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Modern training approaches in industry – ICTs as tools for work-embedded learning

Introduction

>> The twenty-first century demonstrates a radical shift from industrial societies to information or knowledge societies, where advances in information and communication technologies (ICTs) are rapid and shape economic and social development. Globalization has – sometimes dramatically – changed economic structures and the world of work. In a globalized world, the competitiveness of

enterprises and national economies depends to a great extent on a highly skilled workforce that is able to react flexibly to changing work processes, and ICTs have become a “natural” part of these processes. Work procedures are undergoing continuous adjustment due to evolving hardware and software, modernised communication and the immediacy of information on the Internet.



*By Michael Härtel,
German Federal Institute for
Vocational Education and Training
(BIBB)*



Courtesy: BIBB

All business logistics – from purchasing to production, marketing and sales – are changing ever more rapidly. The knowledge and skills of workers must therefore constantly be updated and expanded, and in-depth knowledge of ICTs is a must. Vocational education and training (VET) has to consider the new demands and must provide appropriate and constantly updated training concepts. Catchwords such as “lifelong learning” and “learning-on-demand” describe the trend in education and training and suggest a variety of means and channels for conducting training, with ICT-based learning, including e-learning and mobile learning, as one of those.

Michael Härtel is Senior Researcher and Project Manager in the Quality Assurance and Development - Distance Learning Section at the German Federal Institute for Vocational Education and Training (BIBB). As such, he is involved in and serves as an expert to a variety of national and international projects on ICTs in TVET. He is also the Project

Manager of the web-based platform "www.foraus.de".

Foraus.de is a forum for teachers and trainers that provides information and enables communication, learning and support for in-company training staff.

More information: Haertel@bibb.de

What is the issue at the workplace?

>> In manufacturing, for example, skilled workers are not only expected to produce goods of flawless quality. They are also involved in aspects of inspection and maintenance of the equipment they operate and oversee to ensure high levels of production at all times. Possible faults or damage need to be spotted early on and corrected as quickly as possible to keep loss of production to a minimum.

Newer production equipment is fitted with electronic control and regulation systems and failures are relatively rare, but it is more complex than mechanical equipment and it is not easy to identify faults. Abstract analytical checks are often necessary. Workers may not find problems through the simple inspection of their equipment, but usually have to consult circuit diagrams and drawings in

order to locate the failure. One programme command may indicate where the problem is, while another command is necessary to restore the equipment to working order. An understanding of the symbolic codes of the equipment is therefore necessary. The worker must be able to make a connection between an abstract command and a correlating physical action.

ICT-based learning environments can support the successful delivery of training and foster the development of analytical skills that are needed in the world of work. It is important, however, that such learning environments are integrated into the overall context of initial and continuing education and training with a view to establishing a holistic and user-centred approach. A strategic concept for teaching and learning must be developed that is needs-driven and matched to workplace demands. Structured assistance

for ICT-based training also has to be established. This should include support elements for targeted learning, such as link lists, search information, newsgroups or organizational support. There may also be specific time slots set aside for training, or those with learning difficulties may receive assistance from colleagues. Independent learning skills should be a training component in their own right, since the open nature of ICTs requires learners to be determined and focused. Self-evaluation tools are also valuable mechanisms to this end.

The German Federal Institute for Vocational Education and Training (BIBB) is involved in various research and development projects on the new possibilities for workforce education created by ICTs. These projects take place in close co-operation with the corporate sector in so-called Public Private Partnership (PPP) initiatives (see box below).

Process Learning Workshops (PLWs)

Through a joint pilot project that aims to establish high-quality ICT-based learning environments in VET, BIBB and selected training departments of DaimlerChrysler in Germany developed so-called "Process Learning Workshops" (PLWs). This project was initiated to find solutions to the problems that arise from increasingly information- and ICT-based manufacturing processes. Questions that were meant to be answered included: How can workers adapt to the permanently changing world of work? What methodological and educational approaches can be applied to encourage lifelong learning? How can enterprises set up the necessary technical, organizational and educational structures to encourage lifelong learning?

