

Unique: Learning Factory for Global Production at KIT

Engineers Want to Integrate More Practice into Education / First Learning Factory for Global Production Starts Operation



The learning factory of the wbk Institute of Production Science prepares students and companies for production in worldwide distributed networks. (Photo: wbk)

More and more products are produced no longer at a single place, but at worldwide distributed factories that cooperate closely in a network. Companies have to adapt their processes to this new type of work sharing and to prepare their staff accordingly. To qualify company staff as well as students during education and training for coping with these changes, Karlsruhe Institute of Technology opens a learning factory for global production. It is the so far only learning factory of this type worldwide.

“I hear and I forget. I see and I remember. I do and I understand.” This is a quote of Confucius. “For education, this means: Students can keep something learnt better in mind, if they can directly link theory to practice,” Professor Gisela Lanza, Member of the Board of Directors of the wbk Institute of Production Science, says. She has established and now runs the learning factory. “That is why learning factories at universities are gaining importance.” They reproduce parts of or complete production processes of a company as closely

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to reality as possible, with assembly stations and workplaces as well as with control elements. “Here, students can develop professional skills and learn in a close-to-reality environment to solve challenges in production in a self-organized manner,” Lanza adds.

Existing learning factories mainly focus on general aspects of production, such as lean management or resources efficiency. The learning factory of wbk is the only learning factory worldwide that covers challenges characteristic of production in global networks. One aspect is how production sites differ from each other in terms of e.g. technical equipment, degree of automation, cost structure or staff qualification. In addition, the learning factory illustrates how actors handle existing complexity in a global production network and how they can strategically distribute competencies to the different locations in a favorable way.

The learning factory of wbk consists of several stations for the assembly of an electric motor and gear. Selection of the product to be produced by the students during the courses determines the requirements for the setup of the learning factory, Emanuel Moser, scientist of wbk, says: “To establish a real scenario, we had to select a product that can be produced in several versions with a minimum expenditure and at low costs and has a global market. From the product and production perspective, the selected electric motor is perfectly suited.” The reason is that it can be assembled and disassembled easily. At the same time, the assembly stations may be manual or automated. The stations of the learning factory can be scaled accordingly: The students can adjust manual and semi-automatic stations as well as the fully automatic, flexible robots such that different motor versions can be produced and various degrees of automation can be implemented.

“When setting up and realizing this factory, our partner companies Bosch, Pilz, Bosch Rexroth, Balluff, and Schunk provided valuable help,” Moser says. “Besides material support in the form of components, machines, and sensors, they provided valuable input to lay out the learning factory as closely to reality as possible.”

Linking Practical Training with Theoretical Contents

From the coming winter semester, the learning factory of wbk will be integrated into the curricula of the master’s programs of mechanical engineering and economic engineering at KIT. During the courses, the students are to plan and operate the production of the electric motor. The system realized at wbk is only one part of the global

production network. Production processes of the factory in China are virtually integrated into the courses, as if they were existing in reality. The students have to consider local conditions, such as the qualification of the staff, salaries, rents, or legal and political framework conditions when planning production and to study their effects on delivery reliability, productivity, or quality rates. During the courses, the course directors will constantly make the participants face typical challenges of reality, which are to be managed independently, such as material defects, machines failures, or irregular customer demands.

The theoretical basis to solve the tasks is conveyed to the students in an e-learning course: Six consecutive modules cover the knowledge required on location and process factors, production control, quality management, supplier development, human-robot collaboration, and safety engineering as well as on the planning of production networks. Theoretical learning and practical phases will alternate, with the students being prepared by the learning units for the following application phases. In these phases, they will assume the roles of mechanics, logistics specialists, managers, customers, or observers and will redesign the production process according to the task given by the wbk. The course directors give advice and help the participants, if they get stuck. To look after the students in the best possible way and to closely cooperate with them, the number of participants is limited. "In this way, we can better impart and support understanding for independent acting in global production networks," Moser explains. The pedagogic concept was developed by wbk in close cooperation with the Institute of Vocational Education and Training and General Pedagogics and the Center for Technology-Enhanced Learning of KIT.

Prior to the first course, wbk presented its concept to members of the German Academic Society for Production Engineering in mid-February. "This event has shown that the learning factory can also be used by industrial and research institutions for their professional training," Moser says. For this reason, wbk plans to offer training and advanced qualification seminars to industrial companies in order to prepare them for the requirements of production in global networks." Qualified workers are important to the success of global production. It is conducive to success that the staff can prepare for the challenges and opportunities in a realistic business scenario," Gisela Lanza says.



Course participants have to independently plan and realize running production in a global network. (Photo: wbk)

Karlsruhe Institute of Technology (KIT) pools its three core tasks of research, higher education, and innovation in a mission. With about 9,300 employees and 25,000 students, KIT is one of the big institutions of research and higher education in natural sciences and engineering in Europe.

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