

Implementation of Dual Training Programmes through the Development of Boundary Objects: A Case Study

Michael Gessler
Susanne Peters
Universität Bremen. Germany.
mgessler@uni-bremen.de
speters@uni-bremen.de

Received: 16/11/2015

Accepted: 3/1/2016

Published: 29/6/2017



Abstract

A dual training system or programme tries to balance education (in a school) and training (in a company) in an equal manner to qualify, educate and socialise the next generation. Besides these effects (qualification, education and socialisation), it seems that this dual structure enables a country to achieve economic targets (e.g. economic growth) and social objectives (e.g. the integration of young people into the employment market), which is why attempts are being made in various countries to develop or to preserve dual training structures. This study focuses on emerging dual training programmes in the United States of America. Our questions are: How do German companies establish dual structures in the United States of America? How do they shape the cooperation between companies and schools? As the cooperation aspect will be the focus of the article, we will concentrate on the interface between the schools and the companies. Our theoretical reference is the concept of *boundary objects*; a concept within the tradition of cultural-historical activity theory. Using this concept, we show how and in which way dual training structures and an innovative workplace learning partnership have being established in a German transplant in the USA.

Keywords: activity theory; boundary objects; vocational education and training; professional development; German dual system; case study

Resum. *Implementació de programes de formació dual mitjançant el desenvolupament de boundary objects: un estudi de cas*

Un sistema o un programa de formació dual intenta equilibrar l'educació (a l'escola) i la formació (a l'empresa) per qualificar, educar i socialitzar la generació següent. A banda dels efectes esmentats (qualificació, educació i socialització), sembla que aquesta estructura dual permet que un país assoleixi objectius econòmics (per exemple: creixement econòmic) i objectius socials (per exemple: la integració de joves en el mercat laboral), això explica per què s'intenta desenvolupar o preservar les estructures de la formació dual en diferents països.

L'estudi se centra en programes emergents de formació dual als Estats Units d'Amèrica. Les nostres preguntes són: com estableixen les empreses alemanyes estructures duals als Estats Units d'Amèrica?, com es determina la cooperació entre empreses i escoles?

Ja que l'aspecte de la cooperació serà el focus principal de l'article, ens centrarem en la interconnexió entre les escoles i les empreses. El referent teòric és el concepte de *boundary objects*, que es troba dins de la tradició de la teoria de l'activitat historicocultural. Fent servir el concepte esmentat, mostrem de quina manera s'han d'establir les estructures de formació dual i una associació innovadora de l'aprenentatge en el lloc de treball en aquest procés d'adaptació del sistema alemany als EUA.

Paraules clau: teoria de l'activitat; *boundary objects*; formació professional; desenvolupament professional; sistema dual alemany; estudi de cas

Resumen. *Implementación de programas de formación dual mediante el desarrollo de boundary objects: un estudio de caso*

Un sistema o programa de formación dual intenta equilibrar de igual manera la educación (en la escuela) y la formación (en la empresa) para cualificar, educar y socializar a la próxima generación. Aparte de estos efectos (cualificación, educación y socialización), parece que dicha estructura dual permite que un país alcance objetivos económicos (por ejemplo: el crecimiento económico) y objetivos sociales (por ejemplo: la integración de jóvenes en el mercado laboral), lo que explica por qué motivo se intenta desarrollar o preservar las estructuras de formación dual en varios países.

El estudio se centra en programas emergentes de formación dual en los Estados Unidos de América. Nuestras preguntas son: ¿cómo establecen las empresas alemanas estructuras duales en Estados Unidos de América?, ¿cómo se determina la cooperación entre empresas y escuelas?

Ya que el aspecto de la cooperación será el foco principal del artículo, nos centraremos en la interconexión entre las escuelas y las empresas. Nuestra referencia teórica es el concepto de *boundary objects*, el cual se encuentra dentro de la tradición de la teoría de la actividad histórico-cultural. Usando el concepto mencionado, mostramos de qué manera deben establecerse las estructuras de formación dual y una asociación innovadora del aprendizaje en el lugar de trabajo en este proceso de adaptación del sistema alemán en los EUA.

