Competing approaches towards work process orientation in German curriculum development

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SUMMARY

In 1996, a new curricular framework for vocational education in schools called *Lernfelder* (learning arenas) was implemented in Germany. In the concept of learning arenas learning situations in schools have to be related to work activity in a particular occupation. For this reason work process orientation currently plays a significant role in German curriculum development. However, there is not just one approach on how to transform work activity into vocational curricula, but various competing approaches. In this paper two important approaches are characterised and strengths and weaknesses of each are identified.

Summing up, it may be said that the work-oriented turnaround in German curriculum development has not yet fully happened. Problems of analysing work situations in companies, transforming work process knowledge into curricula and assessing competences which students or apprentices have acquired are still being solved.

The work-oriented turning point in German VET curriculum development

In Germany, school curricula for vocational education and training in a particular occupation (*Beruf*) were traditionally derived from corresponding academic disciplines (e.g. engineering sciences or economic sciences) whereas curricula for in-company training were produced in a bargaining process between the social partners, guided by ministries and the German

National Institute of Vocational Education and Training (*Bundesinstitut für Berufsbildung*). Although there is also a process of synchronisation, the gap between these two curricula in the German dual system was and still is remarkable, especially in the practice of teaching and training. Since 1996, the situation has begun to change as VET policy-makers decided to implement a new curricular framework for VET schools called *Lernfelder* (KMK, 1996; 2000) ([1]). *Lernfelder* ([2]) are didactically reflected occupational fields which follow the international trend of competence-based and work-related curricula. This new curricular framework formed the background of a pilot project programme called 'New learning concepts within dual vocational education and training' (Deitmer et al., 2004). This programme was running from 1998 to 2003 and involved 21 pilot projects in 14 federal states. In total about 100 VET schools (with about 13 000 students who take part in school programmes for one or two days per week and take part in in-company training the rest of the week) and 20 VET research and teacher training institutes participated and developed new learning concepts such as *Lernfelder* (learning arenas). The Institute of Technology and Education at the University of Bremen (ITB) acted as programme administrator and evaluator. Results summarised here stem from the authors' involvement in evaluating that programme.

The key purpose of learning arenas is to link curricula and ultimately learning processes to the work activity and simultaneously promote action learning at curricular level. Thus, the gap between school-based learning and in-company training, between theory teaching and practical work experience is considered in the *Lernfeld* approach. This approach implies quite radical changes for the practice of teaching, at least for everyday teaching practice in German vocational schools. Usually German students, e.g. in the car service sector, begin at school with contents such as 'electro physics by the example of power transmission'. For many students (and even teachers) it might be difficult to understand what this has to do with their usual tasks of car repair and car service. In this case the gap between school-based learning and the learner's experience of company-based

([1]) In the German dual system there is one curriculum on a national level for the apprenticeship in companies and another main curriculum which is formed by the syllabi for VET schools in each federal state (Bundesland). The new *Lernfelder* framework affects as legal provision only VET schools, but not the initial in-company training.

([2]) Terminology is often a problem within a cross-national scientific dialogue. The term *Lernfeld* would be directly translated into 'learning field', but this expression does not really exist in the English language in this context. Also in Germany it is a new term. A common term like 'learning area' would not be appropriate for describing the new curricula. In Germany, this term refers to the old terminology for the discipline-oriented structure of curricula. A 'learning area', for example, would be 'foundations of electronics' or 'electrical machines'. *Lernfelder* are structured differently and they should refer to occupational fields and work processes. An example of a *Lernfeld* would be 'maintenance of a mecatronic system' or 'haircutting'. A term suggested by Pekka Kämäräinen is 'learning arena' might provide a better idea of what is meant by *Lernfeld*. The term 'learning arena' reveals that we do not speak about a given terrain but a pedagogical construction for providing a dialogue between work and learning.

training is obvious. Indeed, surveys in Germany among apprentices have found that they have enormous difficulties relating theoretical knowledge learned at vocational schools to practical experiences with in-company training, especially those apprentices who have developed a particular interest in their own vocational education and training (Pätzold, 1997).

This gap shall be closed by action learning within learning arenas which has to be holistic, situated, contextualised and should support practical experience. Therefore, the learning process via *Lernfelder* is related to a complete process of work including self-directed planning, execution and evaluation of one's own action while also being aware of interdisciplinary aspects (e.g. technology, economics, ecology, law, etc.). Regarding the curricular concepts a paradigm shift from discipline-organised curricula in VET schools towards work-process-related and competence-based curricula can be observed. In this perspective, the *Lernfeld* approach refers to the European debate about work process knowledge (Boreham et al., 2002). As a result, the challenge for curriculum developers and VET teachers is to identify occupational situations which are significant for the work activity and also have a potential for learning (Fischer and Rauner, 2002a).

