Vocational Training Concepts and Fields of Activities of Energy Consulting in Germany

Simon Heinen, Martin Frenz
RWTH Aachen University, Institute of Industrial Engineering and Ergonomics
Bergdriesch 27, 52062 Aachen, Germany
s.heinen@iaw.rwth-aachen.de, m.frenz@iaw.rwth-aachen.de

Raymond Djaloeis, Christopher M. Schlick
RWTH Aachen University, Institute of Industrial Engineering and Ergonomics
Bergdriesch 27, 52062 Aachen, Germany
r.djaloeis@iaw.rwth-aachen.de, c.schlick@iaw.rwth-aachen.de

Abstract

Nowadays, from a pedagogical point of view, services of energy consulting in Germany are unstructured. There are a lot of different and imprecisely defined service offers without unitary standards. The existing standards are often intransparent, and customers as well as energy consultants themselves can hardly distinguish between different service offers. Similarly, vocational and further training in energy consulting are unstructured and a lot of different training offers exist. Additionally, the education pathways for becoming an energy consultant do not follow a systematic approach. Trainees have very different vocational backgrounds, areas of knowledge, skills and qualifications (e.g. architects, engineers, craftsmen in different work areas as interior decorator, systems mechanics or carpenters, etc.) but often are obliged to take the same training programs to become an energy consultant. In this article the results of an analysis of today´s curricular patterns are presented. Today, energy consulting training programs mostly consider technical knowledge and miss soft skills, e.g. interaction with customers. Furthermore, a lot of possible work tasks are not included in today´s energy consulting service offers. In our studies, we address these shortcomings with the development of a concept of a qualification framework including the full service chain of energy consulting. Our concept focuses on structuring the contents of energy consulting curricula regarding both typical work tasks and competence-based structures. Thus, we worked out a modern curricular concept based on the vocational fields of activities in energy consulting and surveyed the activities along the full area of service offers. As a result of our studies the surveyed and validated fields of activities as basis of a modern curricular framework as well as implications on further work are presented in this paper.

1 Introduction

Nowadays, in Germany services of energy consulting are unstructured. There are a lot of different and imprecisely defined service offers without unitary standards. Existing standards are often intransparent and customers as well as energy consultants themselves can hardly distinguish between different service offers. This is due to similar denotation of different training programs or service offers and vice versa. Additionally, the education pathways for becoming an energy consultant do not follow a systematic approach. Vocational and further training in energy consulting are unstructured and a lot of different training offers exist. Furthermore, trainees have very different vocational backgrounds, areas of knowledge and qualifications (e.g. architects, engineers, craftsmen in different work areas as interior decorator, systems mechanics or carpenters, etc.) but

are obliged to take the same training programs to become an energy consultant. In chapter 2 we present an instrument we used to analyze today´s curricular patterns. We explain how the heterogeneous vocational backgrounds are connected to further training concepts to become an energy consultant. Central shortcomings of concepts for the development of competencies in the energy consultant area are described. This implies the necessity to develop a systematical modular concept of vocational patterns regarding the heterogeneous prerequisites of trainees to sharpen the profiles of service offers and its training programs. This framework is mainly based on the development of the different fields of activities in energy consulting which are structured according to the service chain in energy consulting for specific services. In chapter 3 we will present our studies on the development of these fields of activities. In our studies we developed and validated a set of 10 fields of activities. Implications on further work are presented in chapter 4.

2 Studies on the status quo of vocational patterns in energy consulting services

In Germany, the dominant prerequisite to work in a job in general is gaining a formal qualification either by a vocational training program or going to university. There is a broad set of vocations with a connection to further training or studies in energy consulting. Special focus of our studies is the non-academic level. Energy consulting today is based on earlier vocational trainings and work experience in different disciplines and other areas and by doing additional further vocational training for energy consulting. Sustainable buildings have complex requirements for providing optimized energy use along its lifecycle. Experts in energy consulting services are helpful to handle these impacts effectively and efficiently while considering all requirements and effects in the future. Thus, systematic and professional energy consulting services are necessary. Today, only inconsistent standards are available on the market. This causes enormous uncertainties for both the customer as well as the service supplier. Thus, our approach is to first analyze today´s qualification structures in vocational curricula. Qualification research is the basis for occupation and curriculum development [Rauner 2008]. We take into account curricula of earlier occupations, for instance stucco plasterer, carpenter and systems mechanics as well as curricula of energy consulting training programs. As a first step, with regards to Clement [2002] defining the work tasks of an energy consultant and the development of commons and differences depending on the vocational background in curricula due to defined criteria will help to give more structure to the vocational patterns in energy consulting.

