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Connectivity or Complementarity in the Dual System

Implementation of an exploration study

ABSTRACT: The relationship between learning at school and in-company learning is essential to the understanding of apprenticeship, not only in the frame of the German dual system of vocational education. Around the year 2000 two theoretical approaches have been presented. Among those, the theory of connectivity has instigated a few studies, one of which is presented in the following contribution.

Keywords: School learning, learning on the job, connectivity, complementarity, dual system of vocational education

1 On the nature of the relationship between learning at school and workplace learning

Apprenticeship in Germany is known for its tradition of the dual system. Generally, duality of this core of the German system of vocational education is described by criteria of organisational or institutional provenance. It is constituted by both classroom teaching and work-place instruction, for instance it is frequently qualified by its alternating character (as particularly the French term “*apprentissage en alternance*” suggests). This description however, conceals a certain tentativeness on the very nature of the relation between school learning and workplace learning: A merely physical or topological change between vocational school and the enterprise surely does not suffice to comprehend the underlying idea of the dual system.

Quite on the contrary, a pedagogical, or didactical, approach to explain the complex relationship between theoretical teaching and learning on the one side and practical instruction and learning on the other is required. This relationship is in fact the key issue of a system of vocational education in dual structures. More or less by the end of the last century, new theories on this topic have been put forward. Among those, there is the theory of complementary *bildung* (JONGEBLOED (1998, 2004)). This very fundamental, but not very widespread theory explains the relationship by the essentially different character of learning in dual structures, that is, at school and at the workplace. JONGEBLOED argues, that these two types of learning cannot be connected anyway, and suggests therefore keeping them separate and developing each its unique advantages. Not entirely but to a large degree independently from this discourse in German countries, TONI GRIFFITHS and DAVID GUILLE drafted their connectivity theory. They describe different possible stages of connectedness

between school and workplace learning (for example 2001, 2003) and postulate the enhancement of the closest connectivity possible.

GRIFFITHS' and GULE's approach instigated a vivid discussion and new research on the nature of the relationship between the two didactical loci. We understand by 'didactical locus' (Lernort) a coherent context of learning and instruction of its own didactical character. Most frequently however, 'didactical locus' refers to learning and instruction in different organisational, geographical, or institutional contexts.

On all of these hypotheses, RALF TENBERG has repeatedly called for more empirical evidence (see for instance PITTICH/TENBERG (2013), p. 107). This desideratum was tackled in a first attempt within the frame of the European project ConVET (2012–2014), primarily with regard to the connectivity theory. The author of the present paper additionally dealt with complementarity theory in an explorative setting. The study has been carried out in two subsequent steps. Firstly, we carried out a qualitative documentary analysis of the legal foundations (within the frame of the governance of the Federal Republic of Germany) of the dual system of vocational education. Secondly, the system of categories developed in this first step was refined by analysing 26 interviews with apprentices, their teachers at vocational school (or, college), and their instructors at work. This more elaborated system of descriptors was the basis for a frequency analysis of the encoded texts. Because of the relative narrowness of the empirical basis it would be hazardous to speak of empirical proof on connectivity, however, the results make it possible to specify the hypotheses on the nature of relationship between school and workplace learning.

2 A closer look to the theories of connectivity and of complementarity

GRIFFITHS and GULE carried out their research on "the relationship between work experience, learning and knowledge" as expressed in their "concept of 'connectivity'". They define "work experience" as "use of the workplace in a way which supports learners in connecting different types of knowledge, skill and experience." ((2003), p. 56), extending their idea of connectivity and work experience to apprenticeship as well as to upper-secondary 'school-based' learning. They distinguish four types of practices "to come to terms with the world" (p. 59). The first, *practice of thinking*, must take into account different types of knowledge (empirical, narrative), guided by social practices and focussed on argumentation and dialogue. The second, *dialogic inquiry*, "plays a major part in enabling learners to collaborate effectively in activities of increasing social and technical complexity" by "the use of language to make sense of the world" (ibid.). The third, and in this context the possibly most noteworthy practice, is *boundary crossing*, which refers "to the idea that there is a zone of proximal development that facilitates learning in the workplace just as there is in classrooms" (p. 61), whereas the forth practice described is the *resituation* of knowledge and skill (ibid.). They describe different models of work experience, comparing two of them in particular – the "work process model of work experience" and the "connective model of work experience" (ibid., p. 62 and forthfollowing). According to GRIFFITHS and GULE, the first corresponds to the German approach, which, in their view, is supposed to neglect creativity and entrepreneurship. These are to be found in a model of connectivity. They underline the lack of encouragement of integration of knowledge in the context of the firm. In a connective model of work experience, these goals would

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be reached by the abstraction of actions and the work processes. In this sense, school learning and workplace learning get integrated based on a continuous metacognitive comparison of theory and practice, mediated by so-called “kernel concepts” (ibid.). Finally, Marja-Leena STENSTRÖM and Päivi TYNJÄLÄ have enriched in their edition of 2009 the theory of connectivity by differentiation of three levels of connectivity. Connectivity does not only occur at the micro level of the individuals, but also at a meso level of the institution and the macro level of the system.