The German policy document for the new framework sets out four criteria for constructing *Lernfelder*:

- learning arenas should be derived from occupational fields which represent the area of working;
- they should be related to the work and business processes which show the process character of working (and learning);
- they should be competence-based;
- the *Lernfelder* and its contents should be structured according to work-oriented competences. However, it is under heavy dispute whether this structure may partly follow or must not at all follow the systematic structure of a corresponding discipline (in a 'logic of subject matter') ([3]).

The transformation from significant work processes to learning situations entails a complex series of steps beginning with analysis of work activity and the required competences, followed by the development of work-process-related and competence-based curricula and ending with the design of work-process-related learning situations. However, it is an open question how work activity and the occupational background can be considered, how it can be transformed into curricula and how these curricula can guide the everyday teaching and training in German vocational schools.

The manual for the new curricular framework does not provide answers to these questions. Because of this gap between VET policy/administra-

([3]) Structuring elements and contents of curricula is especially important for long-term vocational training as in Germany, because the basic way of learning is prescribed by the structure of the curriculum. The policy document for the implementation of learning arenas says that the contents should be structured appropriately. Unfortunately, it does not describe exactly what is meant by that. Hence, the question is, whether any criterion exists for sequencing curricular contents in the logic of work activity and competence development.

tion and VET practice/research different concepts were established for analysing work processes and occupational tasks as well as different models for developing curricula or *Lernfelder* respectively. The common aim of all approaches was to identify the content and forms of work activity and competence as an empirical basis for curriculum development and its impacts upon learning processes. In this way, the researchers in the programme "New learning concepts within dual vocational education and training" attempted to close the transformation gap between the empirical analysis of work and normative construction of curricula. In this paper two main approaches towards work process orientation (including research methods for work and competence analysis, and models for developing curricula according to the new *Lernfelder*) are described and discussed. However, there is still a lack of appropriate methods in qualification research focused on curriculum development (Rauner, 2000; Fischer and Rauner, 2002b).

The theory-guided pragmatic approach towards construction of learning arenas by Reinhard Bader

In the programme 'New learning concepts within dual vocational education and training' two large projects 'NELE' ([4]) and 'Seluba' ([5]) involving four German federal states followed the Bader approach and developed a manual for constructing *Lernfelder* (Müller and Zöller, 2001).

The basis of the concept is the 'theory-guided pragmatic approach for constructing learning fields in technical vocational areas' (Bader, 2001) in eight curricular steps. The manual starts by analysing the relationship between a vocational occupation, the work processes and the VET conditions. Based on this analysis, the occupational fields can be identified and described. The identified occupational fields can be transposed into *Lernfelder* after validating and reflecting on them. *Lernfelder* must be described using didactical criteria. Finally, learning situations are developed from *Lernfelder*, including reflection on the occupational fields, which is basically the task of VET teachers.

An occupational field in this concept is defined as 'a complex task that contains significant situations for the occupation, life and society'. The core goal for VET is to foster ability to cope with these occupational situations and work situations respectively (Bader, 2001, p. 26).

([4]) '*Neue Unterrichtsstrukturen und Lernkonzepte durch berufliches Lernen in Lernfeldern* - New teachings structures and learning concepts through vocational training in learning arenas'.

([5]) '*Steigerung der Effizienz neuer Lernkonzepte und Unterrichtsmethoden in der dualen Berufsausbildung* - Increasing the efficiency of new learning concepts and teaching methods within dual vocational education and training'.

Figure 1: The eight curricular steps for constructing *Lernfelder* and learning situations ([6])

Step	Task	Reference system
1	Analysing the relationship between the occupation and the work processes	Occupational field
2	Analysing the circumstances of VET in the occupation	
3	Identifying the occupational fields	
4	Describing the occupational fields	
5	Selecting appropriate occupational fields	
6	Transforming the selected occupational fields into an arrangement of learning arenas (*Lernfeld*)	Curricula
7	Describing the learning arenas	
8	Designing learning situations by concretisation of the learning arenas and orientation on the occupational fields	Learning situation

The reference system for gathering and structuring the work processes in this approach is the sociotechnical activity system ([7]).

