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Title   **Dual Study Programmes as a Design Challenge: Identifying Areas for Improvement as a Starting Point for Interventions**

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Abstract   The proportion of freshmen enrolled in dual study programmes has steadily increased in recent years. From the perspective of potential students, these programmes are highly attractive because they combine types of learning that used to be largely separate at an institutional level: vocational and academic learning. In training-integrated dual study programmes, different institutional contexts, governance regimes, teaching styles and learning environments make bridging these two worlds of learning a challenge for both educators and learners. However, these programmes allow leeway for didactic innovation, through the cooperation of different types of educational institutions and new ways of using available didactic methods. Potentially, a new relationship between higher education (HE) and vocational education and training (VET) can be established. This paper positions training-integrated dual study programmes as an object of design-based research (DBR). By developing and using an extended model for the pedagogic development of higher education institutions (HEIs), "pädagogische Hochschulentwicklung" (Brahm, Jenert, & Euler, 2016a, p. 19; Euler, 2013, p. 360), the paper systematically identifies generic educational problems in these hybrids. Based on a literature review, this paper classifies and explains the design challenges at the level of the learning environment, the study programme and the

organisation. The challenges revolve mainly around the cooperation and integration of HE and VET. The paper concludes with an outlook on future DBR projects designing dual studies.

Dual Study Programmes as a Design Challenge: Identifying Areas for Improvement as a Starting Point for Interventions

Lisa Mordhorst, Bernd Gössling

1.0 Introduction: Dual Study Programmes as a Design Challenge

The relationship between vocational and higher education (HE) in Germany is currently being redefined (Elsholz, 2015, p. 256; Euler, 2017b, p. 58; Hemkes, Wilbers, & Heister, 2019; Wolter & Kerst, 2015). While these systems used to be kept strictly separate (Baethge, 2006; Baethge & Wolter, 2015, pp. 100-101), intersections and permeability between the two are gaining importance in the context of "massification" (Wolter & Kerst, 2015, p. 514). Dual study programmes are often recognised as part of this shift (Euler, 2017b, p. 42; Faßhauer & Severing, 2016b, p. 9; Graf, 2012, p. 49, 2018, p. 189; Kamm, Lenz, & Spexard, 2016; Krone, 2015b, p. 81) due to their position at the nexus of vocational education and training (VET) and HE (Graf, 2018, p. 189). First established in the 1970s at the vocational academy Baden-Württemberg (Graf, 2018, p. 193; Wolter, 2016, p. 39), dual study programmes are becoming increasingly popular among students (Mordhorst & Nickel, 2019, p. 12).

Training-integrated dual study programmes (*ausbildungs-integrierende Studiengänge*) are one type of dual study programme that integrates initial VET into an academic bachelor study programme (Wissenschaftsrat [WR], 2013, pp. 7-9), and thus has the potential to systematically link HE and VET. We focus on these programmes in this paper, as we are specifically interested in learning about their capability. The main structural differences of these systems are the formal high relevance of practice in VET and the academic learning in HE, often described as being hard to combine (Weiß, 2016, p. 33; WR, 2013, p. 29). Dovetailing HE and VET, however, could foster innovation in learning, address new groups of learners and overcome the segmentation of HE and VET.

A core research gap are didactic concepts for dual study programmes (Faßhauer & Severing, 2016a, p. 12; Kreutz & Meyer, 2015, p. 233; Meyer, 2019, p. 433). According to the German national education report, the characteristics by which study programmes oriented towards a vocation would qualify as academic and the way in which they can be adequately realised both remain unclear (Autorengruppe Bildungsberichterstattung [AGBB], 2016, p. 142). Further, there is a lack of applied research accompanying dual study programmes (Weiß, 2016, p. 36).

There is a need for didactic research on dual study programmes: the literature identifies challenges to the integration of vocational and academic learning (Holtkamp, 1996, p. 7; Krone, 2015b, p. 65, 2019, p. 462; Kupfer, Köhlmann-Eckel, & Kolter, 2014, p. 19-22; 41; Langfeldt, 2018, pp. 6-7; Meyer-Guckel, Nickel, Püttmann, & Schröder-Kralemann, 2015, p. 22). Findings show that it is often up to the students to link academic and vocational learning (Krone, 2015b, p. 65, 2019, p. 471; Kupfer et al., 2014, pp. 28-29). However, a lack of coordination between the actors involved can cause unnecessarily high requirements for students and thus lead to a narrower selectivity of students (Faßhauer & Severing, 2016a, p. 15). Students have to be able to translate between the different systems on their own and they are likely to face a higher workload than necessary. A missing integration of academic and vocational learning is particularly problematic because linking VET and HE is one of the main characteristics of dual studies (WR, 2013).

Addressing this problem is a challenge of a theoretic and practical nature. Design-based research (DBR) is a fitting methodology to address this kind of challenge because it targets at developing theory-informed solutions for practical educational problems (Design-Based Research Collective [DBRC], 2003, p. 5; Sloane, 2017, p. 17) and aims at "the innovatively discovering and developing that which is possible" (Euler, 2014, p. 16). Proposing a DBR approach in which the process is initiated from a science perspective, this paper addresses the following research question at the beginning of the DBR cycle: *What are the design challenges for training-integrated dual study programmes at universities and universities of applied sciences (UAS)?* To answer the question, this paper presents the following:

- The institutional configurations of dual studies in Germany and broad normative criteria of what constitutes a good dual study programme (Section 2)

- The methodological approach including a definition of design (Section 3.1)

- A theoretic framework for developing the programmes (Section 3.2)

- A classification of generic design challenges using the theoretic framework and a literature review (Sections 4.1 to 4.3)

- A summary of the design challenges (Section 4.4)

- A concluding outlook on future DBR projects designing dual studies (Section 5)

2.0 Identifying the Institutional Set-up of Dual Study Programmes in the German Education System

To understand the design challenges of dual study programmes, it is necessary to consider how they are set up institutionally. As the particularities of dual studies in Germany are grounded in the structural nexus of HE and VET[1], in Section 2.1, we present a brief explanation of the German system of initial VET, the HE system and their relationship. In Section 2.2, we offer a definition of these hybrids and normative criteria of what constitutes a good dual study programme.

2.1 Introducing Higher and Initial Vocational Education in Germany

Traditionally, VET and general education, encompassing HE, are separated in Germany (Baethge, 2006; Baethge & Wolter, 2015, pp. 100-101). VET and HE have "different financing structures, governance regimes and regulation procedures concerning function and influence of the state, market mechanisms or collective stakeholders, such as social partners" (Baethge & Wolter, 2015, p. 100). This segmentation is called the German *educational schism* ("Bildungs-Schisma"; Baethge, 2006, p. 16). It hampers educational mobility (Baethge, 2006, p. 18) and thus social mobility (Busemeyer, 2015, p. 145).