The theory of complementarity of *bildung* is based on a strict difference between theory and practice, *bildung* (a term which confers to Shaftesbury’s famous idea of inward form) being one possible and a desirable result of the educational process. The notion of complementarity is defined as something different but necessarily belonging together (“notwendig Zusammengehöriges voneinander Verschiedenes”; MEYER-ABICH (1976), p. 933). This definition is not to be confounded with complementarity as a sum of two entities forming an entity. In accordance to this definition, there is no linkage between the learning of processes in reality and learning of theoretical content (JONGEBLOED (1998), (2004)). Although ‘theory’ has to give a true picture of ‘reality’, it still is clearly enough not identical to it. Nonetheless, apprenticeship is traditionally enacted in both these fundamentally different, even opposed modes of learning. The duality of the dual system of vocational education emerges from the exclusivity of both sides of their relation. Nevertheless, both are aiming at the same phenomenon, which is in this case *bildung* in the limits of a vocation, or a profession (see fig. 1).

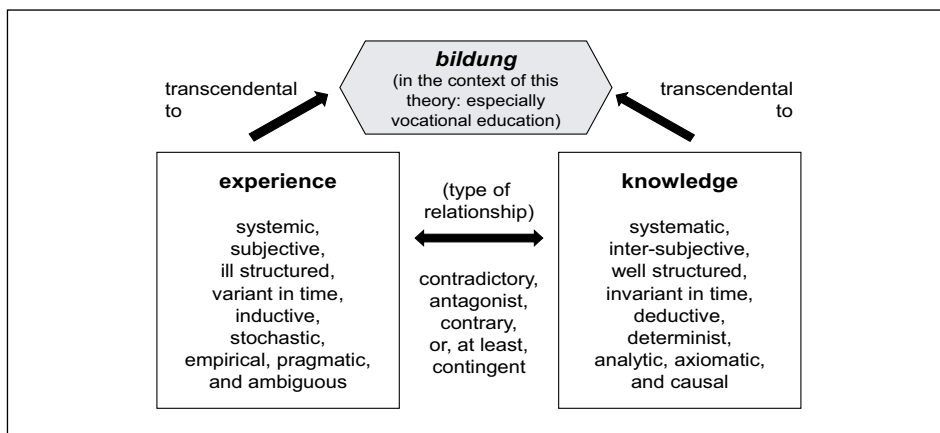


Fig. 1: Modell of complementarity of vocational *bildung*

Thus, complementarity is based on a common goal (vocational *bildung*), with two separate sources one of which would not suffice to reach the goal. This goal of vocational *bildung* is humanistic professionalism that allows to judge and to act in a competent and responsible way. It refers to the different epistemic quality the two didactical loci in vocational education, (1) systematically organised knowledge (school learning), and (2) systemically, or holistically, lived experiences (workplace learning). The acquisition of knowledge and experience occurs in a locally and timely separated way. Maybe the learning at school and at the workplace are not contradictory (in a sense that experience would override the lessons learnt at school, or, vice versa), but they are contrary the one to

the other, as learning happens in essentially different modes in both structures. Its transcendental conditions of being are professional knowledge on the one, work experience on the other side.

On the question of the separateness of the two modes of learning, two different hypotheses have been put forward over the course of time, a strong and weak one. JONGEBLOED (1998, 2004) proposed the strong hypothesis of complementarity, which explains the traditional success of the dual system of vocational education ((2004), p. 29). The realisation of professional *bildung* according to this hypothesis both modes of learning need to be immaculate, none of them can or should be mixed with elements of the other side. For example, sometimes there is classroom teaching within a company instead of workplace learning (despite there is no consistent curriculum). On the other side, sometimes simulation learning displaces the implementation a well-structured syllabus in college (although acting-as-if still is no acting for the lack of its effects in reality). Each didactical locus has its special advantages. Disregarding these qualities is ineffective, nothing to say about efficiency.

There is a less radical interpretation, or 'weak' hypothesis, as proposed by BANK (2016). This interpretation equally assumes the distinction of didactical loci, but it acknowledges the necessity of some kind of reference (or, connectivity) between learning at school and workplace learning. As the nature of theory is digital (and intersubjective), and the nature of experience is continuous (and bound to the individual), transition from one side to the other requires some kind of transfer learning. From this follows, that there can be a gradation of the differences between the systematic locus and the holistic and systemic character of reality. For there are suggestions to widen or close the transfer gap to a certain degree by didactical means, transfer from one didactical locus to the other, under certain conditions, can be encouraged. One condition of transfer learning is to memorise thoroughly content and skills (see for details and references BANK 2011, 2016).

3 Methodology

In the following, the design of our approach and its methodological background shall be introduced, discussed, and the selected design of research shall be presented.

3.1 Design of the two-tier empirical study

Large-scale field studies of positivist or critical-rational background certainly have the greatest reputation in empirical research. However, research on the relatedness of didactical loci is only at a starting point. Therefore and independently from one of the theories introduced above, it is at least difficult to design a questionnaire that meets all requirements of empirical research, particularly in respect to validity. Consequently, piloting studies are needed first.

In order to come to first findings, the relationship in question might be examined in the frame of a non-reactive study of legal texts in accordance to STENSTRÖM's triple-level connectivity model (2009). As a further approach, the persons involved in the dual system can be interviewed or be observed, if we are ready to accept the reactivity of inquiries. Any kind of research finally ought to end up with observations that are not limited to specific situations, or to a narrowly defined group of persons, but ought to aim at findings of general relevance. Gathering reliable information on the

relationship of the different forms of learning in the given frame would be desirable. The number of the observed or interviewed persons must be sufficiently large in all recognised professions to which a dual system apprenticeship gives access. It is obvious that the quest for validity goes together with an enormous need for funding. For these reasons, neither an experimental design nor a quasi-experimental design could be taken into consideration at this stage of research, ConVET being only a project of small resources.

