occupational safety and health issues in universities is compulsory in some cases (as in Tallinn University, Estonia) and elective in other cases (such as the case from Tampere University of Technology, Finland).

Having study requirements for OSH management roles specified in legislation to implement European directives helps to introduce OSH education into certain disciplines, for example, those linked to civil engineering obviously have a direct influence on course content. On the other hand, unless having studied OSH at university level is a requirement for the practice of certain professional activities, for example, in some Member States for civil engineers coordinating construction work, then OSH is much less likely to be a compulsory part of a course.

Where an OSH module is elective, to promote its uptake by students it is desirable that they receive course credit points for the skills they develop. Another method to motivate student participation by providing them with recognition is the use of competitions that result in awards. The Lacobus restoration-design-contest (INRS, France) is an example where OSH has been integrated into a more general student contest. Another example, also from INRS, France, is the design competition for multi-disciplinary teams of international engineering and architectural students. This competition-approach to OSH has also been used successfully in vocational education.

Embedding OSH in course curricula/ taking a cross-university approach

In the cases presented, OSH is more likely to appear as a separate module rather than being truly embedded with course curricula. Exceptions include the project from Liverpool University, UK to embed OSH across several modules of an engineering course and the approach of the National Safety Council in the USA to provide case



studies for use in business studies courses. There is also the example from ENSCR, France regarding risk education for chemistry students.

From the experience of looking for cases to include in the report it became apparent that what was often understood as mainstreaming OSH into university education was whether the university offered stand-alone OSH courses, or courses with a major OSH component, among the list of bachelor and masters' degree courses and postgraduate diploma courses that it had on offer. Such courses are run for students who seek a future career as a specialist OSH technician or to qualify them to be an OSH coordinator on a construction site. The concept of embedding OSH within other course programmes was less clearly understood. The engineering example from the UK and the business studies example from the USA are probably the best examples of the hard work needed to embed OSH into other course programmes, especially if there is not a clear legal requirement regarding OSH proficiency for the profession.

Only a few were embedded in broader strategies. Mostly there were only single universities involved. Examples of broader approaches include 'NOP-online' and the 'KMR-dangerous substances' e-learning projects from Germany, both of which involved a number of different universities. The latter was funded by the Statutory Accident Insurance for the Public Sector of North Rhine-Westfalia. Integral II e-learning platform, also from Germany, involved 10 universities. The German Federal Ministry for Education, Science, Research, and Technology (BMBF) provided funding for the project.

One way to try to get a broader approach could be to work with the professional organisations who are involved in setting professional qualifications and standards. For example, in the UK the Health and Safety Executive has worked with professional engineering institutes: there is now an Inter-Institutional (engineering) group on health and safety for major engineering Institutions and the universities offering engineering degrees. The group is seeking to embed risk management techniques into undergraduate engineering courses by introducing concepts of proportionate risk control. With HSE funding the group has developed a 'sample' CD e-learning package to teach undergraduate engineers of all disciplines about the key concepts relating to health and safety risks (See <http://www.hse.gov.uk/research/rrhtm/rr482.htm>).

Variable length courses

The length of OSH modules offered as part of university courses also varied considerably. The shortest course was the computer-based learning environment developed in the Technical University of Tampere, Finland, which included 12 lectures and an examination. Other courses were almost the same length, for example, those from the UK (14 hours of lectures), in Austria (15) and in France (18). The longest course was established in the Tallinn University of Technology in Estonia, where 32 hours of teaching was provided with an additional 16 hours of laboratory practice. In the Bulgarian case, there were 30 hours lectures plus 15 hours practice. In the Portuguese case the length of the course was 23 hours. It appears that in the technical universities of some New Member States more time is being dedicated to OSH than in the older Member States (EU-15).

Focus on civil engineering and architecture

OSH elements are most likely to have been incorporated into civil engineering and architecture courses – especially, as mentioned above, where OSH training requirements for civil engineering works have been specified in national legislation.



OSH courses involving other engineering disciplines are more likely to be optional. In total seven cases came from engineering. Unsurprisingly, there are also examples that involved mining studies. One case and one snapshot covered medicine. While the need to cover OSH in vocational courses in agriculture is well established, it would be interesting to see how OSH is covered in university level studies on agriculture. The snapshot from HSA (OSH authority), Ireland, mentions that they plan to target agriculture courses Ireland.

As has been mentioned, OSH education should cover not only technical safety issues, but also the place of OSH in integrated management systems and its role and importance in business management. However few cases were found involving mainstreaming OSH into business studies. The initiative by the National Safety Council in the USA came from outside of the university community and was the only case specifically targeted at business studies. At the Budapest University of Technology and Economics (BME), Hungary there is a compulsory module on OSH and ergonomics included in the MBA business studies course. Modules from the on-line learning platform Integral II, Germany have been used in undergraduate lectures for students of business administration.