The PLW concept presents one way of addressing these questions. A PLW has the following features:

- >> Decentralized learning places are situated within the production process;

- >> Learning is organized according to a particular manufacturing chain and the processes connected to it;
- >> Individual and group work take place at defined time intervals;
- >> Training and work are process oriented, and students develop an understanding of processes through constant and intensive reflection about these processes;
- >> The trainer supports the company management by influencing change processes in production.

Training the learners in thinking about processes is the most important element of the PLW. Experience in factories shows that learning in different departments and at various workplaces does not by itself lead to an understanding of procedural relationships. Only the combination of learning and work assignments, together with systematic reflection on these assignments, leads to an understanding of the complex relationships in a production landscape. Through the PLW, learners are introduced to and think about situations that are common in the workplace, as well as the problems that may arise in these situations. This takes place along the process chain and

at the various interfaces (e.g. the interfaces with planning or logistics) or during shift changeovers. Learners are gradually familiarized with the following goals of process learning:

- >> The ability to consciously observe;
- >> The ability to identify relationships and dependencies;
- >> The ability to detect consequences and anticipate effects;
- >> The ability to distinguish relevant from irrelevant facts;
- >> The ability to analyse situations, to draw conclusions and to take appropriate action.

These training goals require the trainer to have extensive knowledge of processes and a high degree of sensitivity regarding individual and group-oriented learning. In order to facilitate explorative or self-directed learning within the production process, a trainer must also have strong "soft" skills. The adequate training of trainers is therefore a prerequisite for the successful implementation of work-embedded digital learning environments such as PLWs.

ICTs as tools for self-directed learning

>> As mentioned above, lifelong learning is crucial in today's world. It is at once the responsibility of the individual and of the employer. Both workers and employers must understand the importance of continuous adaptation and upgrading of skills so as to ensure the lasting employability of individuals and the stable success of businesses. ICT-based education and training offers great flexibility with regard to time, place and the speed of learning and is therefore better suited for lifelong learning than

traditional forms of education and training. It supports self-regulated, application-oriented and co-operative learning, and is therefore particularly suitable for continuing education and training. ICT-based learning requires a high degree of self-organization and motivation while offering learners a high degree of freedom during the learning process.

ICT-based learning environments enable VET to make full use of all available

information and communication technologies – from e-mail to video conferencing and application sharing. It allows students who may be located in different parts of the world to co-operate. They can share their knowledge and experience and obtain access to national and international educational and knowledge resources. This can lead to international educational know-how that may form the basis of international educational standards.

The way forward

>> Many issues have to be addressed at the various levels of educational planning and implementation if the full potential of ICTs in education and training is to be achieved. For example, there is currently no coherent concept that translates new, network-supported, approaches to work and information into an educational framework that could facilitate the development of learning applications. Content providers are addressing this issue through an approach that, in the longer term, may pave the way for lower-cost production of digital content for education and training. They are introducing initiatives to create broad-based and cross-sector content for ICT-based learning that can be used interchangeably and in variable combinations (www.contentforum.de is an example of such content).

BIBB is examining whether such content can be used as learning modules for process-based training. If ICT-based training is to meet its main challenges, then electronic information and training systems must be easy for the user to navigate; content must be readily accessible and the learning elements must raise qualifications. The content should be broken down into the smallest viable learning units – the so-called "granular units". Such small learning modules can be dynamically combined to form lectures or exercises. This enables a high level of flexibility in reusing the content in different situations.

The effective promotion of ICT-based learning, educational and methodological standards for learning applications, as well as an appropriate learning architecture are as important – or even more important – as questions of technology or the organization of ICT-based training. Education policy needs to reflect this and address some critical questions:

>> How can the potential of the knowledge/information society benefit everyone in a society/economy?

>> How can the gap between those who use ICTs in a training context and those who do not be bridged?

>> Are new forms of quality management and new criteria for quality standards necessary?

>> What have been the consequences of the integration of ICTs for education and training systems?

>> How and in which areas should the public sector play an active role?



Courtesy: BIBB

>> What is the responsibility and role of the relevant stakeholders in ensuring the effective use of ICTs in education and training?

>> What role should the international community play in promoting improved training policies and their governance?

It is necessary to create an appropriate terminology and definitions based on actual situations for ICT-based learning to assist in its planning, use and assessment. In certain sectors, standardization will be advantageous, for example as a prerequisite for quality assurance, compatibility and for mixing and matching content.