Finally, a multi-step design of the study was selected, pushing back the large-scale parts to a future follow-up study and an immediate implementation of a two-tier pilot study. This study aims at the question, whether, and if yes, how the learning at school and at the workplace might be inter-related (or, connected). Is there a strong need for cooperation? Is cooperation, on the contrary, detrimental? What kind of connectivity can be described as a fact in the dual system? In the first step of the study, a picture of the factual regulations on interconnectedness of the institutions involved shall be drawn by the means of qualitative content analysis of curricula and other legal texts that give vocational education in the dual system an institutional frame. The documents were analysed for their contents, and categories of descriptions condensed. Because of the pilot character of the study, it was limited to very few examples of commercial vocations. In this study, the resulting set of categories was to be refined and adjusted in the second step of the research programme on the basis of a limited number of interviews. This time, the boundaries of the spectrum of professions was extended to a technical and medical domains. The result of an analysis is a set of qualitative 'categories' that gives access to frequency analyses.

3.2 Specification of method: Qualitative content analysis

In order to deal with the research questions, a method is required that would allow to identify hints on the existence and the nature of connectivity. This method is expected to refrain from subjective interference as much as possible, although any rating of qualities is inevitably related to prior knowledge and presuppositions. In the light of this special challenge to this kind of research, Philipp MAYRING has tried to make a proposal on how to proceed with analyses of texts (see for example (2010)). His aims at implementing a well controlled procedure in analysing fixed forms of communication. The range goes from written texts to transcriptions of spontaneous utterances. The researcher is expected to proceed in a systematic way, led by rules and linked to theory in his or her strive to identify specific aspects in the communication under examination (*ibid.*, p. 13). The procedure's starts with a hypothesis. From there, different 'categories' are to be identified in the analysed texts. The name of 'category' must be read with caution, for it is obviously neither a Kantian term nor a mathematical one, which would formally imply linear independence. We can formulate, reinforce, reformulate or reject these categories by running through several iterations of MAYRING's algorithm.

In doing so, we reach a multiply reduced form of the original text, which already is a reduction of perceived reality in itself. For instance, this is the case with interviews, for the interviewees will try to express their realities, as perceived by them, in a linguistically symbolized way. In addition to this, MAYRING suggests to carry on with an analysis of frequencies of statements, once the categories defined. The starting point of any research is qualitative. What is to be investigated needs

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to be named explicitly (ibid., p. 20). Next to this would be a quantitative analysis, followed by an interpretation of the results obtained (ibid., p. 21). On a technical level we need to mention that the analyses were carried out with the support of MaxQDA, a software that is also designed in accordance to MAYRING's approach.

4 First step: documentary analysis

In this chapter, the design and the results of the analysis of legal documents of the dual system will be presented separately. This part of the study can be found in a more detailed presentation in BANK/ASJOMA (2016), together with its results and all proof from the analysed sources and the data generated by the analysis.

4.1 Design of the documentary analysis

The analysis of documents was executed in 2013 based on documents from selected professions under the jurisdiction of the Federal Republic of Germany. As far as legal texts had to be analysed at the regional level of the federal member states, we focussed on sources from the Free State of Saxony. The legal sources were chosen from the professions of industrial manager and the then existing three professions of office clerks ('Industriekaufmann/-frau'; 'Bürokaufmann/-frau', 'Kaufmann/-frau für Bürokommunikation', 'Fachangestellte/r für Bürokommunikation'). Meanwhile these three have been merged ('Kaufmann/-frau für Büromanagement'). Despite of the expected merger, all the four professions play an important role in office professions. The only question this might rise, is a lack of timeliness of the content of the legal sources, which last had been revised in 1991/92 (office clerks) and 2002 (industry managers). After all, this is only a pilot study, which aims mainly at exploration of the specific field of research.

The legal sources follow the commonly known principles: Any apprenticeship in a recognised profession is controlled on the enterprise side by executive orders of nationwide relevance ('Ausbildungsordnung' (AO) in short). This comprises the frame plans and the individual plans of apprenticeship for each profession. This kind of plans is mirrored at the side of the school. There are nationwide frame curricula, which are developed by the standing conference of school ministries of all 16 member states ('Kultusministerkonferenz' (KMK)). At the level of the member states, the frame curricula are transformed into curricula, which are further specified at the level of a school or even the individual teacher by plans of content distribution ('Stoffverteilungspläne'). The content analysis refers to the four AO and frame curricula, supplemented by the curricula of Saxony. Because of the more or less individual character of individual plans of apprenticeship and plans of content distribution, this kind of texts was excluded from our analysis.

At the centre of the documentary analysis stands the search for hints at the other didactical locus in the legal texts, either governing only one side or both of them. In analysing, we did not differentiate between further didactically learning environments, such as classroom learning, laboratory learning, or learning arrangements (office simulations etc.). The starting point of the analysis consisted in gaining an overview on the material (first in only one of the professions), and in

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making some preliminary definitions of categories, which turned out to be 'only at school', 'only at the company' and 'at school and at the company'. After loading up the documents to the analysis support software the contents were divided into different units and were encoded, along the three years of apprenticeship. The software helped to create spreadsheets of the data for further investigation (see for these tables BANK/ASJOMA (2016); appendix).