Palabras clave: teoría de la actividad; *boundary objects*; formación profesional; desarrollo profesional; sistema dual alemán; estudio de caso

Summary

- | | |
|---|----------------------------|
| 1. Introduction | 4. Conclusion |
| 2. Theoretical Framework, Research Design and the Case | Bibliographical references |
| 3. Co-construction of Boundary Objects between School and Company | |

1. Introduction

Apprenticeships have existed in Germany since as early as the Middle Ages. Compulsory education for all with eight years schooling was mainly introduced between 1800 and 1850. The requirement for all to attend a *Fortbildungsschule* (continuation school) until the age of eighteen was established in 1919 (*Weimarer Verfassung*: Weimar Constitution) when apprentices had the obligation to attend a part-time school. In 1938, a new law (*Reichsschulpflicht*

chtgesetz: law on compulsory education) reformed and centralised the control. The terms *Berufsschule* (vocational school) and *Berufsschulpflicht* (compulsory vocational education) were introduced and used instead of the terms *Fortbildungsschule* (continuation school) and the general term *Schulpflicht* (compulsory education). A general duration of three years compulsory vocational education (after eight years of schooling) was defined – up to completing the age of 18. Exceptions to this rule were made, on the one hand, for apprentices, who had to attend vocational school part-time until the end of the apprenticeship (even if they were older than eighteen). On the other hand, pupils in general education or private education were excluded from this rule. The term *dual system* was first used by the *Deutscher Ausschuss für das Erziehungs- und Bildungswesen* (the German Committee for the Educational System) in 1964 to highlight the two learning venues (Deutscher Ausschuss für das Erziehungs- und Bildungswesen, 1965, p. 57). The purpose of the new term was to strengthen the idea of two cooperating learning venues and to initiate better cooperation. The problem is old and still relevant today, as the cooperation between teachers in vocational schools and trainers in companies is rated mostly as unsatisfactory (Gessler, 2017). The two systems (education and training) do not form one uniform system (Zlatkin-Troitschanskaia, 2005).

The purpose of this article is not to analyse the strengths and weaknesses of the cooperative structure and reality in the German dual system, but this background was the motivation behind analysing the emerging cooperation in a country where vocational education and training (VET) is stigmatised and has a bad reputation – the United States of America (USA). On the one hand, the USA has a long apprenticeship tradition. Already in 1917, the so-called SmithHughes Act was established (with a focus on financing), and in 1937, the US Congress passed a National Apprenticeship Act (a Vocational Training Act was established in Germany for the first time in 1969). On the other hand, the apprenticeship model was seen in the USA as a threat to democratic society and as a source of inequality. Strong opposition existed from the very beginning and one of the most influential thinkers fought against training in companies and the apprenticeship model: John Dewey. Today, politicians in the USA support the apprenticeship idea (e.g. Barack Obama), while in American society, vocational education is often perceived as “an educational backwater for the disadvantaged” (Cohen & Besharov, 2002, p. 14). Nevertheless, especially German companies in the USA (such as Daimler, Bosch and BMW) are establishing dual training structures in their transplants. These companies are acting outside of the established pathways, traditions and routines in Germany, and in many cases, especially in the southern USA, they are acting without a trade union institution, which is a strong promoter of the dual system in Germany. So our questions are: How do these companies establish dual structures in the United States of America? How do they shape the cooperation between companies and schools?

As cooperation will be the focus of the article, we will concentrate on the interface between the schools and the companies. Our theoretical reference

here is the idea of boundary crossing and boundary objects, which are concepts within the broader idea of *expansive learning* in the tradition of Yrjö Engeström: “In expansive learning, learners learn something that is not yet there. In other words, the learners construct a new object and concept for their collective activity, and implement this new object and concept in practice” (Engeström & Sannino, 2010, p. 2).