2.1.1 Higher education in Germany

Together with continuing VET (Gerholz & Gössling, 2016, p. 8), HE is the main pillar of post-secondary education in Germany. The HE system is predominantly a binary system comprising universities and UAS (Hüther & Krücken, 2018, ix; Kehm, 2018, pp. 1-2).

The unity and academic freedom of teaching and research and the principle of self-administration are the main characteristics of the university system (Deißinger, 2000, p. 607; Kehm, 2018, p. 1; see also Grundgesetz für die Bundesrepublik Deutschland, 1949). Clark (1983, p. 140) once described the German HE system as a "bureaucratic oligarchy". Since the mid-1990s, the system has been undergoing significant changes, especially with the introduction of new public management (de Boer, Enders, & Schimank, 2007, p. 146; Hüther & Krücken, 2016, pp. 58-61). Ministries passed responsibility to HEIs, granting the latter more autonomy (de Boer et al., 2007, p. 146; Kehm, 2018, p. 2; Krücken, Blümel, & Kloke, 2009, p. 14), e.g. HEIs maintain their own study programmes.

The federal states are responsible for the legal regulation and basic funding of HE, and the federal government plays only a minor role in relation to legal regulation and funding (Hüther & Krücken, 2018, xi). HE is public, and mainly publicly funded (Kehm, 2018, p. 1). However, the number of private HEIs, especially private UAS, is growing (Wolter, 2017, p. 105) and the number of dual students at private HEIs is

relatively high. In 2017, more than a third of all dual students studied at private HEIs (Mordhorst & Nickel, 2019, p. 16).

2.1.2 Initial vocational education and training in Germany

There are different types of initial VET at the secondary level. Dual vocational training forms the institutional core of the initial VET system (Graf, 2017, p. 95; Sloane, 2014, p. 401; Wolter, 2017, p. 100). The relevance of dual VET is one reason for this paper's focus on those dual study programmes that integrate dual VET. Another important reason is that in the vocational professions, the initial VET is always dual for the most common subjects of dual study programmes, which are engineering and economics (Hofmann & König, 2017, p. 13).

The German dual VET consists of training at a company's workplace while learning is carried out at a vocational school (Sloane, 2014, p. 399). Sometimes, learning also takes place at inter-company vocational training centres (*Überbetriebliche Berufsbildungsstätten*) which form part of in-company training and cover those areas of the regulated profession where companies lack capacity, for instance, because of their size or their specialisation (Autsch, 1999).

By constitution, schools are regulated by the federal states, while company-based education and training–as part of dual VET–are regulated by the federal government (Sloane, 2014, p. 402).

Three underlying concepts–relevant for the analyses of design challenges presented in Section 4–(Sloane, 2014, p. 402) characterise dual VET:

1. *Corporatism* "describes an institutionalised form of collaboration between governmental bodies, employers' associations, trade unions and other collective actors" (Sloane, 2014, p. 403). The government devolves regulatory competence to corporatist bodies, e.g. chambers, and the associations of professions (see Sloane, 2014, p. 404).

2. The *duality* of VET refers to the combination of two learning venues and the role of education staff, the funding regime and the supervision of training. According to the concept, the teaching and learning processes are framed by duality (Sloane, 2014, p. 403).

3. The German concept of *Beruf*, sometimes described as vocation (Sloane, 2014, p. 404), carries the "twofold idea of developing skills and being educated" (Sloane, 2014, p. 405). Vocational schools and companies share an educational mandate (see Kultusministerkonferenz [KMK], 2018, p. 14). While in most countries personal development is associated with HE only, in Germany, this is an integral part of dual VET (Sloane, 2014, p. 405).

2.2 Defining Training-integrated Dual Study Programmes

There is a noticeable shift in the structure and in the educational choice behaviour between the pillars of VET and HE. Since 2013, the number of students beginning an academic programme has been higher than the number of students enrolling in VET (AGBB, 2018, table E1-4web, table E1-1A). For VET, this could mean losing further better performing high school graduates (Euler, 2019, p. 69). Additionally, with the growing participation of people in HE, new trends such as the demand for applied academic degrees have arisen (Schneider, Franke, Woisch, & Spangenberg, 2017, pp. 198-199). Dual study programmes are an example of this development (Euler, 2017, p. 42; Faßhauer & Severing, 2016, p. 9; Graf, 2018, p. 189; 2012, p. 49; Krone, 2015b, p. 81). Formally located within the university system (Graf, 2017, p. 96), they are typical of the current "academisation" of the vocational and "vocationalisation" of the academic (Faßhauer & Severing, 2016a, p. 16).

Quantitatively, dual study programmes are a niche phenomenon. In 2017, the share of dual students among the total number of students was 3.7%. However, at UAS, their share was 9.7% (Mordhorst & Nickel, 2019, p. 16), and the number of dual study programmes has been constantly growing (Hofmann & König, 2017, pp. 8-9). Owing to their "special 'hybrid' position at the nexus of HE and VET–combining institutional elements from both fields" (Graf, 2018, p. 189), they are also of significant qualitative importance.

Training-integrated dual study programmes credit part of the vocational training as study content (WR, 2013, p. 9). Dual students learn at up to four different learning venues: HEI, the company, vocational schools (Krone, 2015b, p. 81) and at cross-company vocational training centres (Leichsenring, 2015, p. 41). Besides a bachelor's degree, these programmes lead to a qualification of the VET system (Graf, 2017, p. 96; Wolter & Kerst, 2015, p. 520).

Since labelling study programmes as dual has become a "hip" thing to do (Krone & Ratermann-Busse, 2017, p. 2; Meyer-Guckel et al., 2015, p. 120; WR, 2013, p. 21), it has to be considered that only those study programmes that systematically integrate VET and academic education can be described as dual (WR, 2013, p. 9). Integration can be structural and content-wise. From an institutional perspective, the content-wise integration depends on the structural component (see Section 3.2 onwards; WR, 2013, p. 27) and therefore the two are not alternatives. Although HEIs are responsible for the study programmes (WR, 2013, p. 28), if genuine duality in terms of qualification and education is to be fostered, responsibility for learning must be shared between the actors. Such a duality has the potential to overcome the "Bildungs-Schisma" (Baethge, 2006, p. 16) on the learning level.

Dual studies must attain the same academic standards as regular academic study programmes (WR, 2013, p. 22). While accreditation criteria count in all forms of dual study programmes, the programmes

analysed here have a higher degree of standardisation because the VET component has to meet vocational regulations, additionally (Graf, 2017, pp. 96-97; Kupfer, Kolter, & Köhlmann-Eckel, 2012, p. 17).

The following are broad normative criteria of what constitutes a good dual study programme:

- The academic learning is on the same level as that of regular study programmes.

- The in-company training is for a vocation and not solely for company-specific skill demands.

- The programme fosters personal development through academic and vocational learning.

- The programme attains duality and integration in the sense that practical and theoretical learning form a whole, enabling students to obtain academic competence of professional relevance.

- The design of the study programme and culture fits the target group of the programme.

In the long run, the "hipness" of the programmes will likely depend on their quality. Stakeholder motives for cooperation and participation can be both a driver and a challenge in this process.