These activities were extended in the following iteration to the other professions after a critical revision of the spreadsheets. In order to compare the content of the three selected documents by profession, the data were encoded by year of apprenticeship and the pagination of the original document. Next to this, the spreadsheets were analysed even more thoroughly once more. This iteration of content analysis contained an attempt of pairing content from the AO with corresponding content from the KMK-frame curricula and from the Saxon curricula. As a result, it became obvious, which content was dealt with in the context of the school, of the enterprise or in both of them. During the following iteration, the deductively defined main categories could be specified by categories of a lower level. A last step included an evaluation and an interpretation of the material in respect to any kind of connection between the documents, and the possible nature of these connections. This was completed by a frequency analysis of the categories.

Because of the legal character of the documents, the steps of paraphrase, generalisation and reduction as postulated by MAYRING (2010, p. 70) could be skipped largely. All documents are written in the clear, concise and neutral language of administration. There simply were no repetitions of the same content, which mostly eliminated the need for reduction. Only a reformulation of the results, occasionally a reduction, or generalisation at different levels of abstraction, proved to be necessary. Furthermore, given the linguistic quality of the texts – stability and unambiguousness in content description – the study was done without validation through communication and without triangulation.

This analysis appears to be the first of its kind, so there was no comparable publication for validation. Instead, there is a comprehensive documentation to this first part of the study accessible (see appendix to BANK/ASJOMA 2016), so that these analyses can be followed in detail and can be repeated at any time.

4.2 Results of the documentary analysis

After the finishing of the analysis of the entire set of data, the categories were put in a structurally reasonable order as indicated by aspects of organisation, content and didactical method. This sub-structure, however, could not be applied to the main category 'concerning workplace learning' (see in detail tab. 1).

The interpretation of the resulting categories focusses on answering the research questions on the nature of connections that have been identified in the documents at different organisational levels. Furthermore, there are text passages in the documents, which describe tasks, differing between school and workplace learning. Some topics were repeated in several tables of analysis, which is an inevitable but minor difficulty (for the following outcomes of the study see *ibid.*).

Although, at first sight, there were apparently hardly any connections directly described in the documents, quite a number of connections could be identified throughout the following iterations.

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Tab. 1: Classification of categories based on documentary analysis

Categories concerning school learning		
<i>Aspects of Content</i>	1	Theoretical basics
	2	Theory in reference to the enterprise
	3	Systematisation
	4	General education
<i>Aspects of organisation</i>	5	Compulsory quantity of lessons taught
	6	Evaluation of performance
<i>Aspects of didactical method</i>	7	Project method
Categories concerning workplace learning		
	8	Knowledge and skills within the company
	9	Specialisation
Categories concerning both to learning at school and in the enterprise		
<i>Aspects of organisation</i>	10	Co-ordination of the legal framework
	11	Record books
	12	Examinations
<i>Aspects of content</i>	13	Identity of content
<i>Aspects of didactical methods</i>	14	Lifelong learning
	15	Preparation to future professional activity
	16	Continuity
	17	From simple to complex
	18	Action orientation

It became obvious, that there is a consensus of all stakeholders before even composing the legal texts on content and procedural aspects of apprenticeship, which is echoed throughout all the documents studied. The apprentices are obliged to keep their record books as a proof on what they have learnt both at the workplace and at school (although they are only compulsory by the regulations of AO). In this sense, the record book is a very important element of connectivity between the didactical loci.

At the end of the apprenticeship, apprentices are examined under control of the chambers of commerce and industry (IHK). The category 'examinations' was subsumed under 'aspects of organisation', because the legal documents did not express precisely which was their didactically connective content. The subjects, the length and contents of examination are defined at a national level in every AO. However, the contents of what has been learnt at school are not mentioned, unless of special importance. On the other hand, no hints on exams are to be found in the curricula. The relationship between school and workplace learning only finds some kind of reinforcement by the recommendation to include the marks obtained at school to the final report issued by the chambers. This, however, only occurs on application by the apprentice, and for this is hardly known, it is not common.

The vast majority of connections can be accounted for in the category of content, both in the sources from the side of the school and from the side of the enterprises. 'Identity of content' systematised this categorically. In these parts of the analysed texts, connectivity between the contents endorse conformities which vary from 55 % to 84 % depending on the different professions. The particularly high degree in the profession of industry managers can be explained by a rather vague formulation of the texts of regulation. While the frame curricula of the office clerks show a description in smaller elements (which are enriched by recommendations of didactical methods in the curricula in Saxony), this does not find its counterpart in the frame curricula of the industry managers, which are action oriented. In each case, despite the strong connectivity in content, there are differences in the timely dimension, in didactical methodology, and in structuration or systematisation. In particular, the timely order remains relatively open within the frame of the year of apprenticeship. In reality, equal content at school and in the workplace can manifest time lags of several months.

Consequently, it is left to the apprentices themselves to overcome this time lag in developing the necessary connections by him- or herself. A helpful feature might be contextualisation and systematisation that are foreseen in some text passages on the side of professional school. The relatively small share of theoretical content concerning the enterprise in the profession of industry managers might be a result of the action-oriented structure of the frame curriculum. The teachers are obliged right away in the preamble to educate towards 'professionality'; maybe the authors of the curriculum considered this a sufficient hint.