In the following section, this learning-oriented approach is applied. The aim is to study the Mercedes-Benz (MB) production facility in Tuscaloosa, Alabama. In section 2, the concepts of *boundary crossing* and *boundary objects* are presented as our theoretical framework. In this section, we will also describe the research design (research question, case selection, data collection, data analysis, interpretation) and the case. In section 3, we present the boundary objects of our case study and draw our final conclusions.

2. Theoretical Framework, Research Design and the Case

2.1. Boundary Crossing and Boundary Objects

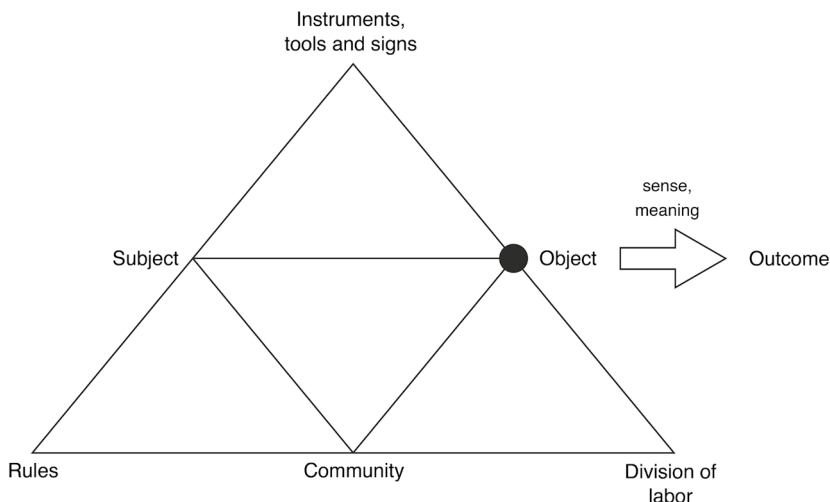
To present the term *boundary crossing*, a brief introduction to Engeström’s activity theory is needed, which is a basic prerequisite for an analysis of learning in hybrid- and multi-organisational contexts (Engeström & Sannino, 2010). Moreover, it specifies the reference framework for the concepts of *boundary objects* and *boundary crossing*, which do not represent self-contained theories.

Any individual activity is integrated into a collective activity system. A trainee’s activity, for example, is his/her own activity in the company, embedded in the activity system of the company. At the same time, the trainee visits the part-time vocational school and is interactive in this activity system as well. It is crucial that the individual is not located at the centre of the activity analysis, but that the activity system is (Engeström, 2008, p. 65). As shown in Figure 1, individual actions (the upper triangle) are embedded into the structures of the collective. The individual’s action has to be seen in the context of a community with a division of labour and shared rules. The result and/or the object of their actions is surrounded by an oval in Figure 1, which means sense formation, surprises and ambiguities – all characterising human acting. Thus, the object lends sense and meaning to the activity. It can represent both a material product and an immaterial, designed thing (e.g. knowledge, service).

An activity system in the corporate (more generally, in the institutional) context exists so that subjects develop something with the assistance of tools and instruments. They do so also as a part of the community. *Expansive learning* is the term coined by Engeström (Engeström et al., 1995; Engeström, 2008), which describes a new development or advancement in an activity system. Advancements are caused by contradictions¹ (Engeström, 1999) resulting from problems that cannot be solved individually in practice, thus leading

1. This term is not purely negatively connoted; contradictions mean conflicts, and in addition, innovative approaches to change (see Geithner, 2014).

Figure 1. Model of an activity system



Source: Based on Engeström (1987, p. 78).

to so-called *double binds*, which are apparently hopeless situations (Bateson, 1972; Engeström, 2008, p. 72). However, *double binds* are solvable by analysing the principles of the activity and by a further development of the collective activity system.

