The contribution of the German pilot project ‘New Learning Concepts within the Dual Vocational Education and Training System’ towards the development of work process related and competence-based curricula

Abstract

In 1997, a new curricular framework for VET-schools called ‘learning fields’ was implemented in Germany. As a result vocational curricula with their elements and contents should be related to work and business processes and described on the basis of competences. Regarding the German tradition of curricula a paradigm shift can be observed, because earlier curricula were organised according to a discipline structure. 1998 a pilot project programme was launched focussing on ‘new learning concepts…’. A lot of the involved projects were constructing ‘learning fields’ and implemented these in VET schools. They developed concepts for the empirical analysis of work processes or tasks and identified required competences as a basis for curricula, intending to link qualification research with curriculum development in this way. Analysing the different approaches it is obvious that an integrated concept regarding the analysis of work and the transformation of the empirical results into curricula is necessary. This also implies a model of competence development, because the focus of this kind of VET research is finally teaching and learning practices in VET schools. Research in this perspective can only be executed domain specific, because it has to deal with the contents and forms of expertise in an occupational field and therefore with the in-depth structure of knowledge and skills.

1 Introduction

Since 1998 pilot projects have been clustered in form of programmes concentrating on a specific topic. The first pilot project programme was called ‘New learning concepts within the dual vocational education and training.’ [1] The overall objective of the programme was to develop new learning concepts within the dual VET system, and ultimately to increase the effectiveness and quality of learning in this way. [2]

Generally spoken, the new quality of the programme has the following characteristics:

- Promoting innovation in a new programme structure. This means that several schools in different federal states work on the same theme, which improves the transfer and dissemination of best practice examples.
- Dealing with the whole context of learning processes in the VET system including occupational analysis and identification of competences, curriculum development, fostering institutional structures of VET schools, the didactical design of (complex) learning situation, the evaluation of learning processes, the use of multi-media learning arrangements and the role of teachers.
- Paradigm shift from a discipline-organised curricula and teaching in VET schools towards a work-process-related and competence-based curricula and design of learning processes.

At the same time the policy makers in the VET area implemented a new curricular framework for the VET schools in Germany (KMK 1996). We call it ‘learning fields’. [3] ‘Learning fields’ are didactically reflected occupational fields and are following the international tendency of competence-based and work-related curricula. This new curricular framework had a great influence upon the programme and determined the further work of the projects. The majority of the pilot projects were focusing upon developing and implementing ‘learning fields’ as an expression of the new learning concepts.

The transformation process from significant work processes to the learning situations implies some complex steps. This process should start from analysing work activities and the required competences, followed by the
development of work-process-related and competence-based curricula and finally ends in the design of work-process-related learning situations.

About one third of the pilot projects elaborated more or less systematic and precise concepts for analysing work processes and working tasks as well as models for the development of competences. The crucial intention of all approaches is the identification of the contents and forms of work activity and competence as an empirical basis for the curriculum development and its impacts for learning processes. In this way, the researchers were trying to close the transformation gap between the empirical analysis of work and the rather normative construction of curricula. The very specific concepts and research methods in some projects also contribute to the development of methodology in VET research. In this paper we describe the concepts of selected pilot projects focusing on the concepts of research methods for work and competence analysis and the models for developing curricula according to the new ‘learning fields’.

2 The new curriculum framework ‘learning fields’ in Germany [4]

The key purpose of ‘learning fields’ is to link the curricula and ultimately the learning processes to the work activity and to promote at the same time action learning at the curricular level. Action learning in VET schools has to be holistic, situated, contextualized and should support making experiences. Therefore, the reference for the learning process via ‘learning fields’ is related to a complete work activity with its typical characteristic of self-directed planning, execution and evaluation of the action and also regarding interdisciplinary aspects (e.g. technology, economics, ecology, law, etc.). 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.