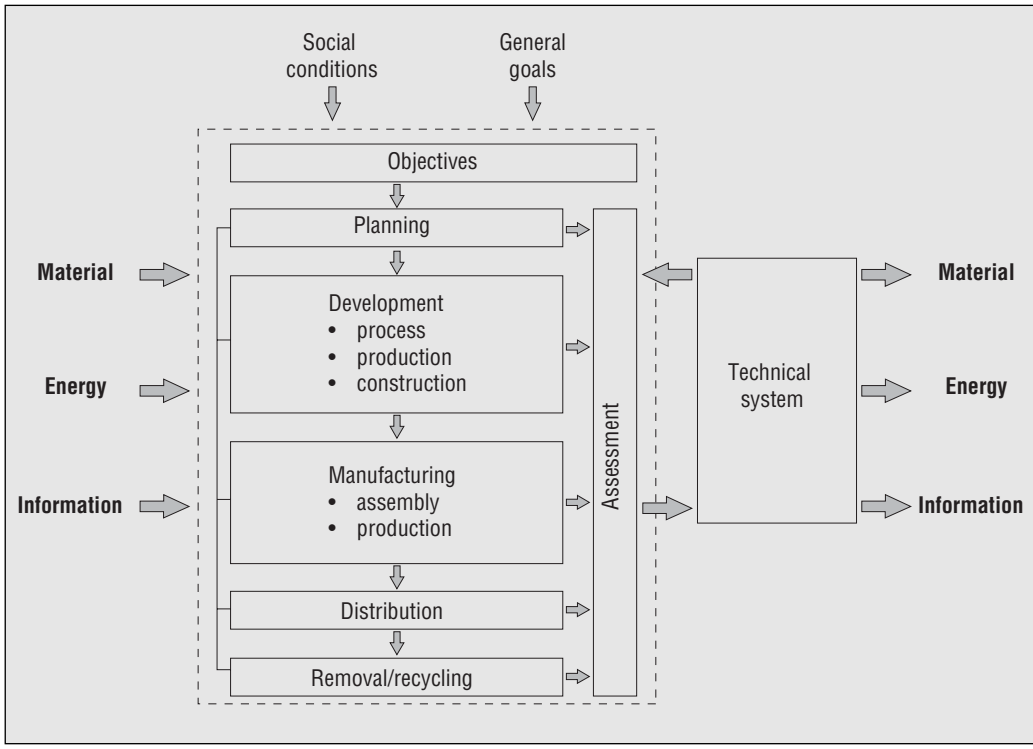
The sociotechnical activity system represents the thinking and action of human beings in technical occupational fields and is based on scientific and technological concepts. Bader supposes occupational fields and work processes should be identified in this system. But the project manual does not explain exactly where work processes can be found. Thus, it is not clear if work processes are located in the vertical process or in the horizontal function unit. Further, modern organisational structures no longer follow this traditional hierarchal structure. Unfortunately, the manual does not mention precise methods for the empirical analysis of work processes. It only provides some suggestions, such as analysing curricula, visiting companies or interviewing experts.

The important criteria for transforming the occupational fields into *Lernfelder* and for their selection are based on the critical educational theory of Klafki (1996). This means that occupational fields have to be valued with respect to societal core problems and their significance for the present, future and its representativeness.

([6]) Each step in the manual also contains several questions of analysis which should be answered before proceeding to the next step. In total there are 63 questions. But the quality of the questions varies considerably. For example, if one intends to describe occupational fields, a question like, 'how can an occupational field be described', does not elicit the answer. Therefore a more precise question is needed.

([7]) Sociotechnical systems theory was formulated in the Tavistock Institute in London in the 1950s and was subsequently developed by American and Scandinavian researchers. Initially, the sociotechnical systems approach emphasised use of autonomous work groups to humanise manual work. In Germany Ropohl developed a theoretical basis for the sociotechnical system (Ropohl, 1979).