One can also describe *expansive learning* as the release of contradictions by analysing and by crossing the boundary. Thus, considerations from activity theory form the basis of *boundary crossing*. The trainee (see above) changes between the different systems, back and forth (from his/her part-time vocational school, to his/her family, to his/her workplace etc.) and thereby uncovers contradictions. Exceeding this border (*boundary crossing*) is examined in more detail below.

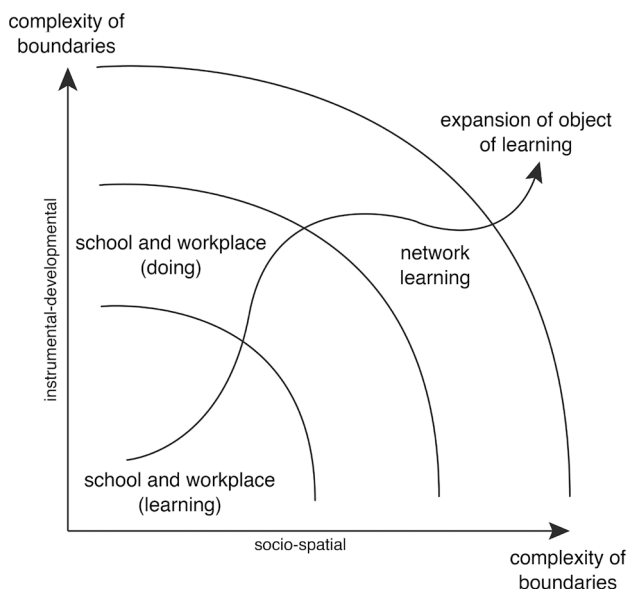
Learning contains boundaries, be it training an inexperienced person who becomes an expert in an area, or one's development from a new member to an established member of a society – the boundary itself is the area or the society (Akkermann & Bakker, 2011). In addition, learning in the case of identity development contains boundaries (e.g. “What is a part of me and what is not?”). With increasing mechanisation and specialisation, these borders become clearer, since networking is possible in all directions, on the one hand, and on the other hand, demarcation is urgently necessary. In recent decades, several studies on boundaries have been carried out (e.g. Star & Griesemer, 1989; Tanggaard, 2007; Trompette & Vinck, 2009; Bakker & Akkermann, 2014). Two concepts have been considered in particular in this context: *boundary crossing* and *boundary objects*. *Boundary crossing* mostly refers to the interaction and transactions of a person between (at least two) different systems.

2.1.1. Boundary crossing

Kerosuo and Toiviainen (2011) describe learning which takes place within *boundary crossing* as a complex process of “constructing and re-constructing new boundaries”. In this context, two boundary complexities are visible: socio-spatial and instrumental-developmental complexities (p. 49 f.).

Socio-spatial boundaries are those that are extended horizontally. As an example, the authors describe a workshop of experts where several cultural and social backgrounds meet, as well as different experiences. Through the cooperation of the individuals in the new context (the workshop), the first part of *boundary crossing* (horizontal) takes place. However, up to this point, according to Kerosuo and Toiviainen, a necessary aspect is missing: the creation and construction of new knowledge, new identities and abilities. Learning is not merely a horizontal process, but also a vertical process (see also Figure 2). The developing aspect of tools and artefacts² is the decisive factor in the yield achieved via cooperation. Exceeding the instrumental-developmental borders requires new concepts and ideas (Gessler & Howe, 2015). In addition, there is learning on different levels. Figure 2 shows that the *boundary crossing* of a trainee takes place at school and on the job within the levels *learning by watching*, *learning by doing* and *network learning*.

Figure 2. Dimensions of boundary crossing



Source: Based on Kerosuo and Toiviainen (2011, p. 49).

2. Passoth (2012, p. 206) defines artefacts as “subjects and embodiments created by humans”; a *boundary object* is an artefact, created across activity systems and with a cross-system connotation.