The manual for the new curricular framework basically mentions four criteria for the development of ‘learning fields’. They should be derived from occupational fields which basically represent the area of working. They should be related to the work and business processes which shows the process character of working (and learning). They should be described competence based. Finally, the ‘learning fields’ and their contents should be structured in a ‘logic of subject matter’. [5] Figure 1 shows the reference points in the manual for developing ‘learning fields’ and its implications:

![Figure 1: Reference points of the ‘learning fields’ and its implication](image.png)
To summarise, the curricular framework implies three problems:

- **Analysis problem**: How can the occupational fields and the working and business processes be analysed focused on developing curricula? Therefore, a methodological concept with adequate methods and categories is necessary to describe work activities.

- **Transformation problem**: How can the empirical results be transformed into curricula regarding the question of competence development? The transformation process must be conceptualised by educational, pedagogical and psychological criteria. Curricula always express specific generic purposes of a society and contain normative objectives which must be taken into account.

- **Systematisation problem**: How can the elements (‘learning fields’) and the contents of the curricular elements be arranged to support competence development? This implies that a competence model is required, because this basically describes an adequate way of learning.

### 3 Selected approaches and concepts of curriculum development in the programme

The manual for the curricular framework does not give an answer to these overall questions. The following pilot projects developed and tested concepts and models within this research field. Regarding the methodological discussion, it is important to notice that they did not develop new research methods but contextualised typical methods from the social sciences within the German VET research.

**Pilot Project SELUBA/NELE**

The two pilot projects NELE and SELUBA developed a manual together for constructing ‘learning fields’ (Müller/Zöller 2001). The concept’s basis is the ‘theoretical-pragmatic approach for constructing learning fields in technical vocational areas’ (Bader 2001) in eight curricular steps.

**Figure 2: The eight curricular steps for constructing ‘learning fields’ and learning situations [6]**

The manual starts with the analysis of the relation between a vocational occupation, the work processes and the VET conditions. Based on this analysis the occupational fields can be identified and described. After validating and reflecting these occupational fields, the ‘learning fields’ are derived and described. Finally, learning situations should be developed out of the ‘learning fields’ including a reflection upon the occupational fields.
An Occupational field in this concept is defined as ‘a complex task that contains significant situations for the occupation, life and the society.’ The ability to cope with these occupational situations is the general goal for VET (ibid., p. 26). The important criteria for selecting the ‘learning fields’ derived form the occupational fields which are the general objectives of VET schools and the significance for the present, future and its exemplarity (Klafki 1996).

The reference system for gathering and structuring the work processes in this approach is the socio-technical action system.

**Figure 3: The socio-technical action system**

The socio-technical action system represents the thinking and acting of human beings in technical occupational fields which is based upon scientific and technological concepts. NELE/SELUBA supposes that the occupational fields and work processes should be identified in this system. But the project manual does not explain where exactly the work processes can be found, for example, in the vertical process or in the horizontal function unit. Furthermore, modern structure and organisation of work do not follow this classical organisational concept anymore. Unfortunately, the manual does not mention precise methods for the empirical analysis of work processes. It only gives some suggestions like analysing curricula, visiting companies or interviewing experts.

The development of competences in this concept is defined as the process of acquiring skills, abilities and knowledge up to the level of theoretical profound, autonomous and responsible understanding and shaping of technology. It is assumed that this process begins from the every day experience, followed by the workplace experience, the model forming and finally ends with the forming of theory. Thus, it is supposed that theoretical knowledge is the centre of expertise of skilled worker that can explain or solve everything in the work life. For selecting and sequencing the occupational fields and also the learning fields a reflection with respect to the theoretical foundation is proposed, but no systematisation is offered.
Pilot Project BS 2000

The above described concept was adopted and applied in the pilot project BS 2000 for the electrical fitter and the power electronics mechanic. For this purpose the eight curricular steps were combined to four steps. The methodological approach started with the analysis of existing curricula and occupational profiles for these occupations. A matrix containing a list of common working tasks and areas of application was derived by the document analysis. In the next step, this matrix was evaluated by expert workers. The verification identified 13 dominant working tasks, from which finally 12 learning fields were derived by a reflection of the researcher (Malek 2002). As a result of the used concept the working tasks and the 'learning fields' have a very discipline-oriented structure (table I). They are referring to typical learning areas of electrical engineering or technology. They were arranged in the curriculum by the technological way of energy, this means from the generation of energy via the distribution and transmission of energy and finally the use of energy in certain plants or devices. Hence, the necessity of a subject matter structure is interpreted as a technological way.