3.0 Setting the Theoretic and Methodological Frame: DBR and Pedagogic Development of HEIs

The methodological approach of this paper is DBR (DBRC, 2003; Euler, 2014). We introduce this methodology briefly in Section 3.1. The theoretic framework we use as a starting point is a concept called the pedagogic development of HEIs ("pädagogische Hochschulentwicklung"; Brahm et al., 2016a, p. 19; Euler, 2013, p. 360). As a first step in Section 3.2, we outline the reasons for choosing this model for organisational development (Brahm et al., 2016a, p. 33) and we introduce the model. Second, we develop an extended version of the concept, which aims at serving dual study programmes. Third, we outline a second relevant model on the macro-level to promote a better understanding of the challenges these programmes are facing.

3.1 Doing DBR, the Methodological Approach

The participation of researchers in theoretically informed innovation processes targeted at practical educational problems are characteristic of DBR (DBRC, 2003, p. 5; Sloane, 2017, p. 17). DBR "commences with the search for and identification of significant problems in concrete practical contexts whose solutions demand an innovative approach. [...] the goal is not only to examine existing realities (actualities), but also to explore the possibilities (potentialities)" (Euler, 2014, p. 17). DBR deals with educational

problems that are ill-defined and means dealing with real-life problems methodically (Reeves & McKenney, 2012, p. 1). DBR has two primary goals: developing innovative solutions for practical educational problems and generating scientific insights of a theoretic nature (Euler, 2014, p. 16; Reeves & McKenney, 2012, p. 1). DBR develops theory-informed interventions, verifies them against reality, takes the results back into the process of developing and designs this cycle iteratively (Reinmann, 2018a, p. 192).

There are different definitions of *design* (Bakker, 2019, pp. 5-6; McKenney & Reeves, 2019, pp. 82-86). In McKenney's and Reeves' (2019, p. 82) "generic model for design research in education", design is one of three core phases (McKenney & Reeves, 2019, p. 83). We follow Bakker's (2019, pp. 5-6) broader definition of design being the very nature of this kind of research. In contrast to McKenney and Reeves, Bakker (2019, p. 5) defines the whole DBR process as design, quoting Mintrop (2016, p. 133): "an intervention design consists of sequences of activities that together or in combination intervene in existing knowledge, beliefs, dispositions, or routines in order to prompt new learning that leads to new practice" (as cited in Bakker, 2019, p. 5). According to him, the object of design can be the educational materials or learning environments, how students and teachers are expected to communicate, or the organisational structures (Bakker, 2019, p. 6). This definition of design provides a comprehensive approach for educational DBR because this field of educational science within which we act is essentially a design science (similar Bakker, 2019, p. 157). In sum, "an attitude of having to "prove that" is not predominantly fundamental for this research, rather one of "exploring and testing what." Even though innovative teaching does not necessarily mean better education, the approach is associated with a demand to shape or change reality" (Euler, 2014, p. 17).

Although the process models of the iterative design cycles (e.g. Euler, 2014, pp. 19-21; McKenney & Reeves, 2019, pp. 82-83; Reinmann, 2018b, p. 1 following Bakker) "differ in their number of phases and notional descriptions, their basic structure displays a degree of similarity" (Euler, 2014, p. 19). The first step in the research cycle commences with the identification of practical educational problems. The second step is then to evaluate the literature and corresponding practical experiences (Euler, 2014, p. 20). "The development of innovative solutions [...] is underpinned by available scientific evidence, as well as experienced practitioners' available everyday theories" (Euler, 2014, p. 17).

The starting point of our paper is the challenge of designing dual study programmes based on a defined level of quality (see Section 2.2). We begin with developing a theory-informed framework that serves to categorise the design challenges that we outline. Only then do we classify the problems that we locate by reviewing the literature on dual study programmes. The literature review forms the core of the contribution. It serves to systematically identify generic challenges

that DBR should tackle and highlights what empirical substantiation exists regarding the respective problems.

As researchers in science-practice-communication (Euler, 1994, pp. 238-242), one should have reservations when it comes to defining goals that others should accomplish. Therefore, we generally target didactical innovations utilizing the potential of dual studies in overcoming the educational schism. That is, we leave the negotiation of the specific goals for which these innovations are applied to the actual cooperation of researchers and practitioners in the DBR field; nonetheless, the identification of possible goals and goal conflicts is an integral part of this paper.

Current approaches concerned with educational innovations do not look at learning as an isolated phenomenon but as a complex social reality. Sustainable change thus has to consider not only the development of learning environments per se, but also the development of the personnel and organisational conditions for learning. One such approach is the "pädagogische Hochschulentwicklung" (Brahm et al., 2016a, p. 19; Euler, 2013, p. 360), which combines the development of the learning environment with the development of the organisation. It looks at the development of the study programmes as an intermediary level between those of the learning environment and its organisational conditions (Jenert, 2016, p. 119).

3.2 Understanding Pedagogic Development as Organisational Development of HEIs

3.2.1 Introducing the model of pedagogic development of HEIs

Designing dual study programmes requires considering the institutional and organisational embedding of these programmes as well as questions concerning the concrete learning environment. Therefore, we have chosen the model of pedagogic development of HEIs as our frame of reference. This concept combines different approaches for designing teaching and learning. It includes, for instance, didactic approaches for qualifying individual teachers and HE management (Brahm et al., 2016a, pp. 21-27). Little extant research deals with the development of the university curriculum as a hinge between the institutional context of HEIs and the individual action of teachers and students (Jenert, 2016, p. 119; see also Gerholz & Sloane, 2016, p. 158). The heuristic of the pedagogic development of HEIs, sometimes also called the *institution-wide development of HEIs*, is an exception (Brahm, Jenert, & Euler, 2016b; Brahm, Jenert, & Meier, 2010; Euler, 2013; Jenert & Brahm, 2010). According to Jenert (2016, p. 119), the position of curriculum development linking concrete pedagogic interaction and the HEI makes it a central level of engagement in the concept. The concept involves implementing the insights gained in teaching and learning research within the

organisational context of HEIs, using methods that affect the logic of teachers' and students' actions. Meanwhile, the central characteristics of HEIs, organisational culture devoted to specific disciplines, bureaucratic structures in administration and specific study cultures, are disclosed at the level of the study programmes and must be addressed adequately (Jenert, 2016, p. 129).

The concept identifies three central levels for the development of teaching and learning:

1. **The level of the learning environment.** This level aims at developing the competence of teachers and students in the HEI and, bound to that, the design of learning settings and classes. This level targets the traditional field of HE didactics (Brahm et al., 2016a, p. 27, 30).

2. **The level of study programmes.** This level addresses the coherent design of study programmes and their specific profiles (Brahm et al., 2016a, p. 27, 31). For this process, communication among and with teachers and students is essential (Brahm et al., 2016a, p. 31; Jenert, 2012a, pp. 36-38, 2012b, p. 385).