Criteria	**Specifications**		
Content objects	Intention of qualification	Content	
Central Idea	Sustainability and handling conflicts of aims	Dynamics of Interaction	
Main principle of construction	Orientation on scientific disciplines	Orientation on typical work tasks	Orientation on personal dispositions

Figure 1: Morphological scheme to analyze curricular patterns in energy consulting

For the studies of curricular patterns a special analysis instrument for both courses in energy consulting and corresponding vocational trainings has been developed. The instrument (Fig.1) surveys items of qualification contents, formal principle and central ideas as the significant aspects in curricular studies [Heinen and Frenz 2009].

The criterion “content objects” surveys the intention of qualification and the curricular contents. It concerns formal qualifications and competencies as well as the implemented knowledge. This criterion is especially used for comparisons with regard to contents. Curricula in general have central ideas [Huisinga 2005]. Learning for the future and an education for sustainable development are today´s central goals in education [UNESCO 2010] as well as dealing with an uprising service orientation with a demand of interacting with people and rising complexity in processes and technologies. Thus, the criterion “central idea” of a curriculum considers the curricular implementation of a sustainability ethos with handling conflicts of aims, e.g. on a macro level in the dimensions of social responsibility, economic effectiveness and ecological agreeableness. Furthermore it considers dealing with uncertainties (often a solitary solution of a problem does not exist, there are several possibilities the energy consultant can strive for) and the significance of dynamics of interaction. These aspects are important in consulting services because a lot of work tasks are service and customer oriented. The criterion “main principle of construction” considers the three aspects of an orientation on scientific disciplines, typical work tasks and personal dispositions [Reetz and Seyd 2006]. Orientation on scientific disciplines means the curricula structuring the knowledge in formulas and scientific contents with special regards to technical knowledge. One has to transfer this more or less abstract knowledge into the concrete work tasks by himself. On the opposite, orientation on typical work tasks means structuring curricular contents with regards to performance in service offers and typical work tasks. They describe the activities one has to do to solve a work task and the knowledge one needs for the work performance. The aspect personal disposition takes the learners different dispositions into account and emphasizes the development of personality as well as personal improvement in key competencies and soft skills. Although there is a strong interdependency between the three principles of construction and all of them always are considered designing a curriculum, one principle mostly is dominant.

An analysis of the demands of service offers in the area of energy consulting offers shows the heterogeneous compound of service offers, all named as “energy consulting service”. Those service offers are e.g. advisory service on how to use technology and the behavior with technology in use, energy-checks, Initiating advisory service without local consultation, Energy Consumption or Demand certificates, different consulting services in programs sponsored by governmental departments for buildings designed for residential as well as business purposes, detailed analysis based on e.g. thermal simulations for different purposes. Those different tasks give an insight into complexity and heterogeneity of energy consulting service offers. It is obvious that those service offers require sharp profiles and different job profiles with varying key competencies. The work task related competencies differ in kind and level.

Due to markets demands of service profiles it is obvious, that situation orientation should be the dominant principle to structure the curricula mentioned before. The qualification systems contents need to be structured regarding to situated tasks. This also offers the possibility of modular training programs and qualification framework. Furthermore, this orientation on work tasks gives more flexibility to ways of qualifying for a job. Besides formal qualification, competence-based ratings easier are to be implemented to “qualify” for fulfilling a job. A central uprising question is to sort the work tasks and service offers due to required competencies on an academic or vocational training level as well as the question how to consider non-formal qualifications in detail.