Pilot Project GAB

GAB has a very integrated and detailed concept. [7] GAB assumes that every occupation can be empirically described by a defined number of core tasks of the trade. Core tasks describe the specific occupation on the basis of associations between different aspects of the work and characteristic tasks that are typical of the occupation and also provide a complete picture of it. With this clarification, core tasks cannot be described as a single ability or job, but rather in the sense of a complete action that exemplifies all aspects of the occupation. A general description of how a core task is carried out contains the specifics of the concrete task, its planning and execution as well as the assessment and evaluation of the resulting work (Kleiner et al 2002).

These core tasks of the trade have different levels. There are working tasks which can be carried out as a novice or more complex one, which only an expert can manage. In this understanding GAB supposes that there must be an empirically describable way for the competence development. This is done by the stages of vocational development, which also illustrate the integration of the core tasks of the trade into the work process and business process of the company where they describe the process in the neighbouring technical departments. The work organisation and the existing design possibilities are integrated in the representation of the stages of vocational development as well as assessing the future importance of the workstation. In this perspective, the challenge was to identify these developmental tasks (Havighurst 1972).

GAB uses a method-triangulation approach for identifying these core tasks. The first and the most important step is the identification and description of the core tasks itself and the stages of development in so called expert-workers workshops (Kleiner et al 2002). [8] The expert-worker workshops are a mixture of different methods of the social science, like expert interviews, group discussion and narrative interviews. GAB is using three categories for the description of the core tasks, which are ‘the artefacts of the occupation’, ‘the tools, methods and organisation of the occupation’ and ‘the requirements of the occupation’. They also use these categories for describing the contents of work and learning in the ‘learning fields’ (figure 5). The GAB research approach is domain-specific, because the contents and forms of work and expertise can only be analysed by a researcher who is an expert of the domain, too. As a consequence this also means to analyse the tacit knowledge of the expert workers. The identified and precisely described core tasks were finally verified by workplace studies in companies and evaluated by other experts of the domain in a national wide survey.

The main characteristic of GAB is the linkage of the method of the empirical analysis of work with a competence model. This model is based upon the novice-expert-paradigm of Dreyfus/Dreyfus (1986) and the assumption that competence is acquired by the successful performance of a task. [9] Thus, GAB has
developed a reference system in order to identify core tasks and arrange according to the ‘logic of
development’. Therefore, GAB uses a macro-structure derived from the novice-expert-paradigm with four
knowledge and competence levels (Rauner 1999).

**Figure 4: Macro-structure for the systematization of core tasks**

<table>
<thead>
<tr>
<th>sectors of learning</th>
<th>sectors of working</th>
<th>work performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>experience-based, in-depth knowledge</td>
<td>How things can be explained in detail and problems solved?</td>
<td>unexpected working tasks</td>
</tr>
<tr>
<td>knowledge of details and function</td>
<td>How things do work like this and not otherwise?</td>
<td>problem based special working tasks</td>
</tr>
<tr>
<td>knowledge of context</td>
<td>Why are things connected like this?</td>
<td>systematic working tasks</td>
</tr>
<tr>
<td>knowledge of orientation and overview</td>
<td>What is the occupation mainly about?</td>
<td>occupational oriented working tasks</td>
</tr>
</tbody>
</table>

GAB identified with this concept the core tasks for six industrial occupations which describe the occupation
and organised them according to their competence model. From this analytic point to the construction of
competence-based and work-related curricula is a very short step.

Figure 5 shows an example of a ‘learning field’ for the industrial mechanic (Rauner & Kleiner & Meyer
2001).