3. **The level of the organisation.** This level deals with the overall structural and cultural conditions of teaching and learning at the HEI (Brahm et al., 2016a, p. 28).

There is an interdependence between the three levels: decisions and actions on one level have consequences at other levels. Therefore, when focusing on one level in a design process, the model stresses the need to take the other levels into account. Figure 1 depicts the connection using arrows. Development processes require a synergetic combination of change management and change leadership roles (Brahm et al., 2016a, p. 28). The strategic goals for teaching and learning at the institutional level are paramount because they guide the design of teaching and learning at the respective institution and relate to its overall HEI profile. Through its strategy, the HEI establishes its fundamental position on issues such as the relationship of employability and personality development, career orientation and social responsibility, or scientific focus and practical orientation of programmes. The strategic goals define the expectations of the HEI in relation to its teachers, but also in relation to other fields such as research. The goals serve as an orientation when making teaching-related decisions (Brahm et al., 2016a, p. 29-30).
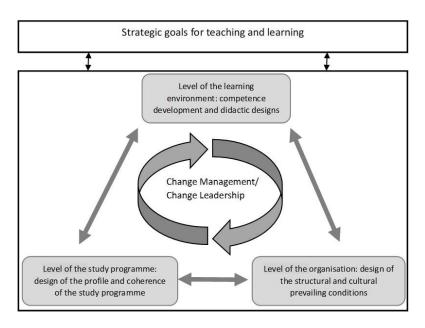
Figure 1. Frame of reference for the pedagogic development of HEIs (Source: Euler, 2013; Brahm et al., 2016a).

3.2.2 Expanding the model of pedagogic development of HEIs to dual study programmes

According to Brahm et al. (2016a, p. 33), change initiatives are currently often triggered by external impetus, for instance by accreditation requirements. In the case of dual study programmes, the external influences become especially relevant in the form of VET regulations and actors. This impetus is present at all levels through an almost mirrored reflection of these levels in VET. A key difference being that an HEI does not deal with one vocational organisation as a partner, but rather with the complex corporatist-governed field of education (Ratermann & Mill, 2015, p. 90). Governance structures in dual study programmes differ from those in the HE and VET (Ratermann & Mill, 2015, p. 90). The extended theoretic model for the development of dual study programmes in figure 2 depicts the cooperation necessary to design coherent study programmes. Additionally, the illustration shows the interdependence of the levels within HEIs and VET. Based on the concept of Brahm et al. (2016a, pp. 27-33), the additional levels are as follows:

1. **The level of educational processes in the company, vocational school and inter-company vocational training centre.** The aims are to develop the competence of (1) those responsible for vocational training in companies and (if involved) inter-company vocational training centres, (2) teachers in vocational schools and (3) the students. This level includes the design of learning environments and classes as well as exams.

2. **The level of the vocational training programme.** This level addresses the development of the VET programmes, which are based on vocational regulations as explained in Section 2.1.

3. **The level of programme financing and arrangements as well as the learning culture of the learning venues.** This level emphasises the overall structural and cultural conditions of teaching and learning in the company and (if involved) in the inter-company vocational training centres and in the vocational school.
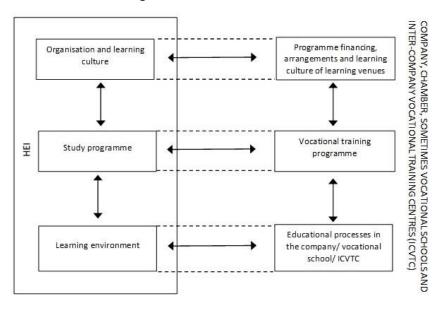

Figure 2. Frame of reference for the development of dual study programmes at HEIs (Source: Own extended illustration of Euler, 2013; Brahm et al. 2016a).

HEIs as organisations are represented by a frame in figure 2. Since the actors in dual VET do not belong to only one organisation, they do not have a dedicated frame. However, in most cases, the companies are the principal partners of HEIs (Kupfer et al., 2014, p. 20). The dashed lines in the model, which symbolise the challenge of integrating HE and VET in the dual study programmes under scrutiny, depict that an integration is necessary on all levels. Formally, the programmes have at least two separate curricula (including exams) for which two different institutions are responsible (chamber and HEI):

- The study plan/curriculum at the HEI, which is manifested in its accredited study and exam regulations, as well as in its module handbook and

- vocational training regulations, which are designed according to the Vocational Training Act (*Berufsbildungsgesetz*) and require a vocational training plan (*Rahmenplan*) and a vocational training study plan (*Rahmenlehrplan*) for a recognised profession (Kupfer et al., 2014, p. 21).

Combining these curricula in a coherent manner for a study programme is one of the significant challenges of designing dual studies in HEIs (Kupfer et al., 2014, pp. 20-22; Langfeldt, 2018, p. 16).

3.2.3 Identifying structural configurations on the macro-level challenging the development of dual study programmes

Figure 3 shows the macro-level relation between HE and VET in a dual study programme, which is clearly marked by their structural separateness. The illustration depicts the design challenge of identifying and carrying out shared educational goals or of balancing the different goals for teaching and learning as a precondition for combining the two educational pathways systematically.
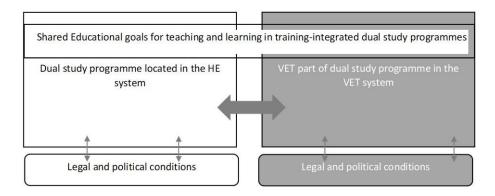

Figure 3. Structural configurations on the macro-level challenging the development of dual study programmes (Source: Own illustration).

Figure 3 also depicts political decisions having a steering effect through distribution of funding, incentives and legal norms (Krone, 2015c, p. 250). The vocational and academic systems have different legal and political conditions, which partly explain the divergent logic and cultures. The mechanisms used by the federal government and the federal states to regulate and steer both systems have an influence on the design options for dual study programmes (Ratermann & Mill, 2015, pp. 117-118). Although there is a need to coordinate political and legal approaches to the HE and VET systems, the model does not illustrate this need because it cannot be the object of pedagogic development of HEIs.

4.0 Classifying Central Design Challenges for Dual Study Programmes

Scientific interest in dual study programmes has grown in the last decade (Nickel, Püttmann, & Schulz, 2018, p. 26). There are a number of studies on these "hybrid programmes" (Graf, 2017, p. 89). Publications deal, for instance, with socio-economic and policy questions (Graf, 2017, 2018) and with questions on the quality, organisational structuring and constellation of agents (Krone, 2015a; Langfeldt, 2018), and the transition from dual studies to work (Krone, Nieding, & Ratermann-Busse, 2019). Practically oriented publications address topics such as the quality management of dual study programmes (Meyer-Guckel et al., 2015) or their implementation on the national and international level (Hesser, 2018, 2019; Graf, Powell, Fortwengel & Bernhard, 2014; Maschke, 2015). However, research

from a didactical perspective on these programmes is essentially non-existent (Faßhauer & Severing, 2016a, p. 12; Kreutz & Meyer, 2015, p. 233; Meyer, 2019, p. 433). The current state of research has four limitations:

- First, the categories used for analyses are not typically based on pedagogic concepts, e.g. the definition of learning venues. Thus, the categories are not always useful from an educational perspective (Wiesner & Winkler, 2016, p. 96).