The objectives of both professional school and enterprises are focussed on the later professional activity of the students/apprentices. While the enterprise has a preference in educating their apprentices to become a future employee, within the options and restrictions of its practical functioning, professional schools are bound to ensure the employability of the students in a universal labour market. The apprentices need to be prepared that they might not be employed by their enterprise after the end of the apprenticeship. Therefore, it is important to teach at school learning content that is not directly connected to the present enterprise. Finally, in all frame curricula a perspective on further professional education is mentioned besides the education to professionalism.

The connections can be attributed to three levels: The first level is the easiest to define. It is the organisational level. At this level AO and frame curriculum are formulated to coordinate the two didactical loci. The curricula of the member states are in a way a specification or reproduction of the frame curricula, so they are at least indirectly coordinated with the AO. The record books together with the intermediate and final examinations are further elements in this context.

The second level is the most extensive one. This is the level of content. A variety of connections between the curricula and the AO could be discovered. Despite the coordinated enactment of these legal documents there is nothing like a hundred percent connectivity. While the AO and the frame curricula both are marked by differences in content and timely order, differences between AO and the Saxon curriculum are founded in the order of topics and the duration of the different contents.

Third is the level of didactical method. At this level, all the documents called for personal professionalism and openness to the future as educational objectives. Putting across action-oriented, self-guided knowledge and practical proficiency is underlined. At both of the didactical loci all content is treated in a continuum, beginning with the simple and proceeding to the complex tasks. This

does not mean automatically, that any convergent or connective didactical method at school and at the workplace was to be found.

These connections given, all the protagonists at school and at the workplace have different tasks to fulfil, according to the documents. Among the preeminent tasks of the professional school there are the strengthening of general education, teaching of relevant professional content but also general techniques of learning and working in a changing environment. The capacity of an independent retrieval and cross-linking of knowledge, together with capacity of judgement and legitimisation must be developed. The focus on processes is tighter.

Confrontation with working tasks is among the preeminent tasks of the enterprise. Their relevance can be both specific to the enterprise but of general relevance, too. It is important that the apprentices learn to take their responsibilities, cooperating in teams, solving conflicts, being both punctual and flexible.

5 Second step: Analysis of interviews

Along the pattern of the last chapter, the design and the results of this part of the study will be presented separately again. For a more detailed presentation of this part of the study, see BANK/GLASS (2017).

5.1 Implementation and analysis of the der interviews

The part of the qualitative content analysis of 26 interviews was carried out in southwest Saxony (Chemnitz und Zwickau). This part of the analysis aims at further specification and deeper insight into the relationship between school and workplace learning. Documents are setting up norms, which do not necessarily entirely become practice (in organisation theory this is expressed by the opposition between “espoused theory” / “theory-in-use”; ARGYRIS/SCHÖN 1978, p. 15).

It was already in February 2012 that we had interviewed apprentices, their teachers at professional school, and their instructors the enterprises. The interviewees were distributed as follows along the selected professions: industry managers (4 apprentices / 2 teachers / 1 instructor), car mechatronics (6/2/2), and nurses (5/2/2). The questions included their observations, their appreciation and evaluation of the learning at school and the workplace. The audiotaped communications were transcribed in a simplified way (e.g. standard language / no dialectal variants, no phatic utterances). Other to the documentary study, which was expressly limited to commercial professions this study was extended to other professional fields, in order to reinforce the explorative character of this study to a generalised view on the issue of connectivity.

The interviews were executed on a set of questions that was agreed upon within the ad-hoc working group as mentioned above. The research interest was fixed in a paper we will refer to as “the protocol of Constance”. The questions have been specified in a guideline for the use by different interviewers, who were less acquainted with the research interest put forward in Constance. Some explanations were added, too (see the protocol of Constance and the questionnaire in BANK/GLASS 2017, appendix).

5.2 Results of the analysis of the interviews

The results of the second run of the content analysis of the documents are put down in the following system of categories (see tab. 2). It is subdivided into four main categories ('concerning school learning', 'concerning workplace learning', 'concerning the apprentice-student', 'concerning school and enterprise'). "Concerning the apprentice" describes the tasks to be fulfilled by the learning person only. According to this, it is a category that had to be introduced newly for it does not appear in the documents, which are addressed to teachers (curricula) or instructors (AO). They do not speak to the learner in the role of a student or apprentice.

Tab. 2: Classification of categories based on documentary analysis and interviews (2nd run)

Categories concerning school learning		Categories concerning apprentices/students	
1	Theoretical basics	14	Acquisition of knowledge
2	Contextualisation	15	Construction of connections
3	Systematisation	16	Time lag
4	General education	17	Knowledge helps with lack of experience
5	Evaluation of performance	18	Experience helps with lack of knowledge
6	Relevance to practice	Categories concerning school and enterprise	
7	Ways of teaching	19	Coordination of legal framework
8	Professionalism	20	Record books
		21	Identity of content
Categories concerning workplace learning		22	Lifelong learning
9	Knowledge and abilities within the company	23	Preparation to future professional activity
10	Specialisation	24	Continuity
11	Goals of the enterprise	25	Increasing degree of difficulty
12	Esteem towards apprentice	26	Action orientation
13	Interest in professional school	27	Perceived connection
		28	Co-operation
		29	Supervision (quality/ quantity)
		30	Divergent learning content