**Figure 5: ‘Learning field’ for the industrial mechanic – an example of GAB [10]**
Pilot Project BQ 2000

BQ 2000 also developed a detailed concept for work process analysis and also a model for the complete occupational field as the basis for ‘learning fields’. The structural element and analytic category within this concept is the work process. They describe the work processes with its elements, which are the customer order, the working environment, the working tasks, the worker, the work materials and finally the product. Analysing the complete work process focused on VET, the external influences from the society, the company and the customer on these elements has to be identified, too (Hägele/Knutzen 2001).

BQ 2000 developed a very complex methodological approach for analysing and describing work processes (figure 6).
The first step is a (rather) quantitative analysis of customer orders to identify typical work processes. [11] After the identification of a topology of work processes, the next step is the profound description of these processes. This is done by participant observation and narrative interviews with experts at workplaces. This step is important to understand the in-depth structure of the work activity and to identify the work process, its elements and procedures as well as the tools, materials and methods of working. This analysis can only be done by a researcher who is also an expert of the domain. The following precise description is done by similar categories like in GAB but with a higher reflection upon external influences within the categories society, company and customer. The verification of the clustered work processes finally is done in a separate workshop with other expert workers in order to evaluate the results and identify future economic or technological trends or developments. Some basic criteria for this research step are the exemplarity, the representativity and the straightforwardness of the identified and described work processes. Finally, the whole analytic process ends with a scenario method by which the complete occupational field is described using the above mentioned elements. Figure 6 shows an example for a work processes using a matrix with these categories (ibid.).

Figure 7: Matrix for describing a work process concerning the example ‘installation of an emergency lighting system and its power supply’

<table>
<thead>
<tr>
<th>Structural conditions</th>
<th>Socio-technical conditions</th>
<th>Customer requirements</th>
<th>Work process steps</th>
<th>Material and methods</th>
<th>Overall vocational competence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ecological, economic and social values, norms and legislation; Technical power supply; Risks and dangers of using energy; Significance of power supply in the industrial society.</td>
<td>Technical connecting conditions and regulation; Detailed estimate; Federal support programmes; Competition conditions in the electrical small-scale business</td>
<td>Financial conditions; Constructional conditions; Customer credits in the work</td>
<td>Identifying the problem; Customer advisory service; Planning of the customer specific emergency lighting and its power supply; Establishing alternative solutions; conventional vs. prospective electrical installation including ecological and economical saving potential</td>
<td>Talking to suppliers</td>
<td>Executing the steps of activity and handling the working materials of the work process; Reflecting, criticizing and shaping the circumstances of the single work process steps; Social and communicative competence; Knowledge of emergency lighting, power supply systems, energy distribution, types of electrical installation and its integration in an existing building, energy economics.</td>
</tr>
<tr>
<td>Role in the area of emergency lighting and power supply; Commitment to the environmental protection within the company; Willingness for the identification as a energy service worker</td>
<td>Role in the area of emergency lighting and power supply; Commitment to the environmental protection within the company; Willingness for the identification as energy service worker</td>
<td>Prof. orientation</td>
<td>Identifying the constructional conditions; the illumination, the technical connecting conditions, the cross-section of cables and the safety units; Choosing and dimensioning the distribution, the control units and the technical connecting conditions, problem solving; Expressing generic needs of the worker for his work; Managing the legislative regulations</td>
<td>Standard tools, multimeter, testing instruments, installation circuits</td>
<td>Reflecting the activities of the work process; reflecting the characteristics of the single work process steps; Social and communicative competence; Knowledge of emergency lighting, power supply systems, energy distribution, types of electrical installation and its integration in an existing building, energy economics.</td>
</tr>
<tr>
<td>Company planning of assignment; Tools and technical equipment</td>
<td>Customer oriented adaptation</td>
<td>Functionality; Safety and constitutional integration of the electrical plant; Stability; Simplicity of service</td>
<td>Planning; Identifying existing electrical installation and analysing circuits; Mounting the cables, the distribution device, the power supply, regenerative energy sources, overload protection unit; Installation and initial operation of distribution devices for electrical energy, energy control and measurement</td>
<td>Customer oriented adaptation</td>
<td>Reflecting the activities of the work process; reflecting the characteristics of the single work process steps; Social and communicative competence; Knowledge of emergency lighting, power supply systems, energy distribution, types of electrical installation and its integration in an existing building, energy economics.</td>
</tr>
<tr>
<td>Company oriented adaptation</td>
<td>High-quality workmanship; Customer oriented adaptation</td>
<td>Functionality; Safety and constitutional integration of the electrical plant; Stability; Simplicity of service</td>
<td>Executing the steps of activity and handling the working materials of the work process; Reflecting, criticizing and shaping the circumstances of the single work process steps; Social and communicative competence; Knowledge of emergency lighting, power supply systems, energy distribution, types of electrical installation and its integration in an existing building, energy economics.</td>
<td>Customer advisory service</td>
<td>Executing the steps of activity and handling the working materials of the work process; Reflecting, criticizing and shaping the circumstances of the single work process steps; Social and communicative competence; Knowledge of emergency lighting, power supply systems, energy distribution, types of electrical installation and its integration in an existing building, energy economics.</td>
</tr>
<tr>
<td>Customer oriented adaptation</td>
<td>Functionality; Safety and constitutional integration of the electrical plant; Stability; Simplicity of service</td>
<td>Functionality; Safety and constitutional integration of the electrical plant; Stability; Simplicity of service</td>
<td>Delivery of product</td>
<td>Computer-aided documentation of the work</td>
<td>Executing the steps of activity and handling the working materials of the work process; Reflecting, criticizing and shaping the circumstances of the single work process steps; Social and communicative competence; Knowledge of emergency lighting, power supply systems, energy distribution, types of electrical installation and its integration in an existing building, energy economics.</td>
</tr>
</tbody>
</table>