This apparent neglect of OSH in business courses was also found in a study published by the UK Health and Safety Executive in 2007, cited at the beginning of the US case. It found that the explicit occupational health and safety content of eight full-time Masters of Business Administration (MBA) courses was either non-existent or very limited. The report suggested that the only practicable way to encourage consideration of OSH in MBA programmes would be the development of high-quality case study materials that meet the needs of business schools, which is exactly what was done in the case from the USA. Construction, with its high rate of fatalities means that the importance of OSH is much more obvious to students and professors of civil engineering, and they are also comfortable with a subject which is often perceived as being wholly technical in nature. Lack of awareness of risks in the administrative professions, such as work-related stress, and the notion that OSH is a technical subject may mean that staff and students from administration sciences are less likely to see OSH as an issue for them, even though business and administrative decisions and actions can affect the OSH of others.

Provision of OSH education by technical faculties

OSH education at universities is mostly organised by technical faculties. Technical faculties are more likely to focus on safety issues than occupational health issues, which are more often taught by faculties of medicine, or work organisational issues. However it is important that the focus of OSH is not only on safety and high risk industries. It could give the impression that OSH is not an important issue in other areas. If a university does not have a faculty that includes an OSH-related speciality (safety, ergonomics etc.) it is more difficult for them to offer OSH modules within other courses as they may not have lecturing staff with the necessary competence or interest readily available.

Technical universities in the newer Member States

There are several cases from some of the newer Member States such as Estonia, Lithuania, Poland, Bulgaria, Slovakia and Hungary. It appears that OSH is often included within, for example, engineering courses in their technical universities and that this is not a new phenomenon. These activities continue, although those in the departments providing the OSH education complain of lack of time and resources.



On the other hand, the requirement in these Member States to implement new OSH legislation to comply with the EU OSH directives has provided opportunities for them to further develop their teaching and research work in the OSH area. They are also introducing new learning methods, for example, e-learning OSH resources.

Practical laboratory work

Carrying out practical work in a laboratory is perhaps the most hazardous part of university activities. While both professors and students usually recognise this, they still need specific instruction and training in laboratory safety. There is a clear interface here between learning about OSH and the university's responsibility to keep staff and students safe. In the laboratory work, students can see the OSH principles and requirements for the first time put into practice in their own work. To get the most out of this instruction, it should not just be a presentation of laboratory rules, but put in the context of learning about risk assessment and prevention so that students develop a more general awareness and skills related to risk and risk prevention. The laboratory safety case from the University of Vienna, Austria, takes this approach and combines theoretical instruction with practice. The NOP-online/KMR-dangerous substances, case from Germany shows how e-learning and an online database can support learning and make resources available over across several universities.

Active and practical education methods linked to the real world

Learning should concern the development of skills, attitudes and behaviours as well as theoretical knowledge. This cannot be achieved through the use of lectures alone. In addition, it is a well-known that practical, 'active learning' guarantees far better learning results than passive methods such as lectures (see box). This is especially true for a practical topic such as OSH and previous EU-OSHA reports have emphasised the importance of ensuring a close link to working life and striking a balance between theory and practice (see annex 3).

It is, however, a challenge to introduce more practical and participatory learning methods into university education where large student numbers are involved. It also requires more resources from universities and perhaps in some cases, perhaps, a change in mentality by some about how learning at university should take place as well as specific skills on the part of educators. In universities the easiest educational methods for them to implement solutions to implement are lecture-hall teaching combined with e-learning. Nevertheless several of the cases demonstrate ways in which a more active-learning and participatory approach can be achieved and how a real-life work situations can be incorporated can be incorporated into their methodology.

Visiting and working in real workplaces is an important, effective way to improve the safety and health awareness of students, which is difficult to replicate in the classroom, even with the use of resources such as videos to take the student out to the real-life situation. In the case description from INRS, France, architectural and engineering students design projects together, such as houses. In the case from Belgium, students of architecture visit construction sites and observe the work in order to understand the safety and health requirements of construction work. In the case of DEMI in the New University of Lisbon in Portugal, students perform risk analysis at real workplaces in order to learn the correct techniques. The University of Mining and Geology St. Ivan Rilski cooperates with mining companies in order for students to learn safe working methods in this hazardous industry. The National Safety Council in the USA has developed OSH/business case studies for use on business courses. The educational materials developed for engineering students at Liverpool University, UK use accident case studies.



Many universities already cooperate with employers regarding student work placements, work visits and to provide visiting lectures. Some companies, such as the 'snapshot' example of Glaxo in Poland, already incorporate OSH into such student activities and make it an important part. Other companies working with universities should routinely be encouraged to do the same.

Retention rates for different learning methods

Research suggests that the average retention rate for different learning methods is as follows:

Lectures	5%
Reading	10%
Audio-visual	20%
Demonstration	30%
Discussion group	50%
Practice by doing	75%
Teach others/ immediate use of learning	90%

(e.g. NTL Institute for Applied Behavioral Science, 300 N Lee Street, Suite 300, Alexandria, VA 22314, 1-800-777-5227)

Providing suitable educational materials

A lack of suitable teaching material is one problem related to mainstreaming OSH into universities. For example, in Finland a substantial amount of occupational health and safety materials are available for workplaces, but they are not directly suitable for educators (Salminen and Palukka, 2007). The cases from the University of Liverpool, UK and the National Safety Council in the USA are examples of where specific case study materials have been developed for use in universities. The materials need to be in a suitable format and appear relevant and interesting to both professors and students. Lack of suitable materials was the major impetus for the development of teaching support materials and a self-learning online version by CIOP in Poland, who worked closely with universities to develop the materials.