In energy consulting curricula a sustainable acting is not implemented; focus is on handling technology and materials. Also in the curricula of previously learned vocations this aspect is barely stressed. Furthermore in energy consulting curricula the handling of uncertainties in solution and dynamics of interaction hardly are touched. As well, the curricula of the earlier vocations more focus on handling the domain and only include a dissatisfying level of service- and customer-orientation.

In Germany, during the 90´s the responsible governmental department (“Kultusministerkonferenz”) decided to restructure the vocational curricula. Before, they have been

structured according to scientific disciplines; the redesign was done to dominantly implement an orientation on work situations. Now curricular contents dominantly regard to significant work tasks [KMK 2000].

Our studies on today´s Curricula in energy consulting showed that mainly technical and material domain knowledge about the building is emphasized, but in training programs they do not focus on the implementation of this knowledge in didactically prepared work tasks. Domain specific aspects like how to perform and prepare a good consulting service are barely touched. They are dominantly structured according to scientific disciplines. Consideration of personal dispositions is barely implemented in the curricular principle. Connections to specific, typical working situations are barely given and they focus on only specific knowledge without cultivating learner´s competencies about those topics.

On the one hand the original crafts are structured as vocational fields of activities and already follow characteristics of modern curricula. For services of energy consulting on the other hand modern structures still have to be developed. The market has a demand of delivering services which are defined by the fulfilment of work tasks. The work tasks are contained in situated service profiles. Hence, the work tasks need to be surveyed and grouped to fields of activities in socio-technical systems to meet the demands of the market.

Today, energy consulting services mainly consist of conceptual designs of energy concepts and concepts of modernization. Hence, current energy consulting processes do not go along the full service chain in energy consulting and miss the capacity of value adding. The conceptual work tasks are merely at the beginning of the service chain; thus, further work tasks, e.g. monitoring buildings, assistance to building design and its realization, have to be included in our set of fields of activities.

Those aspects implicate the necessity to develop a systematic modular concept of vocational patterns regarding to the heterogeneous prerequisites of trainees to sharpen the profiles of service offers and it´s training programs. The vocational fields of activities in energy consulting fully have to be developed according to characteristics of modern vocational patterns and training concepts.

3 Development of vocational fields of activities in energy consulting

Modern training structures follow competence-based approaches [Frommberger 2004], are situated to typical work tasks [Reetz and Seyd 2006; KMK 2000] and include soft skills like interaction with customers etc. as well as general key competencies (Rychen and Salganik 2001) (e.g. acting autonomously and reflectively, using tools interactively or joining and functioning in socially heterogeneous groups).

The trend towards energy-optimized buildings and minimization of effects on the environment includes an efficient and effective handling of energy questions and requires sustainable thinking, planning and acting. The demand of energy-efficient buildings enormously increases the complexity of handling materials, technology and the harmonisation of both to each other. A lot of different complex and often even conflictive social, ecological and economical aspects have to be considered. More and more sustainable solutions are expected, expressed as a fair balance between conflicts of different aims. These aspects can appear all along a buildings lifecycle.

As mentioned before, energy consulting processes do not go along the full service chain in energy consulting and miss the capacity of value adding, at this time. The conceptual work tasks are merely at the beginning of the service chain; thus, we enlarged the service chain. Further tasks for energy consultants can be the escorting of the implementation of developed concept as well as efficiency control and bringing into service. This means the implementation of further work tasks e.g. monitoring buildings, assistance to building design and its realization. These work tasks have been included in our set of fields of activities.

This framework is mainly based on the development of the different fields of activities in energy consulting which are structured according to the value chain in energy consulting for specific services. Central idea of our concept is the curricular implementation of a sustainability ethos and to include a sustainable work performance following the approach of vocational education for sustainable development. A sustainable work performance includes dealing with conflicts of different aims. One has to consider the three dimensions economy, ecology and society

with acting according to the aspects of ecological agreeableness, economical efficiency as well as social responsibility to find a satisfying solution [De Haan and Harenberg 1999; Hahne 2006]. Energy consultants are confronted with those conflicts of aims in a lot of their work tasks. Those conflicts need to be brought forward to the curricular concept to give a basis to learn to deal with finding non-unitary solutions satisfying interests of all three dimensions.