**Figure 6: The methodological approach in BQ 2000**
BQ 2000 derived the ‘learning fields’ from this broad description of the occupational fields. For the systematisation they were using the same competence model like GAB, but did not link this competence model with the methodological approach. Thus, the transformation step is not very clear.

Pilot Projects KUBE and ERKUNDA

Also other pilot projects which originally did not intend to develop ‘learning fields’ at the beginning of the project executed an occupational analysis. The pilot projects ERKUNDA and KUBE were investigating work activities with regards to the influence of new technologies (ERKUNDA for building automation) and the increasing necessity of customer orientation and service competence in small-scale enterprises (KUBE in the plumber area). Both pilot projects did surveys with different target groups (entrepreneurs, producers, customers, workers and apprentices). Finally, the projects also developed some examples of ‘learning fields’ and learning situations concerning this special focus. In both approaches one can see two important aspects. Firstly, the results of the surveys did hardly influenced the design of curricula or learning situations, because they did not have a concept combing the occupational analysis and the development of curricula by taking into account the design of learning arrangement. The linkage between qualification research and curriculum development was therefore not realised. Secondly, because KUBE did not have a concept for organising the curricular elements, they sequenced them according to the product circle of heating systems and tried to integrate customer orientation.

4 Comparison of the concepts and the results

The following table summarises the concepts and results of the above described pilot projects:

<table>
<thead>
<tr>
<th>Pilot project</th>
<th>NELE / SELUBA</th>
<th>BS 2000</th>
<th>GAB</th>
<th>BQ 2000</th>
<th>KUBE / ERKUNDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methods / Instruments</td>
<td>Manual for constructing ‘learning fields’ including analysis questions and methodological suggestions</td>
<td>Analysis of documents (occupational profiles and existing curricula); Interviews with experts; Classification of the identified working tasks</td>
<td>Workshops with expert-workers; Workplace studies; National wide survey with other experts in the domain</td>
<td>Analysis of customer orders; Participant observations; Workshops with experts; Scenario method</td>
<td>Surveying different target groups (skilled workers, entrepreneurs, apprentices, producer, customer)</td>
</tr>
<tr>
<td>Results</td>
<td>Not yet applied and documented</td>
<td>Description of the working tasks; Development of ‘learning fields’ for The electrical fitter and power electronics mechanic</td>
<td>Identification and description of working tasks and learning fields for 6 occupations industrial mechanics, industrial electronics, tool mechanic, motor mechanic, mechatronics fitter, industrial clerk</td>
<td>Identification and full description of the work processes and the all-embracing occupational field for the electrical fitter</td>
<td>Description of working tasks regarding customer orientation for the electrical fitter and the plumber</td>
</tr>
<tr>
<td>Structuring</td>
<td>No specific concept for the curriculum structure</td>
<td>Technological structuring of the ‘learning fields’ according to the way of energy and electrical plants and devices</td>
<td>Competence-based and developmental logical structure of the ‘learning fields’ Sequencing the ‘learning fields’ by knowledge and competence levels</td>
<td>Competence-based and developmental logical structure of the ‘learning fields’ Sequencing the ‘learning fields’ by knowledge and competence levels</td>
<td>Technological structuring of the ‘learning fields’ and ordering the learning situations according to the product circle of a heating system</td>
</tr>
</tbody>
</table>
The key purpose of the ‘learning field’ is the implementation of the work process related and competence-based curricula. The comparison shows that the pilot projects developed and tested different concepts. The common aspect in the concepts is the use of occupational/work analysis as an empirical basis for the development of curricula. Especially GAB and BQ 2000 developed a complete model for identifying, describing, selecting and structuring the working tasks or work processes based on empirical studies and a theoretical model. Both projects developed a very specific methodological approach and also defined categories and selection criteria for the analysis. The methods are similar in some parts, but are combined in different ways. Characteristic for both approaches is that they are domain specific. For understanding occupational areas and the in-depth insight of work activities the VET researcher has to be an expert of the domain.

The categories and objects of the analysis focusing on curriculum development are also very similar and could be summarised as the characteristic work context concerning a complete work activity as a part of the business and work processes. However, differences can be observed

- in the theoretical foundation and the significance of competence in the analysis model and the curriculum model;
- the definition of the categories for describing the work and
- the principles of structuring the elements of the curricula.

In GAB the orientation of competence development based on the novice-expert-paradigm is characteristic for the whole research process. The analysis of core tasks is adapted to this concept and the following construction of the curricula also integrates the ‘logic of development’. For BQ 2000 the constitutive moment of the occupational action system is the work process. Later, the organisation of the work processes is done by service orientation and the following structuring of the curricular elements also by the competence model, but the combination of the analysis and transformation step is not clear.

The difference in the methods and concepts can clearly be seen by comparing the results of two projects. Table II shows the working tasks and work processes for the electrical fitter:

**Table II: Comparison of the identified working tasks in BS 2000 and work process in BQ 2000**

<table>
<thead>
<tr>
<th>BS 2000 Working tasks</th>
<th>BQ 2000 Work process</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Radio and television: advising, installing, operating</td>
<td>- Supplying buildings with electric power and its distribution</td>
</tr>
<tr>
<td>- Lightning and high voltage protection: analysing, advising, planning</td>
<td>- Supplying buildings with electric lighting</td>
</tr>
<tr>
<td>- Instrumentation and control units: mounting, installing, operating</td>
<td>- Supplying information and telecommunication units</td>
</tr>
<tr>
<td>- Lighting installation: customer advising service, planning and installation</td>
<td>- Installing and mounting information and telecommunication units and devices</td>
</tr>
<tr>
<td>- Antenna and telecommunication units and plants: installing and trouble shooting</td>
<td>- Domestic security and protection</td>
</tr>
<tr>
<td>- Signal units: installing and trouble shooting</td>
<td>- Building automation</td>
</tr>
<tr>
<td>- Electrical machines and drives: installing and operating</td>
<td>- Advisory, connecting, maintenance and removal of domestic appliances</td>
</tr>
<tr>
<td>- Energy transformation plants: installing and operating</td>
<td>- Automation of industrial plants</td>
</tr>
<tr>
<td>- Power supplies: installing, trouble shooting and maintenance</td>
<td>- Supplying hot water generation</td>
</tr>
<tr>
<td>- Cables and devices: installing and trouble shooting</td>
<td>- Supplying filament heating</td>
</tr>
<tr>
<td>- Electrical components: customer advising service, planning and installation, planning work process, installing and maintenance</td>
<td></td>
</tr>
<tr>
<td>- Materials: customer advising service, installation and trouble shooting</td>
<td></td>
</tr>
<tr>
<td>- Planning the use of tools and testing tools</td>
<td></td>
</tr>
</tbody>
</table>