Use of electronic resources and learning methods

On its own, the use of e-learning is neither an innovative approach to learning nor a driver for mainstreaming OSH into education, but used in the right way it can open up learning opportunities and the provision of resources and provide an invaluable support to the educational process.

Not surprisingly, universities appear to be making extensive use of new technologies to support student learning about occupational health and safety, however, sometimes e-learning is offered as the only learning method for OSH. The Internet and e-learning environments have some clear advantages such as making it possible to learn without being restricted to time or place. They make it possible to make learning modules and resources more widely available both within and between institutions, and the cases NOP-online and KMR-dangerous substances from Germany are examples of this, as is the case from of the materials developed by CIOP in Poland. They can reduce the pressure on teaching time and make it possible to offer learning



opportunities when there is not sufficient staff expertise available or where no other learning exists. Another good example is the Finnish case TYVE, where the students in the Open University can study while being employed in full-time work. In the case of the University of Salamanca, Spain, they provided a CD-ROM of OSH resources to every graduating student. They can also help to standardise learning across institutions.

Especially more sophisticated packages with interactive resources and high use of imagery can help to bring some realism into the OSH learning experience. They can be a way to safely show real-life cases and dangerous situations and a way of learning and applying skills that can later be transferred to the workplace. The INTEGRAL II case from Germany is an example of OSH being embedded within e-learning packages for other subjects. The emphasis is on skills development and it used case studies. A project has also started to provide some of the case studies and other resources developed for engineering students at the University of Liverpool in an e-learning format. However, there is a possible danger of too great a reliance on electronic distance learning methods. E-learning can never be a substitute for hands-on experiential, participative learning methods. In addition, a general problem related to computer-based training programmes is a lack of social contact, especially to the teacher in order to have questions clarified. Therefore, ideally they should be used to support learning as INTEGRAL II is, but not as the sole learning method. In which case, they need to include guidance for staff on their use as a teaching resource just like for other kinds of teaching resources.

OSH knowledge and education skills for OSH education

A challenge for mainstreaming OSH into universities is the lack of training for teaching at university level as well as the lack of sufficient OSH knowledge among academics whose speciality is not OSH. Often professors and lectures have a very narrow field of expertise and as mentioned above, usually they have not received any pedagogical training and are not familiar with active learning methods and only very rarely will a university teacher have an OSH teaching qualification.

If the university does not have any teaching expertise in OSH, it is obviously helpful if this can be provided by the local OSH authority, institute or work insurance body. The case from ELINYAE, western Greece is an example of an OSH institute providing some training, in this case to both staff and students. As has been mentioned, for obvious reasons, those universities who have a faculty which includes an OSH-related field are at an advantage. However, if OSH education is provided in this way, by visiting speakers or as a module given by another faculty, usually OSH will not be truly embedded, but taught as an add-on.

International cooperation and exchanges

Cases such as the project from INRS in France, where international students from architecture and engineering are brought together to design projects, show that there is international cooperation taking place on OSH education at the university education level. Another example, also from INRS in France is the restoration design contest. Common OSH laws across Europe, networking on OSH and networking on OSH and education and cooperation across Europe concerning other levels of education have probably all helped to stimulate this cooperation. Bringing together knowledge and experience of occupational health and safety from different countries can improve the quality of teaching and helps to prevent 'reinvention of the wheel'.



A good example of this is evident in the case from INRS in France. Another example of a transitional approach is the EDFORSA project from the Czech Republic.

The European Union has supported the exchange of students and researchers between European universities and this provides the students and researchers with an opportunity to look at OSH education in other universities. They not only provide a different kind of learning experience for students, but also allow exchanges concerning educational methods for occupational health and safety between the teaching staff from the different universities involved.

University autonomy, developing individual contacts and setting up local projects

One challenge of mainstreaming OSH into higher education, which is consistently raised when OSH-education experts are asked about interventions at this level, is the extensive autonomy of universities concerning the courses they offer and the educational methods that they use. In addition, the same ministry does not always cover school and university education and different networks are involved. Direct contact with individual professors is therefore important to promote the embedding of OSH in university-level courses. Examples of this approach are seen in the case from the USA involving the provision of case studies for use in business studies courses where the National Safety Council (an NGO) makes direct contact with professors, and in the engineering example from the UK where the OSH research organisation contracted by the Health and Safety Executive worked directly with an interested professor. Similar to the UK example, the US national OSH institute established a project to work directly with an individual business school to develop and introduce a course, in partnership with the National Safety Council (snapshot 12).