Akkermann and Bakker (2011) describe the four mechanisms involved in *boundary crossing* (p. 142 ff.).

1. *Identification*: All of the examined studies have *demarcation* in common. This means the challenge of getting along simultaneously in different institutional environments. If, for example, an employee receives private calls during work time, another world interrupts his/her working world. An *institutional identity* is conditional and it must satisfy all environments and must be ready for development.
2. *Coordination*: Coordination requires different aspects in order to receive the work process outright. What is most important is the *communicative connection*, which contains an intensive exchange of all involved individuals. Likewise, *routinisation* belongs to the coordination aspect, through which coordination becomes automatised and operationalised. An example is school grades. At school, grades are certifications in order to judge and make objective evaluations, but during the acceptance procedures for university entrance, school grades are used to decide on whether a candidate will be accepted (or not) and to assess the probability of his/her successful graduation. School grades are the *boundary object* representing the pivotal point between school and university.
3. *Reflection*: This mechanism involves assimilating new perspectives as well as recognising and evaluating the differences between one's own and others' practices. In contrast to identification, which concerns the reconstruction of one's present identity, *reflection* culminates in a completely new designed identity that strongly affects future practices. If, for example, a pupil recognises the difference between "mathematics" in school and in working environments by visiting different workplaces, then his/her attitude towards "learning formulas" may change completely.
4. *Transformation*: Transformation leads to profound changes in the usual practices. Here, *hybridisation* is the first aspect of transformation. By employing a creative process for problem-solving, a hybrid form arises: a culturally completely new form. Components from different contexts are combined to produce something new. An example could be a new interdisciplinary research field. One further aspect belongs to transformation, which Akkermann and Bakker (2011) describe as *constant cooperation at the boundary*, and this is necessary in order to maintain productivity. This requires genuine dialogues and collaboration between all involved partners, particularly if they belong to different activity systems. It is clear then that *boundary objects* would be missing substance without taking into account the activity system.

2.1.2. Boundary objects

Boundary objects are presented as *brokers* in the literature (see, e.g., Kimble et al., 2010, p. 438). This term has a symbolic origin, since brokers also concern themselves with communication between different communities, although

their role is rather indirect. The term *boundary objects* was coined by Star and Griesemer (1989) in their study “Berkeley’s Museum of Vertebrate Zoology”, where they defined a *boundary object* as an “object that lives in multiple social worlds and which has different identities in each” (p. 409).

These are artefacts that can help with *boundary crossing* by representing a translation device. The authors tried to examine these translation devices in more detail; they work by mediating between different participants or institutions. While most studies on *boundary objects* strengthen their role as translation devices, there are also contributions on *boundary objects* that concern the internal dynamics of interaction in social groups (Gal et al., 2005); here, social infrastructures or social identities are examined.

In the following, Star and Griesemer’s (1989) concept is presented.

Boundary objects can be material articles, as well as ideas or abstract thoughts. Participants from different social worlds use a boundary object to translate their respective interests. On the one hand, they address their aims to the object, and on the other hand, they differentiate themselves from each other by using the object. Thus, a *boundary object* fulfils the function of the object from the activity system, because an object is frequently part of different activity systems (Schaal, 2009). Star and Griesemer (1989) define four ideal types of *boundary objects* in their study. These are the (1) ideal type, (2) repositories, (3) coincident boundaries and (4) the standardised form (Star & Griesemer, 1989, p. 410 ff.):

Ideal types are strongly abstracted objects that describe a few details of a thing, for example, an atlas. They are jointly used symbols that can speak about the same object from different perspectives. At the same time, they make precision possible in a specific context.