- Second, few publications combine the two perspectives of VET and HE (e.g. Euler & Severing, 2017, 2018; Gerholz & Sloane, 2008; Hemkes et al., 2019), thus resulting in, for instance, a poor understanding of the institutional logics on both sides.

- Third, representative empirical data on dual study programmes (Langfeldt, 2018, p. 3; Weiß, 2016, p. 23) do not exist because of the complexity of the subject (Langfeldt, 2018, p. 3). It is a case of "messy research" (Jenert, 2019, pp. 149-151) and the outcomes are difficult to generalise.

- Fourth, studies do not always distinguish between the different types of dual study programmes (e.g. Brändle, Kugler, & Zühlke, 2019; Graf, 2018; Mucke & Schwiedrzik, 2000; Schwiedrzik, 2001). Whenever possible, this paper relies on research results directly referring to training-integrated dual study programmes.

In this section, we refer to the model illustrated in figure 2 to structure generic design challenges that DBR projects intending to use the innovative potential of dual studies should tackle. Although we integrate approaches from research on VET, we present the challenges from the perspective of HEIs since they are responsible for designing them (Akkreditierungsrat, 2010, p. 5; Krone, 2015c, p. 253; Schütz, 2015, p. 213). For the three levels of (1) the learning environment, (2) the study programme and (3) the organisation and culture, we have two guiding questions:

- What are the problems the design process should address?

- What empirical substantiation exists regarding these problems?

We also consider that design challenges interdepend between the levels analysed. The elaborated challenges outlined serve as examples and do not constitute a checklist for developing dual study programmes.

4.1 Challenges on the Level of the Learning Environment in the Dual Study Programme

On this level, teachers and students translate study programme decisions into teaching and learning processes. Stakeholders on this level also make bottom-up decisions that have implications at the levels of the study programme and the organisation and learning culture.

There are two design challenges on this level: linking of academic and vocational learning often remains a task for students (Krone, 2015b, p. 65, 2019, p. 462; Kupfer et al., 2014, pp. 28-29) and some teachers are insufficiently qualified for dual study programmes (Langfeldt, 2018, p. 17).

In 1996, Holtkamp (1996, p. 7) and WR (1996, pp. 29-30) already highlighted the problem of integrating VET and HE learning. Holtkamp (Holtkamp, 1996, p. 7) explicitly referred to training-integrated dual study programmes. Until now, the lack of integration has been a common diagnosis (Krone, 2015b, p. 65, 2019, p. 462; Kupfer et al., 2014, pp. 19-20; Langfeldt, 2018, p. 7; Meyer-Guckel et al., 2015, p. 22),[2] and linking the academic and vocational learning is an extra burden for students (Krone, 2019, p. 462). Studying and working parallelly does not need to be problematic for students generally, but for students in dual studies promising an integrated teaching and learning process as a key characteristic. Not fulfilling one of the programme's key elements challenges not only their classification as being dual but also the students' expectations. A lacking integration of HE and VET is thus a first design challenge.

Some studies identify the transfer of learning as a core problem dual study programmes face (Beaugrand, Latteck, Mertin, & Rolf, 2016, p. 61; Kupfer et al., 2014, pp. 28-29; Leichsenring, 2015, pp. 40-41). Indeed, only one publication deals with didactic designs in the sense of learning methods for dual study programmes (Beaugrand et al., 2016). Euler and Severing (2017, p. 686) name coaching as a method for an approach similar to dual study programmes. Nevertheless, a variety of methods that could be fruitful for the transfer of learning exist, including e-portfolios (Barrett & Carney, 2005; Reinmann & Hartung, 2013; Reinmann & Sippel, 2011), blended learning (Keengwe, 2019; Reinmann-Rothmeier, 2003), problem-based learning (Euler & Hahn, 2004, pp. 110-114; Moallem, Dabbagh & Hung, 2019; Weber, 2007) and research-based learning (Bastiaens, van Tilburg & van Merriënboer, 2017; Huber, 2004; Wildt, 2009). A design challenge, then, is to elaborate how teachers, trainers and students can use these methods in dual study programmes to profit from the different learning venues and create didactic arrangements that serve the integration of VET and HE. Experience and research on the use of these methods in lifelong learning could be adapted (e.g. Waletzke & Angenent, 2019). However, we argue that teachers and trainers cannot use or implement any of these methods well if conditions, such as structural and cultural issues, are not supporting this endeavour on the other levels.

The second design challenge is the missing didactic qualification of teachers and trainers. Such a lack can pose a serious threat to quality, with respect to both the characteristic of duality and the academic standards. Existing literature places special emphasis on the trainers in the companies lacking didactic qualifications (Langfeldt, 2018, p. 17), which is particularly important because staff from companies often work as contract teachers at the HEIs (Langfeldt, 2018, p. 17; Ratermann, 2015, p. 181). Additionally, staff from companies and HEIs rarely accompany the learning jointly (Kupfer et al., 2012, p. 20; Kupfer et al., 2014, p. 24). Evidence shows that some HEIs have already

[2] Dual programmes in initial VET usually face similar problems (Pätzold, 2003, pp. 80-81), although they formally have a joint educational mandate (KMK, 2018, p. 14).

adjusted their selection criteria, support and qualification for external staff. Others have extended specific didactic qualification programmes for all teachers in dual studies (Nickel et al., 2018, p. 75).

4.2 Challenges on the Level of the Dual Study Programme

At this level, the profile and coherence of the study programme are developed (Brahm et al., 2016a, p. 31). The existing literature points at two practical problems regarding academic learning[3] and duality; however, issues of target groups and learning goals are also relevant. The discourse on the study programme level is rather limited to an understanding of *curriculum development*. Curriculum in a narrow sense refers to the teaching and learning plan (Jenert, 2016, p. 122). However, we rather refer to the broader concept of *study programme development*, which takes into account prevailing conditions for successful studies as well (Jenert, 2016, p. 122). We consider this term appropriate for two reasons: First, designing outcome-oriented programmes is not only about the formal structure, content and methods of the curriculum, but also about the no longer simply disciplinary, but (interdisciplinary) study programme culture that socialises students. Second, study programmes are socio-cultural environments in which teachers and students interpret curricular regulations and put them into practice (Jenert, 2016, pp. 125-127). Hence, we continue to use the term curriculum development only when it is inherent in the sources used.