Figure 2: The socio-technical activity system



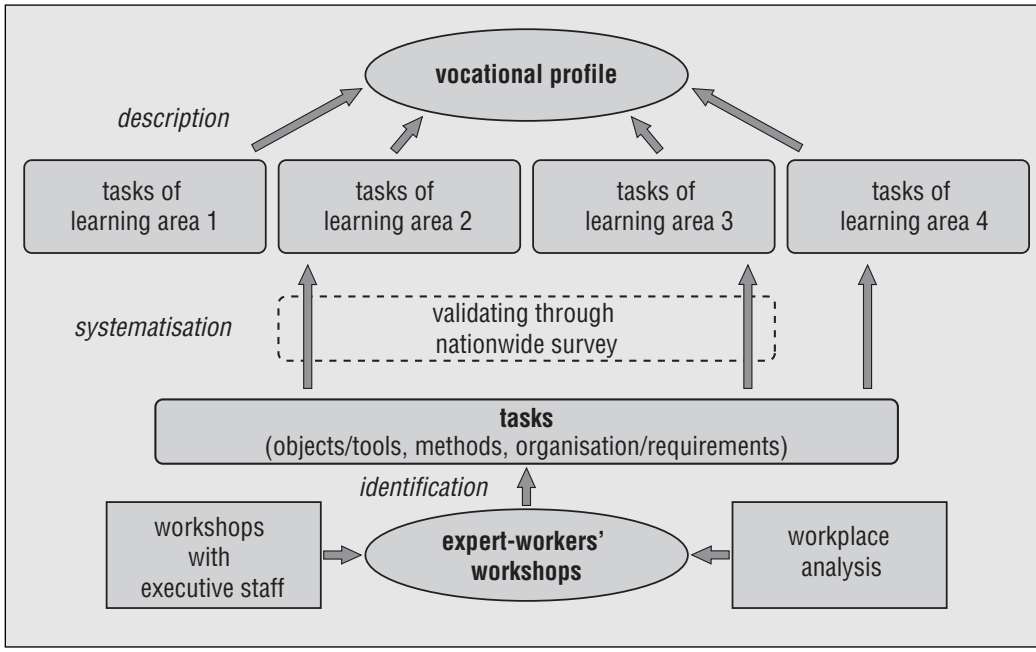
The development of competences in this concept is defined as the process of acquiring skills, abilities and knowledge up to the level of theoretical, autonomous and responsible understanding and shaping of technology. It is assumed that this process begins with everyday experience, followed by workplace experience, model development and culminating with the forming of theory. Thus, it is supposed that theoretical knowledge is the centre of expertise of skilled workers and that theory can explain and solve every technical problem in work life. In terms of selecting and sequencing both the occupational fields and the learning fields, reflection on the theoretical foundation is proposed, but no systematic approach is offered.

The ITB approach towards constructing learning arenas

The ITB approach (Reinhold et al., 2003) towards constructing learning arenas was developed in a large project called GAB ([8]). This project included vocational schools in three German *Bundesländer* and all national production units of a major automobile company. Thus, initial in-company training, the other part of the dual system, was represented.

In the ITB approach it is assumed that every *Beruf* (profession or occupation) could be empirically described by a defined number of tasks. A specific *Beruf* is described through a relationship between different aspects of work (e.g. objectives, tools and requirements for work) and through tasks that are both typical of the occupation and provide a complete picture of it. Tasks as elements of the curriculum are not regarded as a single ability or action, but rather as a complete process of work that encompasses all aspects of the occupation. A general description of how a task is carried out contains the specific requirements of the task, its planning and execution and assessment and evaluation of the resulting work (Kleiner et al., 2002).

Figure 3: The ITB-approach for developing vocational profiles

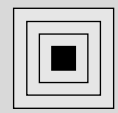
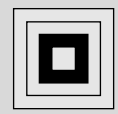
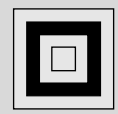
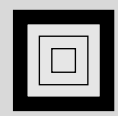


([8]) '*Geschäfts- und arbeitsprozessorientierte Berufsausbildung* - Business and work-process oriented VET'.

Such tasks are identical to *Lernfelder* in the ITB approach. Of such tasks or learning arenas, 12-20 respectively form the curriculum for VET in a particular *Beruf*. Tasks and thus *Lernfelder* are structured according to different levels of competence. There are tasks which can be carried out by a novice or more complex ones, which only an expert can manage ([9]). Building on this understanding it is supposed that it must be possible to describe empirically competence development based on the difficulty of tasks. There are some similarities to Havighurst's concept (1972) of developmental tasks which have to be fulfilled successfully to reach the next stage of development. In the perspective of VET, the challenge is to identify such developmental tasks of a *Beruf* (Benner, 1984; Rauner, 1999).