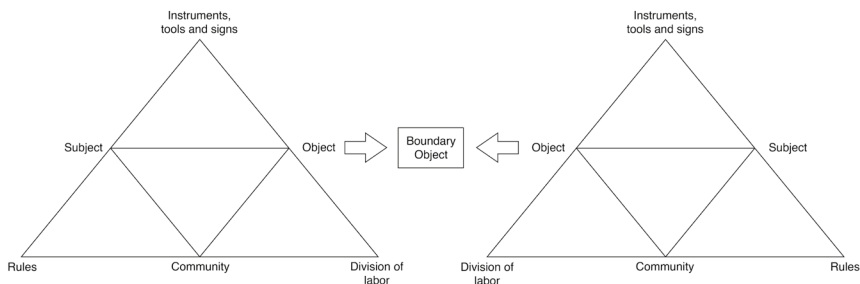
Repositories are characterised by modularity. There are existing components that are used depending on the situation. A library is one example of a repository. Users can help themselves without having to step into negotiation. Individual components (e.g. books, shelves) can be removed without threatening the whole structure.

Coincident boundaries are objects with the same boundaries but different contents. One can call them the “lowest common denominator”. For example, the same object (e.g. a map) can show various emphases: one map might show the most beautiful viewpoints and picnic areas for hikers, while another map of the same region may show the fast routes and more scenic highways for drivers.

Standardised forms are communication forms that make mediation possible via standardisation, for example, if course participants speak different languages. Another example could be a form for patients in which all information about a patient is collected and which is sent to other physicians or hospitals if necessary.

It becomes clear that boundary objects would be missing substance without taking into account an activity system (see Figure 3).

Figure 3. Boundary object as connection of two activity systems



Source: Based on Akkermann and Bakker (2011, p. 139); Schaal (2009, p. 34).

2.1.3. Cooperation and boundaries

An enterprise develops so as to redefine itself through social and technological progress, and in order to remain competitive, customer-oriented services and flexible offerings have to be provided. As an increased adjustment between suppliers, customers and so on become necessary, and transnational cooperation emerges as a successful form of development (Engeström, 2008). It can be assumed that these types of cooperation considerably affect the work activity of the enterprises (Geithner, 2014). For example, a company will adapt its products according to its competitors, partner companies and customers' wishes. The versatile interaction relations require adequate tools and rules of cooperation as well as a shared understanding regarding the cooperative object. Okhuysen et al. (2013) describe cooperation as *boundary activity*. *Boundary crossing* will be increasingly relevant as a sign of cooperation between and within organisations when considering the rise in interlaced working (Engeström, 2009; Gessler & Freund, 2015). Lompscher (2004, p. 158) states that the individual is thus challenged to question the boundaries to reach a common view on the subject of activity and to co-ordinate the actions, means and rules of the activity system; this leads to changes in the entire activity system of the community and to the overcoming of the boundaries.

Oswik and Robertson (2009) stress that *boundary objects* are too often reduced to their role as transformation devices; however, they are much more subject to political processes, are mediators for opposing demands and possibly, they are even the means through which to clarify the balance of power and hierarchies. These aspects should also be kept in mind.

Therefore, a high research interest in the analysis of cooperation between activity systems can be noted (Engeström & Sannino, 2010). Primarily, the focus is on the common object, the shared object and/or the *boundary object*, for example, when analysing networks (Lompscher, 2004; Kerosuo, 2006). The special benefit of the concept of *boundary objects* is that it aims to explain cooperative relations and elements working on a connection as elements between individuals, groups etc. (Schaal, 2009). Flynn et al. (2015, p. 1)

examine so-called industry-school partnerships and notice the challenges of establishing those partnerships, as each partner involved in the cooperative venture has its own aims and frame of reference (such as an educational reference frame or business reference frame).

2.2. Research Design: Case-study Methodology

A case study is a “detailed examination of a single example” (Abercrombie et al., 1984, p. 34). Although there might be concerns using this method, Flyvbjerg (2006) states that “the case study is a necessary and sufficient method for certain important research tasks in the social sciences” (p. 26). Abercrombie et al. (1984) think, for example, that a case study cannot provide any information about the broader class and rather see it as a pilot method in research. In economic research, the case-study method is nevertheless a common and accepted method (Meyer, 2003) and its acceptance is asserting itself also in other social sciences (Gomm et al., 2000).