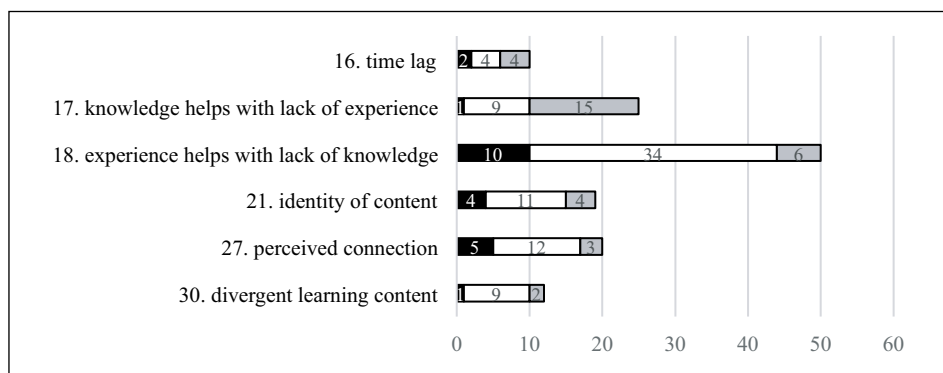
In this paper, we will abstain from explaining the subcategories except for those from this new category (see chapter 4.2 and BANK/ASJOMA (2016) instead). In this one, we find phenomena limited to the control of the apprentice; this is, among others 'acquisition of knowledge', and the 'construction of connections' between the didactical loci, but also bridging the 'time lags' that occur systematically, as the document analysis has shown. We also recorded enunciations of phenomena, that knowledge can be regarded helpful in case of lack of experience, as well as experience can help with shortcomings in knowledge.

The interpretation of the different categories shall follow the leading questions, namely where and in which form connections are indicated. Further more, they look at the tasks the interviewees

attribute to themselves and to the relevant others. The following interpretation will be subdivided into three subsections, each accompanied by a diagram presenting the outcomes of the frequency analyses by category and actors.

5.2.1 Connections between school and workplace learning

Most of the statements on connections between the didactical loci have been made by the apprentices themselves (see the categories of this type in fig. 2). This might indicate that the apprentices construct the connection of the learning content in the first line, if not exclusively.



Legend: Teachers (black), apprentices (white); instructors (grey); frequencies of statements

Fig. 2: Frequencies of connecting categories

In particular, this is the case with category 27 ('perceived connection'). Twelve out of twenty encoded segments of this category have been made by apprentices. Closely connected to this is a time lag, which has been commented by all participating groups. No less than 75 statements of the interviewees show, that this is a daily task of the apprentices: They purposefully construct connections between their acting at the workplace and the learning content at school. They equally make use of their experience as a backdrop for learning at school. All in all the interviewees would consider it reasonable to deal with theory at school first before being trained on the job. They concede, however, the difficulty of its realisation. The more, they blame the theoretical part at school being insufficiently up-to-date, as has been reported in 19 statements.

5.2.2 Tasks for the protagonists of professional education

In the frame of the dual system, the protagonists have to take different roles. This finds an expression in different tasks, attributed by the interview partners to themselves or to the interacting persons (see the frequency analyses in fig. 3).

Passing over knowledge is the top priority task of teachers. The interviewees seem to agree that theoretical basics for professional education is the task of the school (58 hits). Equally, tasks of gen-



Legend: Apprentices (black); teachers (white), instructors (grey); frequencies of statements

Fig. 3: Frequency of task categories (skills)

eral education are attributed to school learning (German language, P.E., political education). It is also the task of a teacher to evaluate the students' performances. Finally, schools have to contribute to the professionalism of the students, as proposed by both apprentices and teachers. Professionalism in this sense is to be read as an individual perspective on the own profession. Apprentices are expected to develop a holistic view on their profession, which entails the teaching of content, which is by its nature not connected to the very often much more specific processes at the workplace. It is well understood, that this shall enable the future industrial managers, bachelors or nurses to be able to flexibly change their employment.

At the company side, all groups of interview partners agree, that the main task of workplace learning is to acquire the necessary abilities to act professionally in an enterprise. This includes a specialisation at the workplace, in acknowledgment of the interest of the enterprise to engage

specialised staff in the future. Occasionally, we observed, that the category ‘goals of the enterprise’ can be in conflict with the goals of the apprenticeship, especially when the instructors are too much under pressure in their productive tasks. Therefore, they do not invest sufficient time in the apprentices (which only one of the instructors openly regrets).

The communal tasks of school and company are namely ‘preparation to future professional activity’ and in enabling ‘lifelong learning’. Besides the development of judgement, ability of acting, both didactical loci are to work on the apprentices’ readiness to react and stand for values, and be socially competent. Both institutions carry out sanctions concerning punctuality, reliability, and ability to work as part of a team.

The preeminent task of the apprentices is ‘acquisition of knowledge’, as both apprentices and teachers point out (there was no hit to this category at the instructors’ side, though). Not only basic knowledge is to be acquired but also the capacity of transfer learning. New knowledge must be embedded into prior knowledge structures, and both must be transferred into varying practical contexts. A second task of importance, if not a crucial one, is the ‘construction of connections’; this was encoded no lesser than 61 times. Whereas it is a task only to be fulfilled by the apprentice, both teachers and instructors can give support, what, in practice they often only do, when asked for by the apprentice, but not by their own initiative.

