

E-learning For **EFFICIENT TECHNICAL TRAINING**



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Safeguarding the future

The global cement industry is striving to reduce its energy consumption and material demands as much as possible. Since, for the most part, the demand for cement across the globe is growing, cement plants worldwide will need to increase their efficiency and update their facilities to the latest technologies. Both the demand for new and highly efficient technologies and the need for additional personnel leave the industry with a challenge in the coming years: the recruiting and training of young engineers, scientists and workers who are able to operate the increasingly complex cement

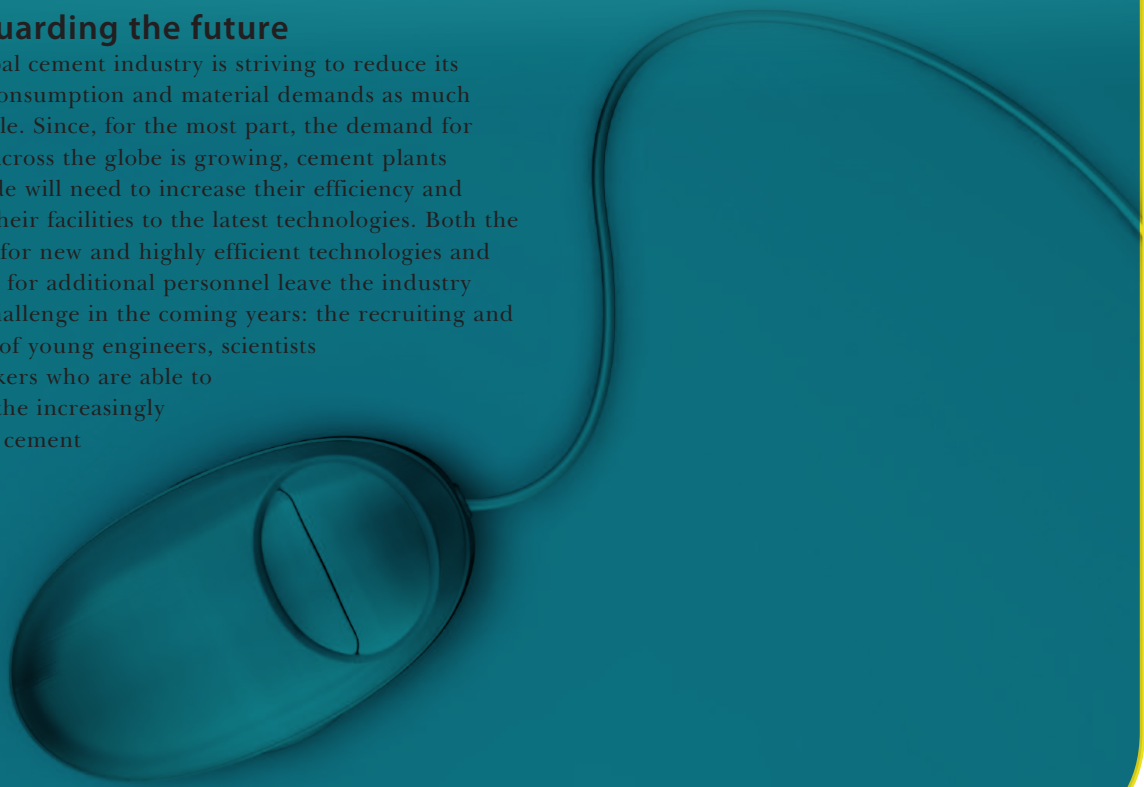


Table 1. List of currently available courses in English

| | | | |
|----------|---|----------|-------------------------------------|
| 0 | Overview | 4.4 | High pressure roller mills |
| 0.0 | From cement production to concrete | 4.5 | Classifiers |
| 1 | Raw material extraction | 4.6 | Cement raw materials, product range |
| 1.1 | Extraction, loading, transportation | 4.7 | Cement blending systems |
| 1.2 | Water drainage systems | 4.8 | Cement cooling |
| 2 | Raw material preparation | 5 | Packing plant and dispatch |
| 2.1 | Primary comminution | 5.1 | Packing machinery |
| 2.2 | Raw materials, blending bed | 5.2 | Palletting machines |
| 2.3 | Combined drying and grinding systems for raw material | 5.3 | Cement storage |
| 2.4 | Raw meal homogenisation systems | 5.4 | Loading equipment |
| 3 | Clinker production | 6 | General plant equipment |
| 3.1 | Rotary kilns | 6.1 | Mechanical continuous conveyors |
| 3.2 | Firing | 6.2 | Pneumatic conveyors |
| 3.3 | Preheaters | 6.3 | Process measurement techniques |
| 3.4 | Calcliner | 6.4 | Metering equipment |
| 3.5 | Bypass systems | 6.5 | Drive technology |
| 3.6 | Clinker coolers | 6.6 | Compressed air supply |
| 3.7 | Fuels | 6.7 | Cooling water supply and treatment |
| 4 | Cement production | 7 | Environmental protection |
| 4.1 | Cement grinding plants | 7.2 | Dedusting equipment |
| 4.2 | Ball mills | 7.3 | Reduction of gas emissions |
| 4.3 | Roller mills | | |

plants efficiently, as well as the continuing education of the existing plant staff.