Funding and attention given to mainstreaming activities at the university level

There appears to be less funding for projects and fewer resources allocated, for example by OSH institutes, at this level of education as compared to others. This is probably partly because of some of the specific challenges at this level that have been mentioned, but also possibly because interventions are not seen as so 'sexy' at this level. Certainly more information and models about how to reach the university level are needed and alternative working methods need to be explored and developed. Support is needed to transfer existing examples of good practice and interventions at this level and an exchange of both ideas and concrete tools is needed.

The European Network Education and Training in Occupational Safety and Health (ENETOSH) is one organisation that provides assistance in the exchange of information, resources and finding contacts through the databases on its website.

Transferability

Regarding the need to transfer existing good practices, it is judged that most of the cases presented in this report could be easily transferred or adapted to other universities. Many of the educational resources developed are internet-based and can be downloaded by anyone from the web pages of the universities. However, for commercial purposes, some resources require licences (for example, Integral II from Germany). Many of the cases are based on the common requirements of the OSH Directives of the European Union, which should increase the ease of transferring an example from one Member State to another. The international examples could also be used in the EU but may require more work to adapt them to the EU context.



On the other hand, many of the successful methods and approaches found in the cases, such as ensuring a close link to working life and the use of practical activities, had been identified in previous EU-OSHA work concerning both OSH and education and training of young workers. Although the university level is a special case it is not necessary to start from scratch. More details of success factors from some previous EU-OSHA reports are given in the appendix.

Combining a safe university environment and OSH learning

One barrier at university level is academic staff who appear to undervalue occupational safety and health issues, especially those holding the attitude that safety issues can restrict research, and in which case investigation should take precedence (often professors' main interest is their research, and teaching is seen as a side issue). In this case, not only is OSH not seen as a priority for learning but it may be viewed as a hindrance. In addition, some universities are not fully aware of the OSH issues on their own campus. Not only are universities autonomous but individual faculties and professors can act quite autonomously within them, which can make it more difficult for the university safety department to put in place an effective management system for OSH, especially where professors are not convinced of its importance. Budgets, time and the availability of resources are always tight, which can push OSH further down the list of priorities both for student education and for management and administration in universities. While the cases show that OSH can be placed higher up the agenda in both the educational and administrative life of universities, it is important to be aware of such barriers.

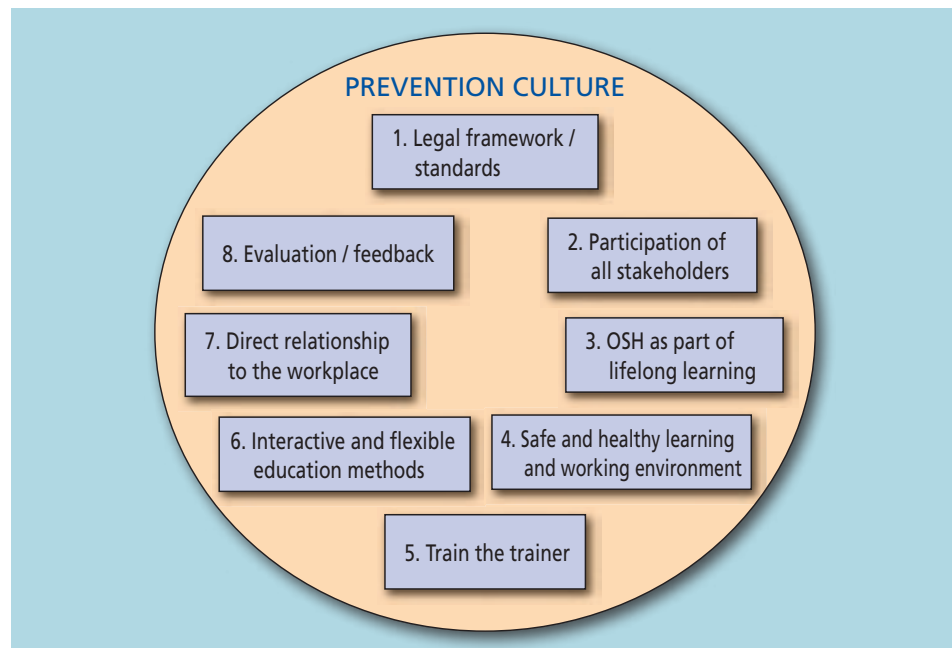
Nevertheless, like all employers, universities have to run themselves safely and comply with OSH legislation, requiring attention to be given to the health and safety of professors themselves and other staff. Addressing safety issues for staff and students can be used as a learning opportunity and such a holistic approach is strongly supported by OSH-education experts. As in schools, an explicit emphasis on a safe and healthy university environment combined with OSH education is probably the most effective way to instil OSH awareness in students. As mentioned, laboratory practice is one area where compliance with OSH legislation on the part of the university interfaces with education. The case from the university in Ireland shows how a 'whole-university' approach can be taken, involving wider student participation in making the learning environment safe. In this case participation included the involvement of the students' union. While not all Member States have such organisations within their universities, it could be useful to develop and share guidance in this area.