5.2.3 *Support to connectivity*

Particularly these last observations lead to the interpretation of categories, which describe different forms of support to connectivity. We find these categories at both didactical loci. There is an apparent reference to the bidirectional transfer in the sense of Tenberg et al. 2012; their frequencies in the interviews can be read from fig. 4.

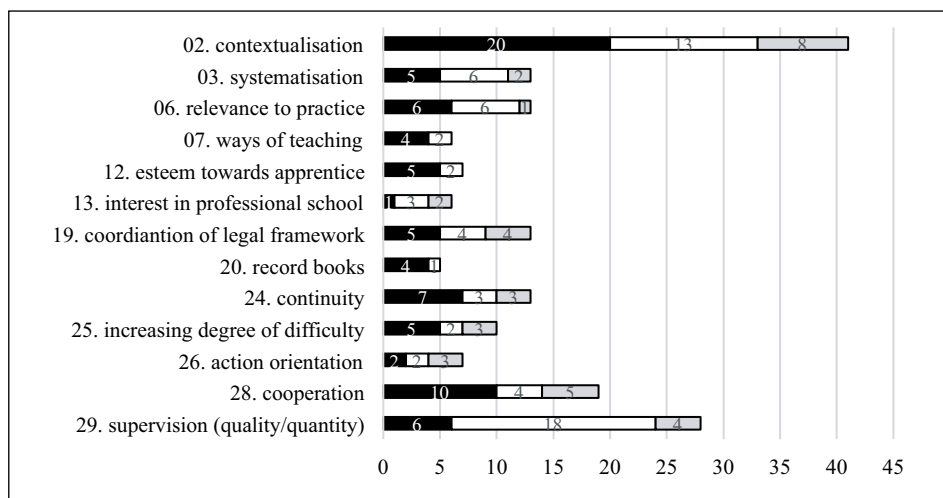
According to the statements of teachers and students, a diversified teaching can enhance the connective learning. Students are more interested, whenever the particular ‘practical relevance’ of the learning content is sufficiently clear and disambiguated. An important feature of teaching is a transparent system of contents, just as teaching with examples drawn from in-company practice improves ‘contextualisation’ (41 statements). The examples strengthen the imagination of students, and they have the feeling to integrate the school knowledge more quickly to their work in the enterprise. Any statement on support from the side of school learning derives from students or teachers, none from the instructors, who possibly have only little idea on or little interest in the didactical processes at their partner institutions in the dual system.

Nevertheless, there is support to connectivity from the side of workplace learning, too. A strong factor seems to be sufficient ‘esteem of the apprentice’. A lack of esteem finds an expression in making use of the apprentices as mere labour force, apprentices who consider to get the esteem they deserve, are not automatically charged with the jobs as required by imperatives of the market. In this last case, time lags or other factors become a question of good luck. A high esteem also finds an expression in intensive supervision; this appears to encourage apprentices to find connective elements, as judged by themselves (there are no entries to this category from the instructors). As a counterpart to ‘contextualisation’ at school, we find positive statements on the connective effect of ‘reference to theory’. Whenever the instructor asks the apprentice about his or her knowledge learnt

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Legend: Teachers (black), apprentices (white); instructors (grey); frequencies of statements

Fig. 4: Frequency of categories of support to connectivity

earlier at school, before introducing a new job at the workplace, and a reference to this is made successfully, this may lead to the discovery of a connective relation between school and workplace learning.

There are seemingly some options for strategies of the enhancement of connectivity both at school and at the workplace. Already in the first step of this study, the 'record book' has been revealed as an important didactical feature. Diligently applied, it is a simple but effective tool to keep all protagonists informed. Admittedly, this was mentioned only five times.

Both teachers and instructors make use of the didactical principle of 'increasing difficulty' or complexity in the learning tasks and try to ensure the 'continuity' so that the student-apprentices are involved in a topic or assignment for a longer period. This aims at the better understanding of interconnections. It helps the student-apprentices to stepwise build up their abilities by integrating the knowledge newly learnt into already existing structures along with the positive motivational effect of a series of little successes. These two categories are mentioned 23 times each, which allows the conclusion, that these methods are already rather common.

To a much lesser degree, the 'action orientation' is mentioned as a support structure to transfer learning (7 statements). Although the approach was designed to give exactly this support, it plays an inferior role for connectivity, at least in the 26 interviews of this piloting study. Contrarily, the category of 'supervision (quality/quantity)' gets frequent hits (28). The time invested by teachers and instructors, but also skilful teaching and instruction are fundamental to the success of an apprenticeship. A relaxed way of interaction is also helpful; it encourages the learner to fearlessly ask questions whenever he or she feels the need for that. A number of statements by apprentices underline that their instructors are too short of time to explain the background of the job they are about to learn. This deficit is left to be compensated at school.

Personal 'cooperation' is an important aspect. To be sure, 14 out of 18 cases were mentioned by teachers and instructors. In both groups, there is a feeling of a need of reinforcement of cooperation

and a wish of coordinated contents to be dealt with at school and at the workplace. However, in most cases they blame respectively the other side not to sufficiently cooperate and to evade the communication they would consider necessary.

Finally, in 13 statements a need for coordination of content at a macro-level was mentioned: the 'coordination' by the legal framework. This task is carried out within the frame of the so-called 'Gemeinsames Ergebnisprotokoll' by the Standing Conference of Ministries of School (КМК (1972) – Common Protocol of Agreements). In this notably high number of statements, the purpose of coordination is well understood and highly appreciated. One single instructor disturbs this observation: He or she did not know anything about the legal framework, including the AO relevant to the instructor's acting in the workplace part of learning.