In the ITB concept a method-triangulation (see Figure 3) approach is used for identifying the tasks described above. The first and most important step in this methodology is identifying and describing the tasks

Figure 4: Macro-structure for the systematisation of tasks

Acquisition of knowledge in four areas				
Learning areas			**Learning tasks**	**Methods for problem-solving**
(4) Specialised and advanced knowledge	How things can be explained in detail and problems solved contextually?		Unpredictable work-based problems	Experience-based (non-deterministic) performance
(3) Detail and functional knowledge	What is important for skilled work and how things function?		Problem-based special work tasks	Theory guided (non-deterministic) problem-solving
(2) Coherent knowledge	How and why are things connected?		Systematic work tasks	Systematic, rule-based problem-solving
(1) Orientation and overview knowledge	What is the main content of the occupation?		Work tasks as introduction into the occupation	Guided (deterministic) performance

([9]) For the car-mechanic an example for working tasks for a novice would be car care or standard service of a functioning car, a more complex one would be expert diagnosis and repair.

themselves and the stages of development of skilled workers in so-called expert-workers' workshops (Kleiner et al., 2002) ([10]).

The general objective of expert-workers' workshops is to gather and describe the tasks of a *Beruf* and finally to put them in order in a learning scheme (see Figure 4). Three categories for analysing and describing such tasks are used:

- objects of the occupation,
- tools, methods and organisation of the occupation,
- requirements of the occupation.

These categories for describing the contents of work and learning are also used in the curricula (*Lernfelder*) (see Figure 5). The defined tasks were then verified by workplace studies in companies and evaluated by other experts of the domain in a nationwide survey. The GAB research approach is domain-specific, because the content and forms of work and expertise can only be analysed by a researcher who is also an expert in the domain.

The main characteristic of the ITB concept is linking the empirical analysis of work activity with a competence model. This model is based upon the novice-expert-paradigm of Hubert and Stuart Dreyfus (1986) and the assumption that competence is acquired by the successful performance of a task ([11]). Dreyfus and Dreyfus proposed a five-stage sequence of developmental stages from novice to expert: novice, advanced beginner, competent, proficient and expert. These stages differ not just on experience, but also on commitment to the problem (increasing with expertise), the degree to which knowledge has been internalised, and the degree of awareness of theory behind knowledge ([12]). According to the novice-expert-paradigm developing competence proceeds in this general pattern in five steps. In the ITB concept developmental stages of competence are transformed into a curricular concept. The four curricular areas of learning are basically located between the five competence stages in the Dreyfus model (Rauner, 1999, p. 436). Thus, a reference system was developed through the help of which tasks can be identified as curricular elements and be arranged according to the 'logic of development' (see Figure 4 where the development from novice to expert is illustrated through icons start-

([10]) This is close to the DACUM approach (Norton, 1997). But the DACUM concept follows the US-American philosophy of jobs. Therefore the duties and tasks represent usually a small part of a complete working task, especially under the condition of modern organisational structures. In contrast, the concept of the working tasks in the ITB approach is broader, because it represents a complete process of work. The second difference between both concepts is that the ITB concept also tries to identify the stages of development of the expert workers to find a way to structure the tasks according to a competence model. DACUM only tries to describe competence in relation to a single job profile.

([11]) Benner approved this concept within the nursing sector and identified paradigmatic cases (or developmental working tasks) for nursing (Benner, 1984).

([12]) This five stage scheme has been applied for chess playing and flying fighter planes (Dreyfus and Dreyfus, 1986). The goal in the developmental approach is to come up with explanations of the process behind evolution to the different stages.

ing with the acquisition of orientation-/overview knowledge and ending with the acquisition of specialised and advanced knowledge).

In a didactical perspective the four sectors of learning were pedagogically described. This normative description and the empirical results of the tasks description link qualification research with curriculum development.

Using this concept in the GAB project, tasks for six industrial occupations, namely industrial electronics mechanic, industrial mechanic, toolmaker, mechatronic fitter, car mechanic and industrial clerk were identified ([13]). Based on the empirical results and the curricular concept GAB organ-

Figure 5: The tasks of an industrial electronics mechanic

Tasks of an industrial electronics mechanic in GAB
Learning area 1: knowledge of orientation and overview
(1) Planning and executing electrical installation
(2) Inspecting and repairing electrical equipment
(3) Purchasing and ordering spare parts and electrical material
(4) Preventive maintenance of a production line
Learning area 2: coherent knowledge
(5) Controlling/operating and setting up production lines and ensuring product quality
(6) Drawing up/revising and maintaining electronic devices and equipment
(7) Documenting the operating conditions and the repair process
(8) Installing/replacing and implementing PC-components and application programmes
(9) Checking and replacing conductions, devices and components at production lines
Learning area 3: knowledge of details and function
(10) Repairing electrical drives
(11) Installing, dismantling and adjusting sensors and actors at production lines
(12) Troubleshooting and fault clearance in the electrical installations of production lines
Learning area 4: specialised and advanced knowledge
(13) Repairing production lines and machines in the case of a fatal error
(14) Optimising the processes of manufacturing
(15) Revising, rebuilding and overhauling a production line

([13]) GAB also established 'core occupations' by reducing 27 occupational profiles to six. Therefore, the question about the boundaries of a Beruf appeared. GAB also developed an assessment system to evaluate competence development using evaluation tasks.