Regarding schools, the approach of combining OSH/risk education with ensuring health and safety in the school for staff and pupils has been recommended in previous EU-OSHA publications and in Sweden, for example, it is compulsory for pupils to be involved in risk management in schools. This recommendation is equally valid for universities. As in industry, top-level commitment and initiative is needed from university chancellors and directors are required to implement this approach: commitment of the DIT senior management to OSH was one of the success factors in the Irish case.

Taking a holistic view, the elements internal to the educational establishment that influence the promotion of mainstreaming OSH can be seen in figure 1 below. It is part of a larger model that shows the external influences on the process as well.



Figure 1: internal elements that influence the promotion of OSH mainstreaming within an educational establishment. Taken for *Mainstreaming occupational safety and health into education, EU-OSHA, 2004*



Challenges and opportunities for mainstreaming OSH into university education

Challenges

It is important to be aware of certain challenges to the process of mainstreaming OSH into university-level education.

Challenges include:

- the need for partnerships with individual universities, faculties and professors;
- convincing professors of the importance of OSH education;
- high existing demands and pressures on undergraduate time;
- lack of suitable OSH educational materials for the university level;
- introducing practical, active learning methods for OSH in a learning environment dominated by theoretical learning methods;
- how to address large class sizes;
- lack of university-level teaching staff with OSH expertise and/or active and participatory education skills;
- sharing of educational resources where there is a strong tradition of guarding information in a culture intellectual ownership;
- the length of time it can take for changes to be made to a syllabus;
- lack of funds for developing and providing OSH education at university level compared to school level, including funding for pilot projects;
- developing new links at Ministry level where different ministries cover schools and universities; and
- the continued need to improve health and safety culture within universities.



Contextual factors that facilitate integration

Certain contextual features appear to facilitate the mainstreaming of OSH into university-level education.

Mainstreaming activity is more likely:

- in areas where national OSH legislation places specific responsibilities on certain professionals such as those involved in civil engineering projects;
- where training requirements for safety technicians are specified in law and include university-level study;
- where there is an academic department on site that is engaged in OSH. This appears to be more likely in technical universities;
- where the OSH authority or work insurance body has a training role that could include providing assistance to universities; and
- in those areas where the university has specific OSH duties, for example, for student safety during laboratory sessions and practical work.

Success factors

The cases suggest certain ways and means to approach mainstreaming OSH into university-level education. For example,

Do:

- start by finding and **engaging some receptive individuals** and institutions to work with;
- **work in cooperation**, do not be prescriptive;
- **be sensitive to competing curriculum demands** and the pressures on undergraduate time that already exist;
- limit OSH teaching to certain **key aspects**;
- **embed OSH issues within courses** rather than as an add-on, especially if there is very limited opportunity for additional modules;
- provide **suitable OSH educational materials** which are relevant to the study area into which they are being embedded and the way that topic is taught;
- use **real cases** and look for ways of introducing problem-solving methods, **active learning** etc.;
- provide **assistance to academics** in how to make effective use of the materials;
- use the **need to provide safety instruction** for practical work as a way of introducing a broader prevention-culture message to those students;
- use **e-learning and electronic resources** to support and complement classroom teaching, but also make them more widely available for distance learning;
- for student motivation, have the study of **OSH contribute to final grades** or attainment of a recognised diploma etc.;
- **get the timing right** - the profession has to be ready to accept changes, and the mood has to be right. For example, open discussions when changes are being made to the curriculum or to strategies regarding future university graduates;
- **engage with professional associations** about university-level curricula;
- **explore partnerships** - cooperation between universities, research institutes, safety authorities, insurance companies, and industry; and
- **promote and facilitate a whole-university approach to OSH** which combines OSH/risk education with creating a safe and healthy working/educational



environment for all staff and students and actively involves staff and students in the process.

Eight more ideas:

- setting up a **repository for sharing university-level learning resources**;
- **where some OSH education is already occurring**, for example, because of the contextual factors above, using this as a stepping-stone to mainstream OSH more generally into other faculties;
- where **local companies** are cooperating with universities, encouraging them to integrate OSH into their activities for students (provision of lectures, student visits or placements);
- **learning from the experiences of mainstreaming OSH into school education** and good practice in training young workers and adapting them to the university level (for example, see annex 3);
- taking advantage of the increasing use of 'modular learning' and developing a specific **OSH module**;
- **adapting vocational training methods** and resources for use at university level;
- encouraging **employers to identify OSH knowledge as a factor in recruitment**; and
- working directly with **business schools to include OSH and economic productivity** in their research and conference programmes as well as their teaching programmes.

Overall conclusions

This report, and the cases in it, demonstrate that there are more challenges to integrating OSH into university-level education compared to other levels of education. This was also borne out by a meeting of the EU-OSHA expert group on mainstreaming OSH into education who discussed a draft of this report (see annex 2).

Nevertheless, the cases in the report also show that steps are being taken to mainstream OSH into university education in a variety of disciplines and in a variety of ways. Furthermore, the cases demonstrate that, depending on the circumstances, there are various approaches that can be used and opportunities that can be exploited.



Figure 2 shows some of the various interacting factors that have an influence on graduating students' knowledge, abilities and attitudes concerning OSH.