The right planning, organizational infrastructure, targeted instruction and intensive supervision of the learning process by qualified teaching personnel

are also of crucial importance. The quality of ICT-based learning is determined by the underlying educational concept and the way in which it is planned and implemented by the training personnel, even if the teachers and trainers do not directly interact with the learners.

VET can only successfully address the radical changes in learning and work that arise from the increasing use of ICTs if powerful interactive user interfaces are developed to address the needs of both training personnel and learners. BIBB is placing particular emphasis on the development of terms of reference that support process-oriented learning at the workplace. Such terms of reference, together with an analysis of work-based training practices, can illustrate current trends and form the basis for the development of recommendations for a sustainable VET system that includes ICT-based education and training.

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Training technology and digital media: background information on BIBB`s research and development activities

The German Federal Institute for Vocational Education and Training (BIBB; www.bibb.de) is nationally and internationally recognized as a centre of expertise for research into and further development of initial and continuing VET. The aims of its research, development and advisory work are to identify future tasks of VET, promote innovation at the domestic and international levels and develop new practice-related training proposals. BIBB's Communication and Information System for Vocational Education and Training (KIBB, www.kibb.de) covers all issues related to vocational education and training. A key role of BIBB's work is to increase the efficiency and attractiveness of VET through activities such as supporting the development and effective use of interactive, multimedia-based forms of teaching and learning.

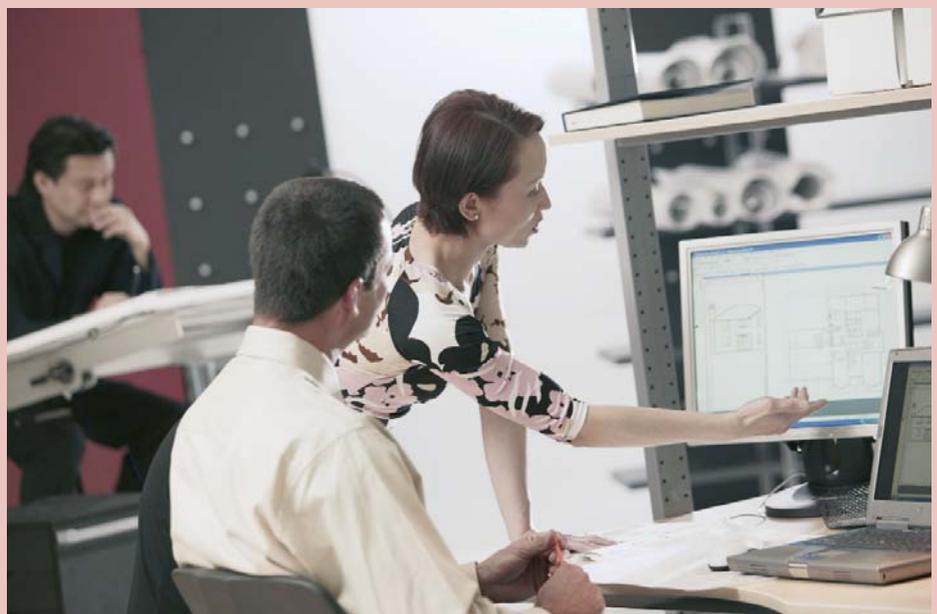
Recent BIBB research on training technology has been driven mainly by e-learning. Learning environments, teaching and learning processes and the development and piloting of electronically supported learning concepts for continuing vocational education and training are the main foci of the projects and programmes that BIBB is

currently undertaking. Many of these projects and programmes involve collaboration with external partners. To view application-oriented, practical examples of this work, please visit:

<http://www.ausbilderfoerderung.de/interaktives/infosystem.php3>

Introducing ICT-based learning into VET changes learning structures and hence the

job profiles of training staff. It sets new standards for the qualification of personnel. This has prompted BIBB to draw up new forms of employee qualifications and develop alternatives to traditional training by integrating cutting-edge information and communication technologies. The result has been the creation of the training staff portal www.ausbilderfoerderung.de. In addition, www.foraus.de is a portal that provides current information on initial and continuing vocational education and training.



Courtesy: BIBB