Figure 6: An example of a *Lernfeld* for an industrial electronics mechanic

<table>
<tr><td>Lernfeld 8
Learning area 2</td><td>Repairing electrical drives</td><td>Time schedule
Company: 12 w.
VET school: 80 h.</td></tr>
<tr><td colspan="3">This task includes both disconnecting and connecting a new (identical) electrical drive, and the integration of a new similar electrical drive which respects the most important parameter (velocity, acceleration, moment of torque). This task requires profound knowledge of electrical drives and its control. This type of knowledge is even more important than the knowledge of the mode of operation of electrical machines. The core task of a specialist in the workshop is parameterising the control of an electrical drive.</td></tr>
<tr><td colspan="3">Objectives of learning at both places of learning</td></tr>
<tr><td colspan="2">In-company training
The apprentices check and repair electrical machines and drives taking characteristic values and operating parameters into account. The manufacturers' instructions have to be considered (e.g. characteristic values, power electronics, control system).
The apprentices analyse the failure-free operation of electrical devices and document parameters professionally.</td><td>VET school
The students know the elements of electrical devices like electrical machines, power electronics and control systems. They are able to analyse and assess the electrical drive system and its components according to the application and the necessary connection. They analyse the flow of energy and information. They apply basic measurements for parameterising the electrical drives. They are able to justify the use of special measuring instruments and have a good command of them.</td></tr>
<tr><td colspan="3">Contents of work and learning</td></tr>
<tr><td>Objects
• Inspecting and starting electrical drives taking the specific application into account
• Replacing worn components at electrical drives and machines
• Work safety while operating electrical drives</td><td>Tools
• Electrical drive system (electrical machines, controller, power-electronics)
• Software for parameterizing
• Special measuring instruments (e.g. true RMS)
• Installation diagram
• Manuals and manufacturers' instructions
• Electromagnetic compatibility (EMC)
Methods
• Estimating and accessing the actual state of an electrical device
• Testing and using control systems and software
• Replacing electrical machines, wires and components of power electronics and control systems
• Parameterising the electrical drive with respect to guidelines and application (booting programmes for testing and inspecting)
• Selecting standardised components (e.g. electrical machines)
Organisation
• Work safety (voltage, rotating parts)
• Self-directed gathering of information (parameter of electric devices)
• External processing of repair orders</td><td>Requirements
• Analysing the characteristics of electrical drives
• Parameterising electrical drive professionally
• Handling special measuring instruments securely and professionally
• Applied handling of special tools/software for the parameterising
• Professional maintenance of electrical drives
• Work safety while operating machines
• Professional selection and replacement damaged or worn out parts
• Respecting EMC
• Handle external processing of repair orders</td></tr>
</table>

ised the tasks according to the competence model described above. Figure 5 shows an example of the tasks of an industrial electronics mechanic (Rauner et al., 2001).

From the empirically based description and the systematisation of working tasks in combination with the pedagogical description of the learning areas, it is a very short step to the construction of work-related and competence-based curricula. Figure 6 shows an example of a *Lernfeld* for an industrial electronics mechanic (op.cit., 2001) ([14]).

Problems of research and development

Research and development activities in the German project 'New learning concepts within dual vocational education and training' have revealed several problems which need to be solved to put the *Lernfeld* approach into practice. To summarise, the new curricular framework of learning arenas implies three main problems.

- Problem of analysis. How can the occupational fields and the work and business processes be analysed for developing curricula? A methodological concept with adequate empirical methods and categories is necessary to describe work activities.
- Problem of transformation. How can the empirical results be transformed into curricula on competence development? Within this transformation process a conceptualisation of educational, psychological and societal criteria is needed.
- Problem of assessing competences which students/apprentices have acquired. How can the elements (*Lernfelder*) and content of curricular elements be arranged to support competence development? This question implies that a competence model is required to describe an appropriate way of learning and methods are needed to assess individual competence development.