To develop the fields of activities, different steps were taken. Firstly, business processes in energy consulting were surveyed and corresponding operating processes were described in detail by expert reports. Those working processes contain the work tasks in detail. Afterwards, they have been structured according to the principle of socio-technical systems and been grouped to fields of activities along the service chain in energy consulting [KMK 2000] By using the design principle of socio-technical systems it is possible to systematic describe the connections between working persons, its environment, the equipment and the work tasks [Bader 2004]. Our model of a service chain of activities in business processes bases on an adapted version for a value chain of consulting processes [Spiegel 2003].

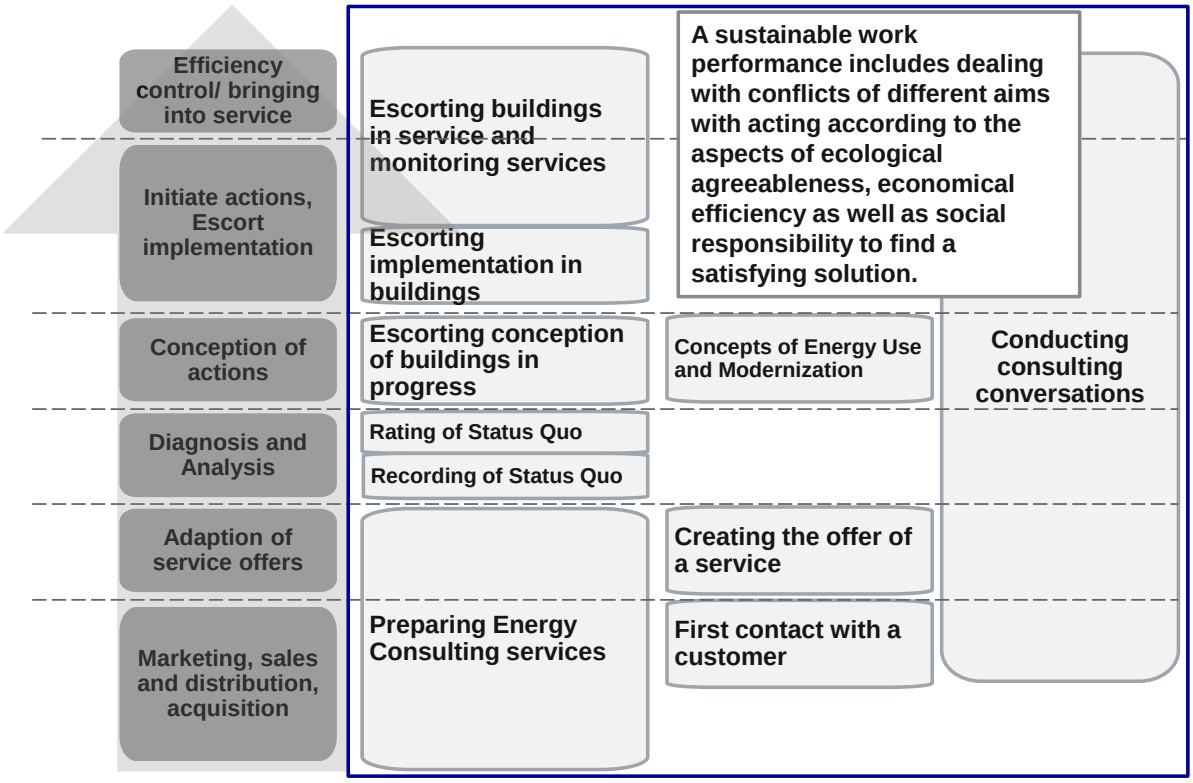

Figure 2: Fields of activities in energy consulting

Consulting services in general include the offer of a service, its delivery and its completion including quality check and monitoring services. They pass through all parts of the chain in order, and at each part the service provides some value gain. In our service chain model, the parts were defined and in detail specified for energy consulting services. By those definitions, the activities in the service chain can be grouped to fields of activities in energy consulting. Today, energy consulting services mainly consist of conceptual designs of energy concepts and concepts of modernization. Hence, current energy consulting processes do not go along the full value chain in energy consulting and miss the capacity of value adding. The conceptual work tasks are merely at the beginning of the value chain; thus, as a result of our studies further work tasks, e.g. monitoring buildings, assistance to building design and its realization, have been included in our set of the 10