10
Regarding the results one can see quantitative and qualitative differences. The quantitative differences are a result from the methodological approach. The identified working tasks in BS 2000 are predominantly related to the artefacts e.g. electrical plants and devices of the technological area. The researchers just added verbs of activity to them. In the following development of ‘learning fields’ this idea is carried on. The identified work processes in BS 2000 are more related to complete working areas and the working context. This difference is a result from the research concept. BS 2000 started with a matrix derived form the existing curricula. Thus, it is almost logical that the identified working tasks are related to the discipline and organised in a technological way. BQ 2000 described the work process with their all-embracing concept of the occupational field based on profound empirical occupational analysis (figure 6).

To summarise, two different concepts for structuring curricula can be observed: On the one hand, the concepts of GAB and BQ 2000 which are oriented towards a model of competence development. They are therefore more subjective and competence-based. GAB and BQ 2000 assign the ‘learning fields’ to knowledge and competence levels; on the other hand the concepts of BS 2000 and KUBE are oriented more towards the contents and objects of technology. If the development of competence, and this must be the goal for a curriculum, is following a technological way or even a real work process, this has to be discussed. The systematisation of the ‘learning fields’ follows the production process, the production circle or the technology (e.g. the way of electrical energy). Thus, the necessity to order the elements and contents of the curricula is interpreted as a ‘logic of development’ or ‘logic of technology’.

The transformation process from occupational fields to ‘learning fields’ is the focus of most projects. They also apply different criteria usually derived from the critical constructivism educational theory (Klaftki 1996). It is to emphasise that a critical evaluation of the identified work process and working tasks is necessary concerning the curricular usability. The projects mention didactical criteria, but do not establish a precise procedure for the transformation process.

5 Conclusions

The differences in the concepts and in the results made in occupational analysis and the developed curricula are an evidence of the imprecise regulation in the new curricular framework. Because of the different approaches there is a variety of different definitions and conceptualisation of terminology, e.g. the difference between working tasks, work processes, occupational field, etc. This is also an indicator for the necessity of further VET-research in the context of occupational analysis and curriculum development. This research should have the following characteristics:

- Analysing occupational fields, work activity, work processes, etc has to be domain-specific to understand the in-depth structure of the work and the required competence. Expertise is domain-specific, this means that the research of expertise can only be done by a researcher who is also an expert of the domain;

- Analysing work activity focused on the development of curricula and therefore on learning processes must be linked. That means not only a concept or method for the empirical analysis of work is necessary, but also a competence model which should be integrated in the analysis concept;

- The transformation step is still an underdeveloped area. For transferring the empirical results into curricula an adequate model procedure is necessary;

- The results of the research process finally must end in the VET-practice which means that VET-teachers or trainers must get useful instruments for the design of work-related curricula or learning situations otherwise the innovation of the ‘learning field’ will not be like intended.
Appendix 1