It is important to note that not only researchers or VET administrators are confronted with these problems. With the implementation of the '*Lernfeld*' approach curriculum development has become an additional task for VET teachers. VET teachers are members of curriculum development committees which have been established in each federal state in Germany. These committees, however, deliver a curriculum for each *Beruf* (occupation) which is more or less a framework curriculum that has to be filled with content for vocational schools. Therefore, a much larger number of VET teachers than those participating in federal state committees have to cope in their everyday work with curriculum development.

([14]) The *Lernfeld* structure of GAB is beyond the curriculum structure for the dual VET system in Germany, where there are two curricula: one for VET schools and one for in-company training. GAB developed integrative curricula for the teaching and training in VET schools and in companies to support cooperation between both learning places.

The problem of analysing work situations in companies

The key purpose of the *Lernfelder* is to implement the related work process and competence-based curricula. However, our comparison between the most important approaches shows that different concepts have been developed. Although in both concepts occupational/work analysis is seen as an empirical basis for developing curricula, different procedures and different frameworks are used.

How do the different concepts handle the problem of analysing work situations in companies? In our view discussion between teachers and developing mind maps as suggested in the Bader concept is not sufficient to analyse work situations. Teachers in German vocational schools with an average of approximately 25 years teaching experience do not have up-to-date work experience. Interviewing experts is also rather vague if it is not made clear who an expert for work analysis is.

A better methodology is using expert-worker-workshops for work analysis because this may help integrate real work process knowledge into curriculum development. However, this method is difficult to execute and validate. A first difficulty arises in selecting workers for the workshop: who represents not only the present but also the future of work? A new curriculum should not represent yesterday's working practice. Thus, workers have to be selected who have experienced modern work systems and are in the middle of technological and organisational change.

If such workers are selected a second difficulty will arise during the workshop: the ITB concept is based on tasks and workers are asked to identify relevant tasks which later form the curriculum. Some will probably identify only one task for the entire occupational field, e.g. maintenance staff might declare: 'Our task is to keep the machines running'. Others will identify more than 300 tasks because every single screw they have to tighten appears as a new task to them. Therefore, as an introduction to the workshop, clarification is needed on what a task in the sense of a complete process of work is, and why a VET curriculum consists of 12 to 20 tasks.

In the end the question arises: are the tasks determined representative for the *Beruf* (occupation) as a whole? As 10 to 20 workers participating in an expert-worker-workshop are not representative of the entire occupational field, validation is needed through a survey involving researchers, social partners and experts from the relevant national VET institute. However, involving such people risks emphasising political opinions instead of empirical findings.

All in all, the Bader concept also seems feasible for VET teachers but it might only revitalise those teachers' prejudices about working life. The ITB concept seems much more able to integrate real work process knowledge but it is doubful this concept can be carried out by VET teachers alone. Such a doubt is particularly justified if we consider that the ITB concept transcends the boundaries of the VET system in Germany (as it aims at an integrated curriculum for schools and companies). In current German curriculum development numerous committees have been established in

each federal state for each *Beruf* and it is not clear which of the approaches described is used and how the goal of work process orientation is reached.

The problem of transforming work situations into curricula for vocational schools

After relevant occupational fields have been analysed the problem of how to transform the findings into curricula arises. In Germany, there were and still are criticisms of the work process orientation in curriculum development. In this debate an important argument was published: a curriculum cannot be derived from work situations, because work situations as such do not imply educational issues. Work situations have to be related to educational, psychological and societal criteria (Lisop and Huisinga, 2000, p. 42).

While we agree, it must be asked to what critics of the *Lernfeld* approach relate their educational, psychological and societal criteria - if not to the work process knowledge which apprentices do acquire or do not acquire in the process of learning. For this reason, identifying work situations and the relevant work process knowledge is required, even if we regard the problem of transformation as a process of relating work and education instead of deriving educational issues from work. Indeed, both concepts for constructing learning arenas introduced here try to combine empirical findings with normative criteria for curriculum development.

The question is how reasonable are the framework and methods of the two competing approaches. In the Bader concept the model of a socio-technical activity system should serve as a guideline for solving the problem of transformation (transforming work situations into curricula). Our view is: through the help of a socio-technical activity system *Lernfelder*, tasks and contents can be located in an ideal business process. However, real life phenomena such as economic demands towards work and the aspect of competence development is missing. The socio-technical activity system also does not fit for non-technical jobs.