6 Summary, possible implications, and further research

This paper is a report of the results of a two-tier study on the manifestations of connectivity between the learning at school and the learning at the workplace in the frame of the dual system of vocational education. In a first step, a documentary content analysis investigates the phenomenon of connectivity. This analysis produced three main and a broad number of subcategories. Because of the legal character of the texts, the persons of special interest, the students and apprentices, did not appear on the screen as expected. In a second step, by the means of content analyses based on interviews of the protagonists of professional education, the results could substantially be supplemented, the original categories of document analysis be refined, and a further category be added.

The analysis of the documents reveals a variety of connections between the two didactical loci. These connections consist primarily in identical content, which is reached by the elementary regulative effect of the 'Gemeinsames Ergebnisprotokoll'. All protagonists are more or less aware of the connections existing between school and workplace. However, they regret the frequent time lags, while they accept the organisational difficulty in avoiding them.

Concrete statements on the connecting points were due to the interviews with student-apprentices. Certainly, teachers and instructors can observe what is happening on the other side of the system, but only the learning persons can construct, or discover each connection of singular character. For this reason, their main task consists in discovery of connections – besides learning at every didactical locus separately. The other protagonists only can encourage this effort.

As this often only happens on the initiative of the learner, this to offer some potential for improvement. In a more active way, the teachers would be reinforcing connectivity by contextualisation, or exemplification of the theory they are dealing with, whereas the instructors could have their share by reference to theory, for example by regularly inquiring for references from content learnt at school. Nonetheless, these strategies, according to the interviews, are regular practice in dual vocational education, the 'contextualisation' approach being more popular by teachers than the approach of 'theoretical reference' by instructors. Both approaches can be improved by mutual interest in the processes of learning initiated by the respective other didactical locus. GRIFFITHS and GULE, too, state that they might "help students to connect formal and informal learning more explicitly. They do not, however, provide any explicit guidance on how to achieve that objective, other than suggesting that students need to be coached to 'reflect-on' and 'reflect-in' action" (2001,

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p. 125). Nevertheless, the statements of the interview partners seem to consider a closer cooperation dispensable. All protagonists, in particular the apprentices, actively deal with the problem of learning in separate structures, i. e. systematic and systemic structures, allocated in different institutions. If the authors ((2003), p. 59) define “the term connectivity ... the purpose of that pedagogic approach which educators would adopt in order to take explicit account of the relationship between theoretical and everyday knowledge in their attempt to mediate the different demands arising in the contexts of education and work”, the analysis of the interviews indicates that this already happens. There is, however, plenty of space for improvement.

The results in total seemingly to not confirm the strong hypothesis of the theory of complementarity of vocational bildung as a theory-in-use (in the sense of interdiction of cooperation). Nevertheless, there are many indications for the validity of the weak hypothesis of complementarity of bildung is (fiat of didactical support or preparation of learning transfer to the other dual partner, see BANK (2011)). The concept of connectivity, as put forward by GRIFFITHS and GUILÉ in a number of publications, shows a lot of parallels to this variant of the theory of connectivity; this at least in the two higher categories of connectivity. All in all, complementarity theory and connectivity theory do not fundamentally contradict each other. There are nonetheless differences. Where the authors postulate to “to overcome the dualism between theory and practice” ((2003), p. 68), complementarity theory denies any possibility of ‘overcoming’ the duality – if it is not even a simple question of definition, for theory remains theory because it is no reality, and practice remains practice because there is no symbolic representation. In a practical sense, the weak hypothesis of complementarity theory is quite close to connectivity theory. The central point is its postulate of an individual bridging the gap by transfer learning, which is explicitly excluded by GRIFFITHS and GUILÉ ((2003) p. 61): “The emphasis on resituation reflects our concern that the metaphor of transfer is inadequate ...”

The aim of this study was to find ‘approaches to be developed for the future of the included education systems’ (“zukunftsfähige Ansätze für die einbezogenen Bildungssysteme zu entwickeln”; see TENBERG et al. (2012), p. 8.). Nobody will expect this goal to be reached by a simple documentary analysis and a qualitative piloting study. Nonetheless, a number of opportunities for improvement of vocational education efforts could be identified. Efforts of strengthening the connectivity between systematic learning at the didactical locus of knowledge (school) and systemic making of experiences (workplace or company) in the frame of the dual system appear to be possible, as both of the analysis of documents and the analysis of the interviews suggest. The important role of the coordination by plans for connectivity at the system level of the national state (AO and frame curricula) has been presented in detail. Whereas the relations at the institutional level generally appear to have a rather weak connectedness, manifold phenomena of connectivity occur at the practical level of didactics. In the end, it appears to be a question of the capacities of the person learning, if connectivity of learning is realised.

Before the results of this two-tier approach can be turned into recommendations, the empirical basis must substantially be extended. It would firstly require a repetition of this pilot in all professions. At least, a significant selection of the most important professions or vocations needs to be examined. The number of rates must be enlarged, and the qualitative studies must be controlled for different ratings in regard of rating reliability. Secondly, a large-scale and nationwide study is needed, which is mainly quantitative. This would imply the need for a valid and reliable questionnaire.

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On this basis, it finally might become possible, to compute for the explaining variables throughout different existing forms of connectivity and their efficiency.

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