Such first-class workforces are essential for the further development and competitiveness of an industry, as they ensure the quality of the products and services as well as their compliance with national and international standards and policies. It is the *people* who operate the plants efficiently and safely, make suggestions for improvements, and contribute to the climate of progress and innovation that is needed to handle the industry's upcoming challenges. Under the pressure of a growing demand for cement, especially in the emerging economies, highly complex and interrelated processes in the plants, rising automation and production rates per person, rising costs for conventional energy and the growing efforts spent on environmental protection, the importance of education and the 'human factor' in the cement industry is most likely to grow.

On one hand, some countries face the problem of demographic change and the arising shortage of qualified personnel in some regions and industrial branches. For a highly efficient industry such as cement, securing the availability of qualified and specialised personnel is crucial in order to keep up with the latest developments. In addition to effective recruiting programmes, continuous training of semi-skilled personnel is important to maintain and extend the available skills.

On the other hand, some emerging economies will face an enormous demand for cement in the future if they continue to develop. Within such economies the growing demand for qualified staff will lead to a high demand for basic as well as cement-specific education and training. In order to update existing plants to the

latest technologies, as well as to operate more and more plants on a world class level, large quantities of people must be trained using the most efficient and flexible technologies, for example, E-learning.

Training materials for the cement industry

VDZ, the Research Institute of the Cement Industry in Germany, was founded in 1877 on the idea of joint first class research and high quality services for the advancement of cement production. Today, the institute employs around 160 people from various disciplines, such as process or chemical engineering. For more than 50 years, the company has been offering training courses, lasting from one to six weeks, for different target groups such as industrial workers, engineers, laboratory personnel, control room operators or supervisors.

From highly concentrated one-day workshops to the broad mid-term education of cement (and lime) foremen, the trainees can rely upon long-term experience and highly skilled trainers. Besides the regular training programme, numerous customised trainings have been carried out in the past. In 1997, VDZ, in conjunction with union representatives and the national cement plants, commenced the development of paper-based training material for unskilled or semi-skilled personnel. The main areas handled are those that relate to the production sequences in the plants and are closely connected with the work of the production employees. In 2007 the documents were transformed into E-learning modules and made available through an internet-based Learning Management System.



Figure 1. Classroom training as part of blended learning activities.

| | Engineers | Supervisors / Foremen | Operators | Industry Workers |
|--|-----------|-----------------------|-----------|------------------|
| Technical Trainings | ★ | ★ | ★ | ★ |
| <ul style="list-style-type: none"> • Cement production • Safety • Quality Assurance • Environment Protection • Concrete Technology • Chemistry | | | | |
| Plant Supervisor Training | | ★ | | |
| Control Room Operator Training | | | ★ | ★ |
| VDZ Online Courses | | | ★ | ★ |

Figure 2. VDZ's overall training scheme.

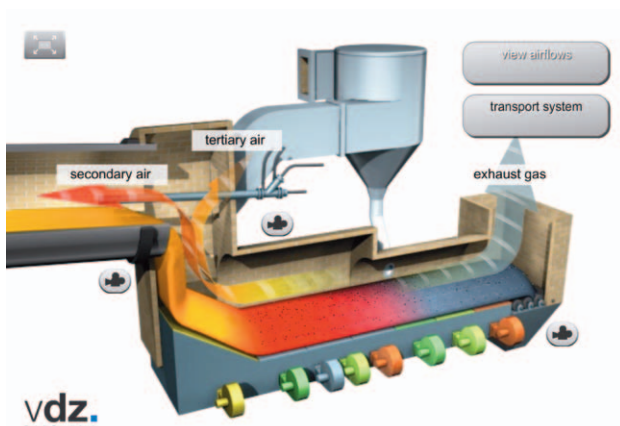


Figure 3. Animated illustration of a clinker cooler (from the corresponding VDZ online course).

E-learning is short for any kind of electronic supported training format; however, the term E-learning is nowadays synonymous with training programmes conducted via the internet. It can be divided into two major branches: live online training, which is mainly based on the idea of video-conferencing via internet, whereas web-based training is based on the idea of multimedia course material and self-paced learning. Both formats have individual strengths and weaknesses that make a combination of the two most effective: web-based training is ideal for delivering basic knowledge for a large audience; live online training is more efficient for any training situation where a subject expert is needed to discuss special questions, or as a quick replacement for any classroom-based seminar.