fields of activities. The enlargement of the service chain as mentioned before provided especially the fields of activities on escorting residential and non-residential buildings in service and monitoring buildings in service as well as escorting implementations of concepts in real estate have been developed. Another important field of activity developed in our studies is the field of conducting consulting services in general. Until now, there existed a lot of shortcomings in that area. The fields of activities are listed in fig. 2. They were in detail structured by the different phases of operating in fulfilling a work task [Hacker 2005] as a structure model (Fig. 3). Following this approach, the action-regulating knowledge, which regulates the activities from the energy consultant, is represented [Hacker 2008].

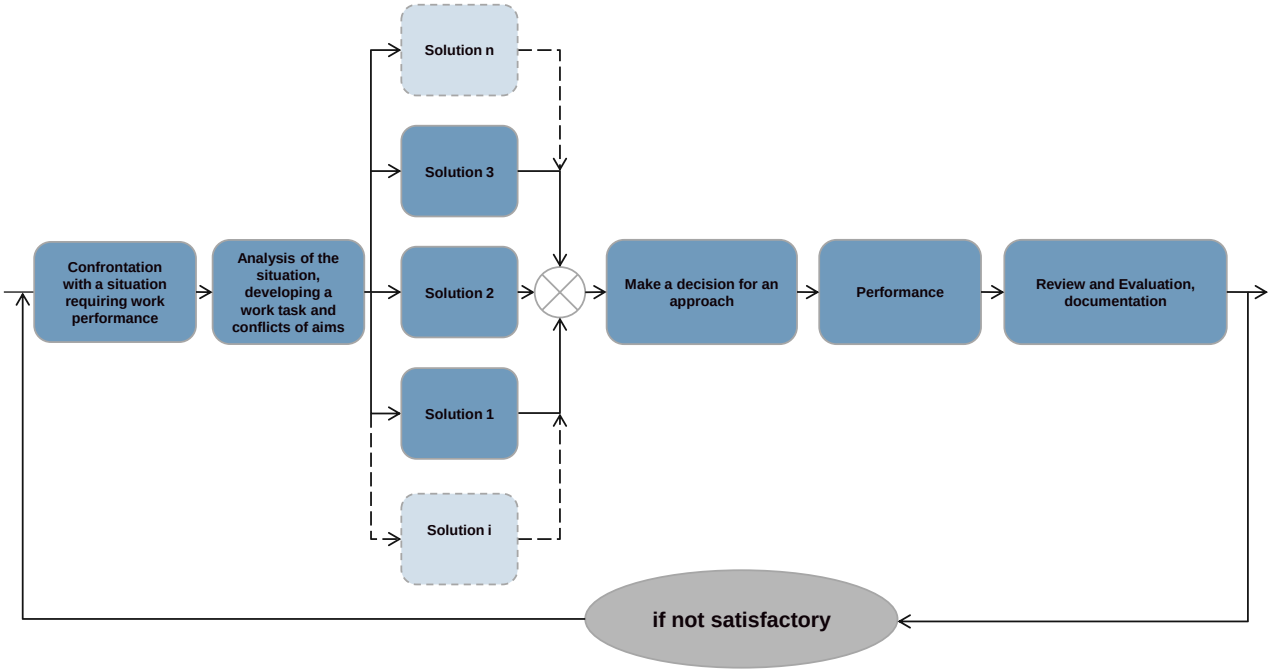

Figure 3: Feed-back control system for phases of operating in fulfilling a work task

The phases we defined are: 1. Confrontation with a situation requiring work performance, 2. Analysis of the situation, developing a work task and conflicts in aims, 3. Planning of possible solutions, 4. Make a decision for an approach, 5. Performance, 6. Review and Evaluation, documentation, 7. Completion of the task. Each field of activity has been designed regarding to those phases. In this structure the activities an energy consultant needs to perform are describe with regards to the general work tasks. This indicates the competencies to be used as well.

