The learning field concept - an approach of demand-oriented vocational education for modern structures of production and service

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The main function of vocational education is to qualify employees to be able to meet the demands of production and service. The problem of this task is that the demands change continuously, because the industrial engineering, production technology and the employment system constantly develop. Therefore, the central task of vocational education is aimed, to empower employees to cope with these processes of change in the professional work.

The scientific debate on flexible professionals, who can meet changing work demands, has in the German vocational education a long tradition. Already in 1956, DAHRENDORF asked for development of so-called extra-functional qualifications in vocational education alongside forming of functional skills. In 1970 KERN and SCHUMANN distinguished in qualifications that are bound to work processes and qualifications without such a binding. (comp. Ebner 1992, p.40) As qualifications which are independent of the work processes, they saw:

- the ability to quickly adapt new working conditions → "flexibility"
- the ability to abstract, hypothetical and causal thinking → "technical intelligence"
- the ability to perceive changes in a complex signalling system → "perception"
- the ability to empathize with complex technical interrelationships → "technical sensibility"
- the ability to conscientious, dependable independent work habits → "responsibility"

In 1974 MERTENS published his thesis on education for a modern society, in which he warned, to orientate the vocational education only in the narrow work experiences of the presence. (Mertens 1974, p.37) MERTENS pointed to significant shortcomings concerning of prognostications of future work requirements and he came to the conclusion, to direct vocational education stronger to the adaptability to unpredictable work requirements. The prerequisite for such adaptability are so-called key qualifications. Key qualifications are knowledge, skills and abilities, which bear no immediate limited relation to certain disparate practical work activities. Rather, they allow

- the suitability for a large number of positions and functions in the work process
- the suitability for coping of the changes in requirements over the life

MERTENS distinguished four categories of key qualifications.

Basic qualifications are mental abilities that enable the transfer of existing experience to new situations, for example, logical thinking, analytical thinking and constructive thinking.

Horizontal qualifications are abilities that enable quick access to knowledge stored elsewhere, thus abilities for winning, understanding and processing of information.

General elements are such knowledge abilities and skills, which occur as requirements in many workplaces within a field of occupation or field of professional activity.

Vintage factors are abilities to compensate generation-specific educational differences by individual learning.

An important result of the efforts to provide flexible professionals for the industry was the introduction of the one-year basic vocational education for various professions of a field of occupation as part of the reorganization of industrial occupations in the 70s.

The increasing adoption of lean management structures in industrial production and the growing importance of the factor "knowledge and information" for the economic success change the professional requirements over the past 30 years significantly. Work activities in the production were more complex and problem oriented, individual work in tayloristic structures has been replaced by teamwork and the personal responsibility for work organization and quality control has increased markedly. In a study of modern production structures in the automotive industry FRIELING found out the following, for vocational education relevant components:

Process chain oriented company organisation instead of functional hierarchies

- Customer orientation instead of product orientation

- Responsibility for the project/venture and budget instead of hierarchically structured task management
- Working in teams or groups instead of working alone
- Complete operations instead of individual/single acts
- Self-regulation instead of standardised input/guidelines
- Involvement instead of heteronomy
- Continuous improvement instead of hope for innovation. (comp. Frieling 1993, p.32)

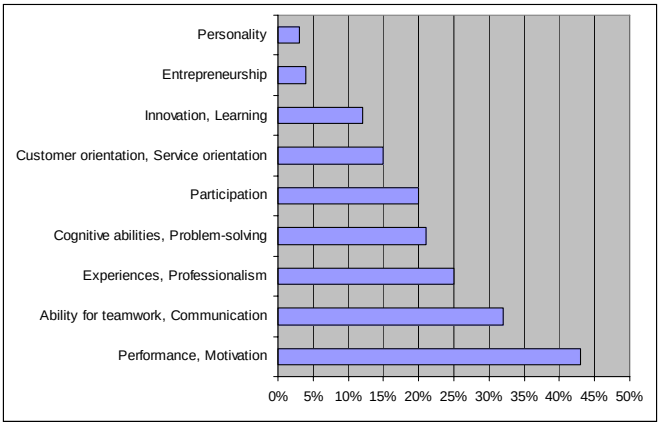
Another important aspect regarding the change of work requirements is the growing importance of knowledge and innovation for products and production processes. While the intangible portion of the total value of the stock exchange in 1978 amounted to only 5%, there are now more than 80%. Terms such as "knowledge management" or "learning companies" are among the approaches of business management and involve ongoing training needs. Therefore, human resource development as an independent element of work design is becoming increasingly important. This requires the capability for individual acquisition of knowledge and ability for the design of self-directed learning.

These considerations lead to the conclusion that modern production- and service structures need professionals who

- are qualified professionally demand-oriented
- a high degree of autonomy and personal responsibility possess are flexible professionals
- are adaptable to changing work demands
- have available social-communicative behaviors
- have the abilities and willingness to vocational further training.

A survey of companies regarding the required qualifications for recruitment of staff led in 2001 to the following results:

(Multiple answers were possible)



Source: Federal Institute for Vocational Training, 2001

The German law of vocational education defines the occupational proficiency in a changing work environment as the goal of vocational education. This occupational proficiency includes a professional, methodical and social-communicative component.

How, can now vocational education meet these demands of society and economy?