A major design challenge is to set the educational goals of the study programme. The problem for the stakeholders is to develop shared goals or to balance the different goals despite their embeddedness in two separate institutional spheres. This challenge must be addressed to achieve an integration of academic and vocational learning. Educational goals refer to the three principles of science, practice and personality (Huber, 1983, p. 128). The goals commonly mentioned such as "employability" (Langfeldt, 2018, p. 16), discipline-based "know-how" (Krone, 2015b, p. 67), and fostering autonomy and communication skills (Krone, 2015b, p. 67) are located within the three principles. Following Huber (1983, p. 128), these goals can be described as a specialisation as opposed to a general education, which is typical for applied study programmes such as dual study programmes. Regarding the practice, the discourse is limited to professional practice or is limited even further to company-specific skill demands (Krone, 2015b, p. 75; critical see Graf, 2018, p. 187). Notably, the cooperation with VET does not have to be limited to the principle of practice. Traditionally, initial VET focuses on personal development and the legally defined occupation which is the focus of the training (Aff, Klusmeyer, & Wittwer, 2010, pp. 331-333); it does not correspond to training for company-specific skills in any narrow sense. According to the German federal law for HEIs, the preparation for working in a professional field consists of gaining the relevant knowledge, competence and methods that enable the students to work scientifically and that foster responsible action in a free, democratic and social state under the rule of law (Hochschulrahmengesetz, 2017, section 2, § 7). Further, Elsholz (2015, pp. 254-255) sees convergence between VET and HE, where VET has

[3] The academic character of the study programmes is not only important for the bachelor's degree, but also for the transition of students to master's programmes. According to an online survey from 2015, 40% of dual students wanted to study a master's programme then or after finishing the bachelor's degree, and another 40% had not yet decided. Krone (2019, pp. 476-477) pointed out that these plans often contradict with the interests of companies, which anticipate higher costs and missing workforce.

to ensure compatibility with scientific approaches and HE is challenged to foster professional qualifications. In sum, it is possible to set educational goals for dual study programmes combining all the three principles set by Huber (1983). The design challenge is to find and carry out suitable goals between the partners of HE and VET. Perhaps dual study programmes will be successful in this respect. Similar attempts have been made before (Blankertz, 1995).

According to Langfeldt (2018) and Weiß (2016, p. 21), there are signs of shortcomings in the academic character of some study programmes labelled as dual (see also AGBB, 2016, p. 142). When developing these hybrids, the notion of scientific must be defined and academic standards must be put into practice. Designing the profile of the study programmes links in with the challenge of setting the goals. It is a significant challenge because obtaining academic standards is what qualifies the programmes as a university or UAS degree. In line with accreditation criteria for dual study programmes, HEIs must ensure the academic qualification of students (Akkreditierungsrat, 2010, p. 5). However, what academic means in practice can vary. With reference to Dahinden, Sturzenegger and Neuroni (2006), Langfeldt (2018, p. 3) defined academic work as a systematic extension of one's state of knowledge regarding concrete questions and as a critical reflection of new insights. She stated that companies have to fulfil the first criteria through structured learning processes. She considered the critical reflection of the learned and the search for alternative practice and explanation as part of the responsibility of the HEIs, which have to coordinate their learning processes with those of the companies (Langfeldt, 2018, p. 3). Langfeld (2018, p. 15) saw the risk especially in periods when the students are learning in the companies and thus suggested that HEIs pay greater attention to these phases (Langfeldt, 2018, p. 15). Weiß (2016, p. 33) drew on recommendations of the WR, which claimed that guaranteeing the academic relation is the foremost task. Relevant parameters include the duration and intensity of the theory phases; the scope and demands for scientific work in the programmes; the content, formats and assessment of exams; and the line-up of the teaching body (WR, 2013, p. 29). The WR saw the shortened time of study as a risk for academic standards and therefore argued for longer regular times of study in dual bachelor's degrees (WR, 2013, pp. 28-30). Both the WR and the German Academy for Technical Science (*Deutsche Akademie der Technikwissenschaften [ACATECH]*) have stressed that the practice orientation should not hamper the academic character of the programmes (ACATECH, 2014, pp. 30-31; WR, 2013, p. 29). Weiß (2016, p. 33) saw in this approach a risk in putting academic learning before in-company learning, suggesting that it would endanger a cooperation at eye-level. Thus, the stakeholders in the prevailing discussion interpret academic and vocational learning as widely opposing. According to the ACATECH, companies consider dual study programmes a version of a vocational training rather than a version of an academic study programme (ACATECH, 2014, p. 30). Finding practical solutions to this problem will require taking into account decisions regarding the learning goals and duality of the study programmes.

According to Faßhauer and Severing (2016a, p. 12), linking theory and practice in dual study programmes draws on the traditional understanding of cooperation in learning venues from VET. The

authors pointed out that the transfer of the concept of duality has its limitations; dual study programmes lack a methodical-didactic concept and a shared education mission and therefore the pedagogic dimension (Faßhauer & Severing, 2016a, p. 12). There seems to be no consensus on what duality means. Only a few publications draw on the understanding of the duality of qualifying and educating (Leichsenring, 2015, p. 41; WR, 2013, p. 28). The HEI is frequently defined as the venue for learning theoretical competence and the workplace as a venue for practical learning (ACATECH, 2014, pp. 24-25; Kupfer et al., 2014, pp. 31-32). This definition is an insufficient transfer of the understanding of theory and practice from VET, relying solely on the institutional setting. *Learning venue* not only refers to the institutional level, but also to the pedagogically designed unit in the institution and the learning person (Euler, 2015, p. 6). Considering the two additional levels of learning venues allows for a different perspective on learning in dual study programmes. Practical learning, for instance, could also take place in a learning venue at the HEI or vocational school and theoretical learning in the company or inter-company vocational training centre and vice versa. However, it is likely that dual study programmes need at least an adaptation of the VET concepts.

Krone (2015b, p. 81) described the development process for these programmes as an adjustment of university curricula and a removal of parts of the in-company and vocational school-based training. Thus, the development is actually a process of adjustment on the formal level of two different curricula for which two different institutions are responsible (Kupfer et al., 2014, p. 21). According to Kupfer et al. (2014, pp. 20-22) and Langfeldt (2018, p. 16), a real integration on the curriculum level would mean that a unified study and training plan exists, assigning learning experiences explicitly to the respective learning venues and defining the learning objectives and goals. Kupfer et al. (Kupfer et al., 2014, p. 21) did not find such a close integration in any of their cases. Indeed, changing a legally recognised vocational training according to the needs of a single university study programme might be almost impossible. Limitations, especially on the legal level, however, must not prevent a closer integration, because vocational training regulations are formulated very openly to allow for on-site adjustment ensuring that certain standards are met. It would certainly be possible that a study plan of a university draws on elements of a vocational training curriculum (Kupfer et al., 2014, p. 21; Langfeldt, 2018, p. 16). Kupfer et al. (2014, pp. 21-22) explained two reasons why this adaptation of university study plans did not happen in the cases they explored: first, HEIs did not want to interfere with the autonomy of VET, and second, the HEIs argued that the level of education in HE is higher than in VET. Such arguments demonstrate the cultural dimension of curriculum development, explained by the term *study programme development*. Hence, a lot depends on the interpretation of and attitude towards VET by key actors in charge of curriculum development. Currently, informal and pragmatic synergies are often deployed; dual study programmes shorten the period of VET and establish special classes for dual students in vocational schools or special exam preparation by the chambers.