Figure 2: Some factors influencing risk knowledge and skills in new graduates



Given the hurdles to embedding risk education at the university level, networking and the sharing and exchange of experiences are particularly important. More specific projects to support the development of approaches and resources at this level are needed.

Ultimately the aim should be to develop a 'whole-university' approach to creating a safe and healthy, work and learning, environment combined with risk education. While some laboratory work and research activities can involve potentially high-risk activities, universities as a whole are not the most hazardous work areas. Nevertheless, many working days can still be lost through accidents and ill-health. A 'whole-university' should therefore be taken which combines OSH management to prevent risks with raising awareness and developing knowledge, skills and safe attitudes and behaviours in students and staff, including professors, technical, administrative and support staff.



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ANNEX 1. OVERVIEW TABLE OF THE CASES

Country	Title	Lead organisation	Main feature or achievement
Germany	Good Practice Databases Integrated in Chemistry Studies: NOP-online and KMR-dangerous substances in lab courses	Two consortia from German universities	Two consortia from German universities launched websites covering good practice instructions on safety and environmental issues in organic chemistry lab courses (NOP-online), and also on health and safety instruction when working with carcinogenic, mutagenic and reproduction toxic substances (KMR). Both websites provide ready to use information that can be applied directly by teaching staffs at universities.
Germany	Integral II	The Institute of Industrial Engineering and Ergonomics (IAW) of the RWTH Aachen	The Institute of Industrial Engineering and Ergonomics (IAW) of the RWTH Aachen coordinated the development of an on-line learning platform concerning industrial engineering and ergonomics, covering various OSH-related modules. These are suitable for e-learning, blended learning and teaching at universities. Currently the modules are being used in undergraduate lectures for students of Mechanical Engineering, Industrial Engineering, Psychology, Business Administration and Industrial Education.
Austria	Introduction to the principles of laboratory safety – prevention and emergency response – handling biological and radioactive substances	University of Vienna	The primary objective of the seminars is to raise the students' awareness of the fact that safety and health protection (occupational safety) is an integral part of any research project and that these issues can gain even greater significance when students finish their studies, for instance in their possible future occupation as company safety inspectors. Moreover, the students need to become familiarised with basic aspects of safe work practices and provided with a legal background.
Czech Republic	Risk prevention and health protection in adult education	Výzkumný ústav bezpečnosti práce (VÚBP)/ Occupational Safety Research Institute	The EDFORSA project aims at improving knowledge and skills through completion of a distance-learning course of occupational health and safety and risk prevention issues for the following target groups: specialists in this field, managers and employers (especially from SMEs), employees and the general public. The partnership formed with various institutions (research institutes, universities, providers of non-formal education, enterprises) from different countries strengthens the transnational character of experience sharing and information transfer from EU member countries to other European countries.

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Country	Title	Lead organisation	Main feature or achievement
Bulgaria	Management of risk in mining and natural environment in academic education and research	University of mining and geology "St. Ivan Rilski"	The university carries out teaching and research activities closely connected to the safety issues. It prepares students to design, organise and carry out work processes in the area of mining and geology. The scope of interest in the area of OSH covers engineering safety, mining safety and rescue, fire safety, health and safety risk assessment, and environmental safety.
United Kingdom	Risk Education in Engineering - Development of Year one materials	University of Liverpool and HSL	The project incorporates risk education into the curriculum of an undergraduate engineering degree course as a compulsory part of the course. The project uses real-life case materials, and has an active learning approach.
USA	Transferring the results of business cases awards initiative to business and engineering schools	National Safety Council	The winning OSH business management cases from an international award are converted into business case studies for integration into business and engineering school curricula.
Poland	Multimedia educational package on OSH issues	The Central Institute for Labour Protection - National Research Institute	The institute has developed multimedia educational package for tertiary education: Work knowledge – safety, health, ergonomics. This work is an interdisciplinary, monographic, didactical material based on recent technological, biological and social developments. The two versions are available – one prepared for the teacher and the other (slightly simplified) for those who will study on their own. The package is available on CDs (accompanied by special software and manual), over the Internet and as printed textbooks (each of 8 textbooks is accompanied by CD).
Portugal	Learn by doing	The Faculty of Science and Technology/ New University of Lisbon	The faculty offers a variety of OSH courses for Graduate and Post-Graduate Engineering students. The OSH skills are built not only on theoretical classes but also by performing practical risk analysis activities based on real world work situations, from different fields of activity according to students' vocational area. They are also encouraged to use the kind of measuring equipment which would be employed on an OSH assessment of the work environment. They also undertake different manual and computer-based calculations.