It is certainly known that the German vocational education and training system is characterized by a sharing of responsibilities, of financing and of learning venues. The practical training takes place in enterprises and is regulated by central training regulations for the respective professions. The theoretical education and training takes place in the vocational schools and is regulated by the framework curricula for the various professions.

I would like to explicate in my following remarks the contribution of school to the vocational education and training and associated describe the structure of the framework curricula.

According the Framework Agreement on Vocational Schools the theoretical education has to provide the following contribution to the vocational education and training:

- "to impart employability, which combines technical expertise with the general capabilities of human and social nature
- to develop professional flexibility to cope with changing requirements in work and society, including with regard to the coalescence in Europe
- to awaken the readiness for vocational further and continuing education
- to assist the ability and willingness for responsible action in the individual life and in public life"

(KMK: Framework Agreement on Vocational Schools. 1991)

To achieve these objectives, the vocational school

- "has to direct the instruction to a task-specific pedagogy, that emphasizes the act orientation
- has to impart overall vocational qualifications, taking into account the needs for specialization
- has to ensure a diversified and flexible educational offer, to meet the different abilities and talents and the needs of work and society
- has to assist fully the disabled and disadvantaged people within the means
- has to show, with professional and private life-style related environmental threats and risks of accidents and to suggest ways to their prevention or reduction."

(KMK: Guidance to the development of framework curricula. 2000, p.8)

In the context of the design professional instruction, geared to the needs of the economy and society and the psychological characteristics of learning, a didactic approach of act-oriented learning or rather learning based on act-theory has been debated for more than 20 years. This didactic approach follows the principle, to relate learning processes consistently to the concrete professional work. The starting points of learning processes in the theoretical training are practical situations in the working environment of each profession. Thus, the professional work is assimilated with the mind and it will

create the conditions for learning in and out of work. The didactic approach of act-oriented learning can be characterized by the following features:

- The learning takes place through the planning, executing and evaluation of professional acts or through their cognitive Reconstruction.
- The professional situations, which constitute the starting point of learning activities, are prepared didactically.
- The learner becomes an acting individual that shapes learning processes widely self-determined, active and reflective and that is able to make independent decisions concerning alternatives for aims, ways and media of learning acts.
- Learning takes place in a union of cognitive, affective/emotional- volitional and psychomotor learning processes.
- Learning aims at the formation of professional, methodical and social components of occupational proficiency.
- Learning follows the internal logic of learning (acts) in first place and the structures of the underlying discipline (subject) or the institutional determined subjects in second place.
- Learning is characterized by deepened dealing with exemplary fundamental matters of acquisition. The learners should be able to transfer thus acquired insights to comparable situations.

  (comp. Hortsch 2006, pp.18/19)

The pedagogical use of this act-oriented didactic approach in the practice of vocational education and training required a rethinking of curriculum development. The previous curricula were geared cognitive heavily and structured disciplinary. It means, that the underlying scientific disciplines of the occupational fields (electrical engineering, mechanical engineering, material sciences, chemistry and so on) constituted the structural elements of the curricula. Thus, the learning took place thematically arranged according to scientific and specialist aspects. Learning according to the approach of professional act-orientation requires a curriculum structure, in which the areas of professional activities constitute the structural elements. Such a curriculum structure has been introduced for the vocational oriented instruction in Germany starting from the 90s. In this structure, the existing discipline-oriented curricular subjects are replaced by profession-oriented learning fields. “Learning fields are through target-setting, content and time guidelines as described thematic units, which are oriented to professional tasks and working sequences. From the totality of all learning field unfold the contribution of the vocational school to occupational proficiency.” (KMK: Guidance to the development of framework curricula. 2000, p. 14)

The learning field concept, with its consistent orientation to professional activities, doesn't exclude a systematic knowledge-building. Although the structure of learning processes is determined by the fields of occupation, the integrated imparting of structures, terms and categories, as they will provide the specialized sciences and related sciences, takes place but still. It is a prerequisite for the successful transfer of knowledge to new situations.

I want to finish the article with an example from the framework curriculum for electronics technician for devices and systems.

Learning field 2 time value: 80 hours

Electrical installations plan and execute

Learning objectives:

- The students analyze tasks for the installation of the energy supply of plant and equipment.
- The students plan installations, taking account of typical network systems and the necessary protective measures. They create switching and installation plans, also computer-based. They assess the components and select them according to functional, economic and ecological aspects.
- The students use the terms of the electrical installation technology. They evaluate information, also in English language.
- The students plan the typical processes for the construction of facilities. They determine the approach to order fulfilment, materials planning and coordination with other stakeholders, select the equipment and coordinate the workflow. They determine the costs for the facility construction, generate biddings and explain them to customers.
- The students construct plants. They hold into them the safety rules, taking into account the safety regulations when working in and on the electrical system.
- The students take equipment into service, record data and create documentation. They check the functioning of the plants and look for and eliminate errors. They commit the equipment to customers, demonstrate the functionality and instruct into the use.
- The students evaluate their work results to optimize the organization of work. They create an invoice for the processed task.

Learning content:

- task planning, task realization
- energy needs of a facility or unit
- safety regulations
- installation technology
- characteristics of equipment
- types of connection schemes
- dimensioning of cables
- work organization
- costing, quoting.

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