Another challenge is designing dual study programmes according to the needs of their target groups.[4] With the shift from teaching to learning and the greater focus on the students' perspective that comes

[4] On the level of the organisation and learning culture, the challenge is linked to the gatekeeper function of companies (Graf, 2017, p. 103; Krone & Mill, 2014, p. 53; Meyer-Guckel et al., 2015, p. 90; Nickel et al., 2018, p. 65; Ratermann, 2015, p. 180), which is particularly problematic when widening access to the

with it, it would be problematic not to design programmes in line with the needs of the students the programmes target. In this context, there is a debate on how to widen access to dual study programmes (Nickel et al., 2018, p. 66), since they have the potential to qualify new target groups (Kamm et al., 2016). Data on dual students show that there is mainly a selected group of people in these programmes: (a) men,[5] (b) people without a migration background,[6] (c) young adults with a high school diploma who want to become financially independent quickly[7] and (d) people having a preference for a strong practical orientation (AGBB, 2018, p. 158). Although sometimes maintained differently (Ebner, Graf, & Nikolai, 2013; Krone, 2015b, p. 57, 2019, p. 466; Krone & Mill, 2012, p. 4), dual studies are not especially tailored to so-called "education climbers" whose parents do not have an academic degree (AGBB, 2018, table F2-18web; Krone, 2019, p. 466; Wolter, 2016, p. 46), nor are they purely elite programmes (Kamm et al., 2016; Wolter, 2016). The proportion of students from academic and non-academic families is equally divided (Woisch, Renneberg, & Mentges, 2018, p. 4). Extant literature points toward the performance expectations in this context (Faßhauer & Severing, 2016a, p. 15; Kupfer et al., 2014, p. 41; Nickel et al., 2018, p. 65). A lack of coordination between the actors involved, for instance, can lead to unnecessary high performance requirements and therefore to a greater selectivity of students (Faßhauer & Severing, 2016a, p. 15).

4.3 Challenges on the Level of the Organisation and Learning Culture of Dual Study Programmes

On the level of the organisation and learning culture of dual study programmes, the design challenges are the relationship of collaboration and the formal cooperation structures between HE and VET (Kupfer et al., 2014, pp. 19-20) including questions of financial resources (ACATECH, 2014, p. 31; Kupfer et al., 2014, p. 20; Ratermann, 2015, p. 181).

The cooperation between HE and VET is the dominant theme (Krone, 2015b, 2015c; Kupfer et al., 2014; Langfeldt, 2018; Meyer-Guckel et al., 2015; Ratermann, 2015). Facilitating cooperation is a design challenge because it must set the frame for an integration of academic and vocational competence development on the level of the learning environment and its conceptual design on the level of the study programme.

The cooperation between HEIs and companies in dual study programmes is considered to be loose (Kupfer et al., 2012, pp. 19-20; Kupfer et al., 2014, p. 28; Langfeldt, 2018, pp. 6-7). Evidence indicates that their cooperation is often narrowed down to the necessary minimum (Kupfer et al., 2012, p. 15; Kupfer et al., 2014, p. 28; Langfeldt, 2018, p. 7), which is problematic if it hampers the integration of academic and vocational learning. Kupfer et al. (2014) distinguished between the relationship–of cooperation and formal cooperation structures. In a case study with companies and UAS, they

found that relatively few formal instruments (cooperation contracts, committees etc.) are in common use (Kupfer et al., 2014, p. 20). These instruments are sometimes only fall-back options in the case of conflict (Kupfer et al., 2014, p. 20). However, recent studies draw a different picture: Contracts and committees seem to be commonly used, but agreements are often vague; committees do not necessarily integrate relevant partners and meetings do not take place with high frequency (Krone, 2015c, p. 254; Langfeldt, 2018, pp. 9-10; Ratermann, 2015, p. 177). Even interactions such as phone calls or visits are in most cases minimal (Kupfer et al., 2014, p. 19; Langfeldt, 2018, pp. 9-10). According to Kupfer et al. (2014, p. 19), the intensity of cooperation seems to be higher in training-integrated dual study programmes compared to other types of dual study programmes (see also Kupfer et al., 2012, p. 15). By contrast, Langefeldt's (2018, pp. 9-10) study found evidence that the frequency of contact does not depend on the type of programme but rather on the size of the company. The bigger the company, the higher the frequency. Bigger companies often have more dual students and therefore more reasons to contact HEIs. Large companies also have the capacity to manage the relationship because they can hire staff for educational tasks. According to the ACATECH, there is insufficient knowledge of the internal structures of the partner institution on both sides due to lack of cooperation (ACATECH, 2014, p. 30). If the integration of VET and HE is to function properly, it depends essentially on the values and interpretive patterns of the actors (Meyer, 2019, p. 423).

Funding by the companies (Ratermann, 2015, p. 181) can also be a crucial part of cooperation.[8] However, companies sometimes proclaim a right to participate in decisions regarding the content of study programmes when they are substantially involved in funding them (similar Graf, 2017, p. 104; Ratermann, 2015, p. 181).

As outlined in Section 2.1, vocational schools, chambers and inter-company vocational training centres are, next to companies, an essential part of the German dual VET system. They can also play an important role guaranteeing academic and VET standards. However, there is little empirical substantiation on their role in dual study programmes. According to Kupfer et al. (2014, p. 21), sometimes other actors aside from companies, e.g. chambers, serve as a hinge between the HEI and the company. These actors communicate with both sides and tend to balance the different system logics. Vocational schools do not always participate in dual study programmes because compulsory school attendance varies between federal states (Mordhorst & Nickel, 2919, p. 149; Ratermann, 2015, p. 190).

It is a challenge to find suitable ways of designing structures of collaboration and the cooperative relationship. Cooperation is a means to an end; it should follow the educational purpose. Thus, formal instruments and the relationship of collaboration itself should reflect the design at the level of the study programme. For instance, it

[8] Schimank (2008) and Weingart (2001, pp. 171-231) discussed the relationship of HE and economy. However, they focused on research.

is possible to work out the concrete function of a committee only in relation to the design decisions on the study programme level.

4.4 Summarizing Design Challenges for Dual Study Programmes

Considering the analysed literature, major challenges arise from the prevailing conditions on the level of the organisation and the study programmes, as well as from the effects they have on the level of the learning environment. Krone (2015b, p. 81) stressed this point without mentioning the specific levels, but stated that cooperation on different levels is necessary for a successful integration of vocational and academic learning. The structural linking of vocational and academic learning serves as a basis for a content-wise integration.

The design challenges revolve mainly around the integration and cooperation of HE and VET. The practical problems could be classified as independent challenges or as interrelated with integration. We hypothesize that the latter will be a helpful perspective and therefore follow this approach. DBR projects would aim at resolving the challenges of designing dual study programmes by utilizing the innovative potential of linking academic and vocational learning.