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Country	Title	Lead organisation	Main feature or achievement
Portugal	Overview of the inclusion of OSH courses in Portuguese universities		New stand-alone courses and OSH elements incorporation in engineering prompted by legislative requirements regarding OSH competence. Educational methods usually include practical work and company visits. Courses providing graduates with accreditation as an OSH technician are certified by the national OSH institute.
Spain	'Programa Universita's' for occupational risk prevention	The Salamanca University	A training programme for Post-Graduate students, named "Programa Universita's" is aimed at the management of occupational risks. The course is designed to promote a culture of occupational risks awareness and prevention among the graduated professional entering on work market. This programme is based on an internet portal where the registered users have access to OSH related materials and tools.
France	Chemical engineering students teach each other OSH	CRAM Bretagne	The students themselves give lectures concerning basic occupational and industrial risk management knowledge to other students, The method has proved its effectiveness for the acquisition of knowledge by future engineers.
France	Architectural and engineering students design projects together	INRS	For 2 weeks, about 20 architectural and engineering students, i.e. students from different backgrounds, work together involving projects for the design of work areas, taking into account comfort, health and occupational risk prevention.
France	Allowing for occupational health and safety as of the design stage	INRS	A design contest giving an award each year to the best architectural restoration training project.
Estonia	Teaching occupational safety in Estonia	The Department of Work Environment and Safety, Tallinn University	In the department, there is a basic course for engineer students and voluntary courses for all students in the university. In addition, two students are preparing their doctoral thesis in the department.
Finland	Computer-based learning environment for OSH	Tampere University of Technology	A computer-based learning environment for occupational safety (TYVE) programme includes 12 lectures, and in every lecture there is an animated dialogue, a short presentation of theory behind the dialogue, and a short task related to topic. The evaluation showed that the test points were similar for students with TYVE and for students with traditional teacher contact.

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Country	Title	Lead organisation	Main feature or achievement
Greece	OSH institute provides training in universities and technical professional schools,	ELINYAE Western Greece (Ioannina)	Programme providing basic theoretical and practical OSH training free of charge in local vocational schools and to university chemistry students and professors. The programmes are customised to students' needs with professors' involvement. Training provided on campus and during normal study times, in order to facilitate attendance. Includes the use of participatory training methods and examples of real work situations through audiovisual means.
Lithuania	Kaunas University of Medicine programme related to OSH	The Faculty of Public Health of the Kaunas University of Medicine (Department of Environmental and Occupational Medicine)	The department provides courses for the students of public health faculty. The course for the bachelor degree students in public health covers the area of occupational safety fundamentals. The outcomes of the course are that students will gain cover the knowledge and skills in the area of legal provisions and requirements in order to protect workers against occupational risks or to reduce such risks, general requirements for workstations, work equipment and work conditions, protection principles and means of avoiding exposure to dangerous factors.
Belgium	Awareness raising on safety with students and professors in architecture	SEFMEP - Ecole d'architecture de la Cambre	Training was set up for delivery during the last year of the architecture studies. The methodology used is a general, participative and pluridisciplinary approach that favours collective responses to OSH-issues. The training focuses on the legislation and responsibilities in prevention issues, sector related risks and risk assessment, prevention policy before the works start, coordination 'project' and coordination 'realisation'.
Slovak Republic	Integration of OSH at the Faculty of Metallurgy of the Technical University of Kosice	Faculty of Metallurgy of the Technical University of Kosice	The aim of the programme is to integrate OSH education and OSH management into the educational process. Since the academic year 1999-2000, 179 students have passed this study programme. In the 3rd year of level I (Bc study) and the 5th year of engineering study (level II) students of the Integrated Management Department study OSH management. Compulsory subjects evaluated in the final exam are: total quality management, environmental and OSH management.

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Country	Title	Lead organisation	Main feature or achievement
Slovak Republic	Integration of OSH at the Faculty of Mechanical Engineering of the Technical University of Kosice	Faculty of Mechanical Engineering of the Technical University of Kosice	In 1993 an OSH study programme was initiated in the faculty. Since 2000, the Department of Safety and Quality has received accreditation in this area. It has improved its qualifications and quality standards, e.g. through special certifications, scientific publications and research projects. The research interest is focused on the creation of tools for risk assessment, the prevention of Major Hazards Accidents, tunnels, gas pipelines, the integration of management systems, etc.
Germany	Teaching OSH in construction engineering and architecture studies: cooperation with statutory insurance organisations and the Labour Inspectorate	University of Applied Sciences (FH) Mainz	Students of Civil Engineering, Architecture, and Facility Management are taught about safety and health on construction sites. The provided lectures enable them to gain an additional qualification as safety and health co-ordinator after two years of additional practical experience.
Ireland	Promoting safety culture at DIT – A step closer to the real world	Dublin Institute of Technology (DIT)	Technical Institute provides vocational training as well as undergraduate degree courses and post-graduate activities. A holistic approach aimed at maintaining safety and promoting of a safety culture in the institute which includes training, a combined approach that targets both staff and students. Consultation with the student's union and their participation in safety meeting.
Hungary	Teaching OSH and ergonomics	Budapest University of Technology and Economics (BME)	OSH and ergonomics integrated into various degree courses throughout the university, including a compulsory module in the MBA business studies course. The Department of Ergonomics and Psychology provides the teaching to the other departments. Theoretical and active learning methods used, including project work and use of case studies. A safety-related event analysis method also used.