E-learning, in terms of web-based training, has several strengths compared to classroom-based training:

- In most E-learning programmes, learners can access the courses whenever they have free time and from any place where they have access to the internet. Since a learning management system controls the learning process and saves all the steps a learner takes, learners can easily continue the course from the last visited topic.
- Learners can go through the courses at their own speed. They can search the courses and learn only the topics they actually need or are interested in.
- Learners can easily check and verify their knowledge through computer based tests.
- E-learning can be scaled up easily for the whole plant or the whole company and is not limited to the availability of rooms, time slots, subject experts or trainers.
- E-learning provides economic benefits, such as cuts in travel expenses, reduced costs for trainers or off-times.

The development of the VDZ online courses as web-based training units was finalised by the end of 2009. Due to their modular structure they can be extended by live online training, as well as classroom training according to the needs of each plant.

Efficient training of cement basics

Since 2010, 48 online courses have been on offer to cement manufacturers. The majority of the courses (35) are available in English and hence open to an international audience. They cover all aspects of cement production, from quarry to shipping, and mainly address unskilled or semi-skilled personnel (Table 1). Through the internet-based format, the courses provide several benefits compared to traditional classroom training. The courses can be used individually, as well as embedded into blended learning activities (such as classroom training shown in Figure 1).

The online courses can be implemented in an overall training scheme in technical trainings, courses for foremen and control room operators, or during the education of employees (Figure 2). For example, in technical trainings, whether delivered as daily or weekly classroom sessions, it was very effective to implement the online platform within the time schedule of the trainings. Online training could be used for the preparation of different topics, for homework, or as a tool during the training session. Because of the different levels of the online courses, individual programmes could be implemented for entry and advanced level training. The online courses were also successfully integrated within expert workshops.

The modular structure makes it easy for the learner to work through a single course within 1 – 2 hours. If disturbed during self-paced learning, learners can continue at their last position in the course or repeat or skip specific parts of the training. In general, electronic formats are less expensive compared to face-to-face training since they help to save time and cut travel expenses.

First experiences with the new training format show that the acceptance among employees is high. In particular, the animations and illustrations are seen as helpful for the users (Figure 3). However, online training needs promotion within the companies, since the technical infrastructure must be available and the conditions for the use of the platform need to be communicated. Experience has shown that E-learning is most effective when it is carefully introduced to a company and accompanied by face-to-face training sessions. This is why VDZ has developed a special training course for the people acting as tutors for the learners in the cement plants.

Experiences from the first year

After the successful prototyping and a kick-off event with representatives from all major cement producers in Germany and the unions at the end of 2009, the VDZ online courses were offered to cement manufacturers in German speaking countries. Companies could order modular licence packages that met exact training needs and budgets. One of the advantages of E-learning compared to classroom training was that companies could easily scale up the number of people and groups being trained with the platform, while at the same time the costs per person significantly decreased and lay below the costs incurred by traditional training formats.

The roll out of the electronic learning solutions was supported by workshops with representatives from the plants, such as the plant managers, department heads, foremen, tutors and representatives from the unions. Special training courses for foremen and tutors were offered, since they were asked to act as multipliers on a plant level. The overall experiences from the rollout were very positive and several companies came onboard as early adopters of the tool.

Many companies have used the E-learning from VDZ to intensify training programmes for the production

workforce and have combined it with traditional classroom training. In some companies, E-learning is used for teaching the trainees more about the cement production process and its dependencies.

The ease of use, as well as the quality of the information and visual elements have proved to be crucial for the acceptance of electronic supported learning formats in the cement plants. However, compared to traditional classroom training, learning with the online courses requires a higher degree of self-learning competencies, such as time management, to integrate both learning and working.

In any case, electronically supported training should be integrated into the company's overall training programme to provide the maximum benefit both for the company and the employee.

Future outlook

VDZ widely launched its E-learning platform as part of its national and international training activities in 2010. Since the global demand for cement is predicted to double by 2050 and the industry is facing new challenges (e.g. climate protection), the association is constantly extending its support both for national and international cement producers to build up, secure and update the knowledge and fundamental skills of their personnel. The mid-term goal of the newly set up electronic services is to serve as a central point of information regarding the basic and advanced knowledge in cement production. In addition to the existing training courses and the E-learning platform, new formats (such as Web 2.0), will be developed in the future in order to make advanced training more efficient and cut unnecessary travel expenses. In this context, web-based training might be supplemented by live online training or onsite classroom sessions for delivering both basic and advanced knowledge, as well as vendor neutral experiences. 