Model validation and revision of contents was done by a set of expert skilled worker workshops. Expert workshops are a standard instrument for revision of contents to validate them and give precise and accurate formulations. This approach enables to specify the developed work tasks in the fields of activities in terms of important work tasks. Criteria for important work tasks are [Spöttl 2008]:

- Being characteristic for the respective occupation
- Encouraging learning in order to challenge occupational competence development by concentrating on the work task
- Enabling a systematisation of vocational learning in terms of development of key competencies
- Being designed in a way that they also contain future occupational developments.

According to the criteria of good “expert skilled worker workshops” (Spöttl 2008) and experiences from other studies (Reinhold 2009) we carried out four workshops with workers on expert level with a total amount of 21 participants. The workshops have been moderated by a team of two persons, one to lead the conversation and one expert with detailed domain knowledge. The participants all worked for several years in different areas of energy consulting with different

vocational backgrounds (e.g. architects, engineers and craftsmen). Additionally, people with several years of experience teaching in training programs were taken into account. ´

On the basis of validated fields of activities a concept of possible vocational patterns for energy consultants on a makro level has been developed. In further studies those vocational patterns and fields of activities of energy consultants can be augmented with detailled key competencies. The fields of activities have to be compared with the original crafts to survey the benefits and qualification lacks depending on trainees earlier education. With those results a systematical concept of vocational patterns can be developed and special training programs can be adapted.

4 Implications on further work

On the basis of the vocational fields of activities a concept of possible vocational patterns for energy consultants on a macro level has been developed. In a next step these fields of activities of energy consultants as a general description of work actions can be connected with business activities. Those business activities comply with market demands of energy consultants and can be grouped to business portfolios [Bretschneider, Grunwald and Zinke 2010]. Afterwards, they have to be augmented with detailed key competencies. On that basis, needs of qualification can be developed. The key competencies in the portfolios differ mainly in number and level. Therefore another study is planned. The fields of activities and business portfolios will be compared with the original crafts to survey the benefits and qualification deficiencies depending on trainees' earlier education. With those results a systematical concept of vocational patterns can be developed and special training programs depending on earlier education and gained competencies can be adapted. Figure 4 gives an overview on possible vocational patterns in future.

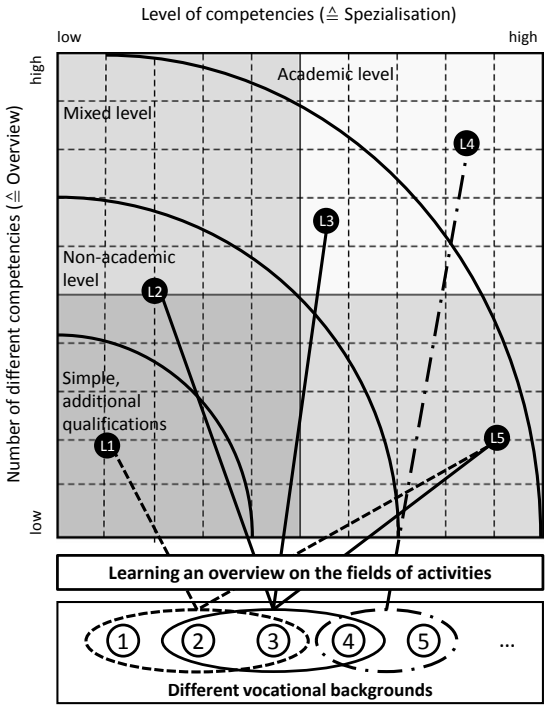

Figure 4: Portfolio-Concept of grouped vocations to qualify for working in different business profiles

Another aspect of our further studies will especially be competence-based, outcome-oriented approaches. We do not just want to rate formal qualifications. Furthermore on-the-job-learned competencies shall be taken into account. Thus to describe a person´s competencies findings from the development of the European as well as the German Qualifications Framework will be considered

Based on this systematic qualification concept it is possible to determine training programs which fit to energy consulting service offers and have unitary standards. To solve the deficiencies in competencies, the first exemplary items for further training have been developed. They are based on the earlier mentioned qualification concept, e.g. modules about an introduction into identifying vital work task related aspects of communication with the customer have been developed. Additionally, a course work has been devised with the objective of advancing participants in competencies regarding sustainable conduct in exemplary work tasks for certain fields of activities, e.g. for planning the heating of a housing estate.