The ITB concept on the other hand, offers a model of competence development as a reference point for curriculum development - but the devil is in the detail. Our view is: *Lernfelder*, tasks and contents can be located in an ideal process of competence development. However, it is difficult to relate a particular task to only one learning area (e.g. to follow the theory that the standard service of an automobile is exclusively a matter of orientation knowledge). This is a practical difficulty. More important is that up to now the assumed steps of competence development have not been empirically justified - either by Dreyfus and Dreyfus, or by Benner or in the GAB project. It is a matter of future research to find out which tasks can be regarded as paradigmatic tasks for reaching the next stage of development.

To summarise, two different concepts for structuring curricula can be observed. We have concepts such as the ITB concept oriented towards a model of competence development and assign the *Lernfelder* to

knowledge and competence levels. On the other hand, concepts like the Bader concept are oriented more towards the content and objects of a work system interpreted as a socio-technical activity system. The latter approach allows a connection to a discipline-oriented structure of the curriculum whereas the ITB concept abolishes the logic of a discipline as a reference system in favour of an assumed 'logic of development'.

The transformation process from occupational fields to *Lernfelder* was the focus of most projects in the programme 'New learning concepts within dual vocational education'. These projects applied different criteria to this transformation process often derived from the critical educational theory (Klafki, 1996). Nobody derived curricula from work situations without any intermediate considerations. It is worth emphasising that a critical evaluation of the identified work process and tasks is necessary to assess the curricular usability. In the projects didactical criteria were mentioned, but a precise procedure for the transformation process was not established. Thus, in current curriculum development it is not clear which approach towards transformation is used and how competence development is considered.

The problem of assessing competences of students/apprentices

In Germany, most examinations apprentices have to pass are multiple-choice tests, especially the final examination. This is an assessment of 'know-that', but not an assessment of 'know-how' which apprentices should acquire through learning in *Lernfelder* (learning arenas). Examinations are generally not competence-oriented.

Up to now, there has been no thorough investigation into if and how *Lernfelder* (learning arenas) strengthen the process of competence development. Some projects report an increase in students' motivation, others report some students having difficulties to organise self-directed learning in *Lernfelder*. In the GAB project an assessment of competences which apprentices had acquired after 12 to 18 months revealed most (almost 900 students took part in this study) were not able to create the kind of work process knowledge that would help them cope with real tasks which skilled workers have to face - despite teaching and training being already, at least officially, organised according the *Lernfeld* approach (Bremer, 2005). This quite surprising result was explained by teachers' and trainers' refusal to change their teaching and training practices radically and it was traced back to biographical strategies of apprentices (Heinz et al., 2005) who had developed a much stronger company orientation than a vocational identity towards their particular *Beruf* (occupation).

Nevertheless, as the GAB project used the developmental tasks they had established as evaluation tasks the project developed a methodology to assess work-oriented competences which students/apprentices have (or have not) acquired in the course of their vocational education and training. This methodology has been applied to one of 21 projects. As most

projects focused on developing curricula and not on assessing students' competences there is a lack of large-scale evaluation studies ([15]). For this reason we are unable to conclude that the *Lernfeld* approach leads to improved competences of students. Further, in the everyday practice of teaching and training, traditional examinations counteract the idea of work process orientation and competence development which stands behind the implementation of *Lernfelder* (learning arenas).

Overall conclusions

Although intended and dictated by national policy, the work-oriented turnaround in German VET curriculum development has not yet fully happened.

There are political reasons: no policy decision exists or can be expected on which of the different approaches developed to construct *Lernfelder* (learning arenas) should be followed.

The differences in the concepts and results of occupational analysis and developed curricula are evidence of the ambiguity of the new curricular framework. Due to the different approaches, various definitions and conceptualisations of terminology exist, e.g. the difference between tasks, work processes, occupational fields, learning arenas and learning situations. As a follow-up effect there are also practical reasons for a lack of clarity: there is no transparency on how committees for curriculum development solve the problems of analysis, transformation and assessment. Clear guidelines to solve these problems do not exist. Only one fact is known: in each of the 16 German *Bundesländer* it is done in different ways.

If we look at the situation from an empirical point of view, up to now we do not have convincing empirical findings that the *Lernfeld* approach is superior to the traditional disciplinary structure. Much more research is necessary to clarify and to assess the process of competence development. The results of research should be fed back into VET practice which means that VET teachers or trainers should be provided with useful instruments for constructing work-related tasks, for designing learning situations and for competence assessment.

And, last but not least, there are structural reasons why the work-oriented turnaround in German vocational education and training is only half way through: the *Lernfeld* approach does not fit into traditional school organisation, the German system of specialised subjects or the competences teachers have acquired in that system.

([15]) See description and results of the project programme 'New learning concepts within dual vocational education and training' (Deitmer et al., 2004).

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