Table III: List of pilot projects

<table>
<thead>
<tr>
<th>Pilot Project</th>
<th>Title</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS 2000</td>
<td>Vocational School 2000 – Learning in work oriented occupational fields</td>
<td>Hamburg</td>
</tr>
<tr>
<td>BQ 2000</td>
<td>Vocational education and training 2000</td>
<td>Saxony</td>
</tr>
<tr>
<td>ERKUNDA</td>
<td>Customer orientation and service skills in the VET within the automation of buildings</td>
<td>Bremen and Mecklenburg-Western Pomerania</td>
</tr>
<tr>
<td>GAB</td>
<td>Business and work process oriented dual-cooperative VET within selected industrial occupations</td>
<td>Lower Saxony and Hesse</td>
</tr>
<tr>
<td>KUBE</td>
<td>Customer-oriented vocational skills within the plumbing area</td>
<td>Saxony</td>
</tr>
<tr>
<td>NELE</td>
<td>New structures for teaching and learning by ‘learning field’</td>
<td>Bavaria and Hessen</td>
</tr>
<tr>
<td>SELUBA</td>
<td>Fostering efficiency of new learning concepts and teaching within the dual VET</td>
<td>North Rhine-Westphalia and Saxony-Anhalt</td>
</tr>
</tbody>
</table>
Notes

[1] Pilot projects as a form of innovation have a very long tradition in Germany. Since 1971 more than 2,400 projects in the VET system were carried out. In 1997 the administration (BLK) which is in charge of pilot projects in VET schools decided to install programmes intending to promote innovation and transfer which have more countrywide effects. The first programme is running from 01.10.1998 to 30.09.2003 and funded with approx. 14 million Euro. 21 pilot projects in 14 federal states are part of the programme. In total about 100 VET school and 20 VET research institutes are participating and developing new learning concepts. The Institute Technology and Education of the University of Bremen was installed as the programme administrator and evaluator.

[2] The programme structure and evaluation design defines 4 main criteria, which are work process orientation, fostering vocational competence, self-organised learning processes and holistic forms of learning. Each project defined within these categories their specific objectives of their projects. Altogether more than 100 goals were defined. Hence, a variety of different concepts with different implications were developed in the programme.

[3] Terminology is always a problem in the international discussion. The expression ‘learning field’ does not really exist in English in this context, but in Germany it also a new expression. A common expression like learning area would not be adequate for the description of the new curricula. This is the old terminology for the discipline oriented structure of curricula. In Germany a learning area e.g. would be ‘foundations of electronics’ or ‘electrical machines’. ‘Learning fields’ are not structured like this and its contents should not be derived directly form science, because they should refer to the occupational fields. A ‘learning field’ could be e.g. ‘maintenance of a mechatronic system’.

[4] This new framework is only valid for VET schools. In Germany are actually existing two curricula, because of the dual system. The curricula for the initial VET within companies are not affected by the curriculum reform. Therefore the VET law must be reformed.

[5] The necessity to put the elements and contents of curricula into an appropriate order is especially for a long term VET like in Germany very important, because this describes basically the learning way. The manual mentions the criteria ‘logic of subject matter’ to order the contents. Unfortunately, it does not exactly describe what is meant by that. According to the work-related and competence-based structure, a discipline structure is definitely not adequate. Hence, the question is, if any criterion exists for sequencing curricular contents in the logic of work activity and competence development.

[6] Each step in the manual also contains several analysis questions, which should to be answered for proceed each step. In total there are 63 questions. But the quality of the questions varies a lot. Just to give an example, if one intends to describe occupational fields, a question like ‘how can an occupational field be described’ does not give the answer. Therefore a precise concept is needed.

[7] Besides the following description GAB also established ‘core occupations’ by reducing 27 occupational profiles down to 5. Therefore, the question about the borders of occupations appeared. GAB also developed a testing system to evaluate competence development using evaluation tasks.

[8] This is basically the DACUM approach. The main difference between both concepts is that GAB also tries to identify the stages of development of the expert workers to find out a way to order the tasks into a competence model.

[9] Benner approved this concept within the nursery area and found out paradigmatic cases (or developmental working tasks) for nursery (Benner 1996).

[10] The ‘learning field’ structure of GAB is beyond the curriculum structure for the dual VET-system., because GAB developed integrative curricula for schools and companies.
BQ 2000 applied this approach for the electrical fitter which is a profession in a small-scale enterprise and therefore in some aspects like the work process, work organisation, requirements, products very different in comparison to industrial professions. One researcher was analysing in the first step more than 4,000 customer orders respectively accounts and identified 10 work processes for this occupation.
References