REFERENCES

Bader, Reinhard (2004), Unterrichtsgestaltung nach dem Lernfeldkonzept, Bertelsmann, Bielefeld.

Bretschneider, Markus, Grunwald, Jorg-Günter and Zinke, Gert (2010): Wie entwickelt man eine Berufsgruppe – ein mögliches Strukturkonzept. In: BWP Vol. 04/2010, pp. 12-15.

Clement, Ute (2002): Lernfelder im 'richtigen Leben' - Implementationsstrategie und Realität des Lernfeldkonzepts. In: Zeitschrift für Berufs- und Wirtschaftspädagogik, 98. Band, Heft 1 (2002), pp. 26-54

Clement, U. (2006): Curricula für die berufliche Bildung - Fächersystematik oder Situationsorientierung? In: Arnold, R.; Lipsmeier, A.: Handbuch der Berufsbildung, 2.

De Haan, Gerhard and Harenberg, Dorothee (1999): Bund-Länder-Kommission Heft 72: Bildung für eine nachhaltige Entwicklung. BLK, Bonn.

Frommberger, D. (2004): Zauberformel "Competence-based-approach"? ZBW Band 100, Heft 3, 2004. Stuttgart: Steiner, pp. 413-423

Hacker, Winfried (2005): Allgemeine Arbeitspsychologie. Huber, Bern.

Hacker, Winfried (2008): Knowledge Diagnosis. Rauner and Maclean: Handbook of Technical and vocational education and training research. Springer, pp. 761 – 766.

Huisinga, R. (2005a): Curriculumforschung. In: Rauner, F.: Handbuch Berufsbildungsforschung. Bielefeld: Bertelsmann, pp. 350-357.

Hahne, Klaus (2006): Kompetenzen und Berufe für erneuerbare Energien im Konzept einer Berufsbildung für nachhaltige Entwicklung. In: Lernen & Lehren, Elektrotechnik-Informatik, Metalltechnik, 81. Band, pp. 20-25.

Heinen, Simon and Frenz, Martin (2009): Beruflichkeit in der Energieberatung-Analyse curricularer Strukturen. Fenzl, Spöttl, Howe and Becker :Berufsarbeit von morgen in gewerblich-technischen Domänen. Bielefeld: Bertelsmann, pp. 370-375.

KMK (Kultusministerkonferenz): 2000, Handreichungen für die Erarbeitung von Rahmenlehrplänen der Kultusministerkonferenz.

Rauner, Felix (2008): Qualification and curriculum research. Rauner and Maclean: Handbook of Technical and vocational education and training research. Springer, pp. 364 – 371.

Reetz, Lothar and Seyd, Wolfgang (2006): Curriculare Strukturen beruflicher Bildung. In: Arnold, Rolf and Lipsmeier, Antonius: Handbuch Berufsbildung. VS. Wiesbaden.

Reinhold, Michael (2009): Experten-Workshops zur Validierung beruflicher Handlungsfelder. Fenzl, Spöttl, Howe and Becker :Berufsarbeit von morgen in gewerblich-technischen Domänen. Bielefeld: Bertelsmann, pp. 61-66.

Rychen, Dominique and Salganik Laura (2001): Defining and selecting key competencies. Göttingen: Hogrefe.

Spiegel, Thomas (2003): Prozessanalyse in Dienstleistungsunternehmen. Hierarchische Integration strategischer und operativer Methoden im Dienstleistungsmanagement. Wiesbaden.

Spöttl, Georg (2008): Expert skilled worker workshops. Rauner and Maclean: Handbook of Technical and vocational education and training research. Springer, pp. 756 – 761.

UNESCO (2010): Learning for the Future. [Internet: http://www.unesco.de/esd.html?&L=1, 01-09-2010].