ANNEX 2. CONCLUSIONS OF THE MEETING OF THE EU-OSHA MAINSTREAMING OSH INTO EDUCATION EXPERT GROUP, HELD 26-27 MARCH 2008, BILBAO

This group, made up representatives nominated by the EU-OSHA focal points, the European Commission and an observer from ENETOSH, discussed a draft of this report. The main points arising during their discussion can be summarised as follows:

- Reaching the university level is entirely different from reaching schools. Different ministries may be involved – how can we deal with this? Networks are different. They are largely autonomous entities.
- It is very difficult to convince professors of the importance of OSH. In addition, professors' main interest lies in their research. Teaching is a side issue for many.
- The route may be to start with high risk occupations. OSH is more likely to be included in disciplines such as engineering and law. Technical universities that have a safety faculty will provide OSH teaching and it is seen in medical universities. Administration sciences are the least likely to see the value of OSH teaching as the risks to those working in these professions are low even though their work can affect the OSH of other.
- In disciplines such as engineering there is a need to teach the practical aspects, e.g. related to scaffolding, as well as the theoretical aspects.
- Attention should be given to professors' own OSH. However, too often universities do not recognise that they have OSH problems.
- Including the students' union in the OSH of the university could help, but not all Member States have this sort of student organisation and their role and function can differ. It could be interesting to have a guide on how to involve the students' union in university OSH matters.
- To promote OSH courses taken students should receive credit points for the skills they develop. So OSH needs to be included in the European system of credit points for skills.
- More information/models about how we can reach the university sector are needed. Perhaps another working method is needed. How do parties collaborate? An exchange of ideas and concrete tools is needed.
- A holistic approach is needed combining OSH education and OSH within the universities – 'safe and healthy universities'.



ANNEX 3. SUCCESS FACTORS FROM SOME PREVIOUS EU-OSHA REPORTS ON OSH AND EDUCATION AND TRAINING YOUNG PEOPLE ABOUT OSH

Mainstreaming OSH into education

According to the EU-OSHA report *OSH in the school curriculum: requirements and activities in the Member States (2009)* there are a number of common success factors that can be identified in the cases and programmes presented. These success factors include:

- Make a clear commitment and provide adequate resources.
- Set objectives for mainstreaming OSH into education in the national OSH strategy.
- Base activities on research into what is taking place in reality, what can be realistically achieved, what works best, etc.
- Develop close cooperation with education authorities and especially with curriculum-setting bodies.
- Identify opportunities in the education curriculum and seek to influence the curriculum as it changes and develops.
- Tailor proposals and initiatives to the core curriculum and current teaching policy and methods, including the integration of risk education across the compulsory and non-compulsory curriculum. Key areas for integration include the frameworks for personal, health and social education and citizenship. Risk education should also be incorporated into health promoting schools ('healthy schools') programmes.
- Develop learning objectives for OSH and risk education for the relevant subjects in the curriculum framework matched to the age and ability of children and young people. Focus learning objectives on developing an understanding of risk, including hazard recognition, risk assessment and developing informed safer behaviour.
- Provide OSH/risk education resources appropriate to the various curriculum subjects and age levels.
- Provide professional development in risk education for teachers and trainers. Training is needed for teachers at all levels, both as part of the professional development of (existing) in-service teachers and in trainee teacher programmes. Consider the needs of others involved in education such as those involved in the management of schools and parents too.
- Develop partnerships with key promoters of risk education to achieve a consistent approach and avoid duplication.
- Pilot initiatives and monitor and review progress.
- Exchange experiences and network.
- Place learning about risk within a whole-school approach to safety and risk. The approach should cover both a safe learning environment for pupils and staff health and safety. Link this in turn to 'healthy school' initiatives.



Preventing risks to young workers

According to the EU-OSHA report *Preventing risks to young workers: policy, programmes and workplace practices* (2009) there is a number of common success factors that can be identified in the cases and programmes presented. These success factors include:

- mainstreaming youth into prevention actions;
- basing actions and interventions on risk assessment, and ensuring that actions are implemented and monitored;
- consultation and active participation of young workers;
- top level commitment to OSH measures to protect young people;
- the importance of learning from experiences of mainstreaming OSH into education, as recommendations regarding effective teaching of OSH in education are also valid for the workplace, such as:
 - striking a balance between theory and practice;
 - utilising suitable teaching resources and methods;
 - the requirement for training for supervisors, mentors and trainers in their role and in OSH; and
 - partnership
- the effectiveness of using peers, including more experienced young workers and the use of older, experienced workers as mentors. This provides a positive experience for both new workers and more senior colleagues;
- ensuring a close link to working life;
- having young people examine and solve real-work problems;
- feeding the results of such student work back into the real workplace risk assessment and prevention process. This makes the exercise meaningful for youngsters and is of value to employers; and
- making OSH an integral part of doing the job right – at work and in vocational training.



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In order to improve the working environment, as regards the protection of the safety and health of workers as provided for in the Treaty and successive Community strategies and action programmes concerning health and safety at the workplace, the aim of the Agency shall be to provide the Community bodies, the Member States, the social partners and those involved in the field with the technical, scientific and economic information of use in the field of safety and health at work.

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