Dual educational programmes can be designed as vocational trainings or as academic study programmes. In the case of the dual study programmes analysed, an academic dual programme should fulfil the requirements of VET, too. Thus, the overarching challenge we identified is to design a form of cooperation between the stakeholders involved in dual studies that facilitates duality or, in other words, an integration of academic and vocational learning while fulfilling academic standards.

Following, we summarize the generic design challenges according to the levels of the heuristic used. On the level of the learning environment, we identified the challenge of adapting teaching and learning methods for dual study programmes, so that an integration of academic and vocational education does not remain the task of the students only. To use the methods adequately and create didactic arrangements for the dual study programmes, teachers and trainers must be sufficiently didactically qualified. Therefore, designing concepts and practices for the development and possibly cooperation of teaching staff is another challenge.[9] Although the discussion revolves mainly around the didactic-qualification of staff from the companies, we stress that qualifying university teachers for these didactically challenging study programmes is just as important. Depending on their role, one could argue that they need, for instance, competence for teamwork with the partners in VET or competence for study programme development and implementation. The exact needs have to be specified in a concrete DBR project.

On the level of the study programme, developing shared paramount educational goals of dual studies or balancing different goals within

[9] The development of staff in management can also be an issue. On the theoretic level, this issue raises the question of whether staff development must be moved to another level of the heuristic framework or if it must be present at all levels of pedagogic development of HEIs.

the legal and structural frameworks and cultures of HE and VET is a central challenge. These goals must be translated into coherent study programmes and can serve as a starting point for developing the hybrids, which includes integrating or aligning the academic and vocational curricula. As some normative criteria of these programmes are already set by their definition, designing academic learning in dual study programmes and fulfilling academic standards are further challenges on this level. This holds true for interpreting duality in the case of dual study programmes and finding its relation towards the academic learning. Tailoring dual studies to new target groups could be a challenge, if this is what an HEI and its study programme partners are striving for. In any case, study programme designers must consider the target group.

On the level of the organisation and learning culture, design researchers and practitioners would need to find measures to develop the relationship of collaboration and formal cooperation structures with companies that foster academic standards and duality in dual study programmes. The role of stakeholders, such as chambers and vocational schools, must also be considered. The learning culture of an HEI is an essential factor in this process. It is relevant to consider, whether collaboration with companies is usually an integral part of learning in the HEI or whether this is atypical for the institution. Typically, in this regard, the line runs between universities and UAS. However, learning cultures at HEIs and companies are not static–they can change, thus offering a chance for the integration of academic and vocational learning, but such integration needs time (Meyer, 2019, p. 434).

The prevailing goal is to integrate or align academic and vocational learning. Designing on the study programme level and on the level of the organisation and learning culture of dual study programmes must serve this purpose on the level of the learning environment. If linking VET and HE in these programmes works, the insights could serve as a basis for fostering the integration of less standardised dual study programmes in terms of the vocational part, thus presenting another design challenge.

5.0 Conclusion: Approaching Challenges of Dual Study Programmes with DBR

In this section, we conclude by highlighting our contribution to the DBR process and outlining the next research steps in the DBR cycle. We also suggest DBR activities for the development of dual study programmes.

In potential future DBR projects, we evoke using the process model proposed by Euler (2014, p. 20). To outline the research steps, we use the slightly modified version from 2017 (Euler, 2017a, p. 9):
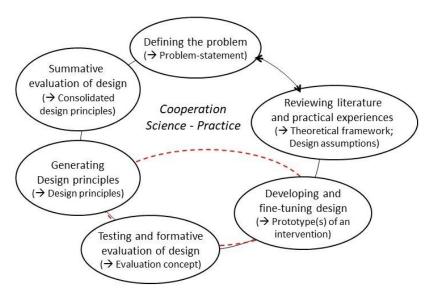
Figure 4. Phases of a DBR process (source: Euler, 2017, p. 9).

The basic structure of this process model for DBR is as follows:

1. Scientists and practitioners state the practical problem "identifying the (key) objectives related to (as yet provisional) research and design issues" (Euler, 2014, p. 25) and justify "practical and scientific relevance" (Euler, 2014, p. 25).

2. During the next step, a literature review is carried out and practical experiences are evaluated. The results are a theoretical framework with a further specified problem definition, design requirements and assumptions (Euler, 2014, p. 26).

3. Next, "*prototype(s) for potential interventions and/or measures to achieve the desired objectives* [emphasis in the original]" (Euler, 2014, p. 28) are developed.

4. Here the design is tested and evaluated to explore how applicable the design is in practice. This step also aims at further improving the interventions (Euler, 2014, p. 28) and creating an evaluation concept (Euler, 2014, p. 31).

5. Generating "*design principles* [emphasis in the original] for a defined area of application" (Euler, 2014, p. 33) is the next step. "On the one hand, these principles arise as a result of theoretically and empirically guided forms of knowledge production. On the other hand, they form, as prescriptive statements, the basis for designing practical action concepts to achieve the defined practice goals" (Euler, 2017a, p. 2).

6. Once the interventions are robust enough, a summative evaluation can be carried out (Euler, 2014, p. 33). "In contrast to a formative evaluation, which emphasizes the intervention's exploratory optimization, causal relationships are reviewed in a summative evaluation" (Euler, 2014, p. 33). The results "will at best deliver refined design principles or action heuristics that practitioners can adopt and transfer to their specific practice situations" (Euler, 2014, p. 35).

In this paper, we prepared steps one and two. In step one, we identified the practical educational problem and outlined its relevance. In step two, we developed a theoretical framework and classified the generic design challenges based on a literature review. The framework shows the area in which to design and develop the solutions and theories. We have not defined the design requirements and assumptions for a simple reason: as practitioners have not been involved, we have not yet considered practical experiences. That would be a necessary next step before conducting the other steps listed above. The specified problem definition also needs to be checked against the views of the practitioners.

Future DBR activities could address the specific design challenges identified in this paper. A DBR project could, for instance, integrate or align the academic and vocational curricula in dual study programmes. A possible project could also involve developing fitting measures for the qualification of staff at HEIs and in VET. The targeted interventions could specifically address the challenge of cooperation on the levels of the organisation and study programme; we consider that they are key to integrating VET and HE on the learning level. Aligning change management at the levels of the organisation and study programme with the processes at the level of the learning environment could be part of such a DBR project. Another DBR project could accompany processes that help develop shared goals and understandings of duality and academic learning aiming at the integration of VET and HE, for which these programmes stand. Decisions on target groups would also be part of this process. It could be an ideal to develop a shared understanding of education and methodical-didactic concepts for a dual study programme.

Researchers and practitioners could conduct one of these DBR projects while setting up a new dual study programme. However, as doing so is extensive work and therefore less likely, they could instead adjust an existing programme. When adjusting dual study programmes, actors should be aware that some HEIs combine different types of dual bachelor programmes in one programme and others even combine regular and dual programmes (Hofmann & König, 2017, p. 10).

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