“The case need not be a person or enterprise. It can be whatever ‘bounded system’ is of interest” (Stake, 1978, p. 7). Our system of interest is the transfer of an educational system to another country, so the country, the company and the vocational education system are relevant.

The selection of the case is crucial for the relevance of the study and its results (Meyer, 2003) and we determined different criteria which the case has to fulfil:

1. Accessibility of data (Rowley, 2002): the data has to be available regarding resources, time and archives.
2. Paradigmatic case (Flyvbjerg, 2006): the company and the sector should play a paradigmatic role in both countries examined.
3. Representativeness and relevance (Eisenhardt & Graebner, 2007): both the country and the company should be representative and the case is supposed to be relevant with regard to the VET systems.

All of the criteria are met in the selected case. In the following, we present the methods that were used to work on the case study (Section 2.2.1) and we describe our data analysis (Section 2.2.2).

2.2.1. Methods

Information on the development of the transplant Mercedes-Benz US International (MBUSI) production facility was initially obtained by analysing existing documents: (1) articles in the *Tuscaloosa News* newspaper; (2) documentation from the factory itself (e.g. DaimlerChrysler, 1999); and (3) academic studies of the factory, which cover specific aspects, such as the production system (Haasen, 1999; Oeltjenbruns, 2000). The analysis of documents is an appropriate method to gather the first batch of extensive information and to supplement other data from the survey (Prior, 2003).

A second source of information was from interviews (spring 2015) with (4) a German training instructor who, as an expatriate in Tuscaloosa, was responsible for the development of dual apprenticeship structures from 2011 to 2014 (duration: 2 hours); (5) the US trainers who were responsible on site at the MBUSI plant (duration: 3 hours); and (6) two course leaders and the academic dean at the colleges (course leaders, duration: 3 hours and 1 hour; dean, duration: 1.5 hours). All of the interviews were semi-structured expert interviews.

Another source involved (7) site visits to the factory (duration: 2 hours) and the college (duration: 3 hours) also in spring 2015. The observations were documented via photos and by noting down the relevant remarks and conspicuousities.

2.2.2. Data analysis

All of the interviews were recorded, transcribed and analysed. For the analysis, we used the four above-mentioned, theory-oriented (top-down) types of *boundary objects* (ideal types, coincident boundaries, standardised forms, repositories) as the main categories and developed eight data-oriented (bottom-up) sub-categories (see Chapter 4). After a thematic pre-analysis, a conventional qualitative content analysis was used for the in-depth analysis (Hsieh & Shannon, 2005).

For the interpretation, we used, on the one hand, the criteria for a successful dual system of Gonon (2014) and, on the other hand, the German dual system for a comparative perspective with a focus on the similarities and differences, which will be clarified in the following section.

2.3. Criteria for Interpretation and Analysis

Gonon (2014) published a list with criteria, which have to be fulfilled “if dual models are to be successful” (p. 244). These criteria are: (1) company criterion (readiness of companies to train); (2) school criterion (second learning venue in addition to the workplace); (3) formal law criterion (e.g. apprenticeship contracts, compulsory school education, certificates); (4) formalised knowledge criterion (the knowledge also has to be formalised and connected to vocational-expert and scientific knowledge); (5) governance criterion (cooperation between the state and the business is essential, so governance aspects which require a culture of cooperation are important as well); (6) vocational practice criterion (an orientation towards a profession/occupation or professional activity); and (7) meritocratic criterion (a dual apprenticeship has to be regarded as a way to develop aspects of one’s career, so a good reputation and links to higher education and other educational paths are relevant). In Chapter 3, Gonon’s criteria are the basis for the analysis of MB’s aspirations to implement a dual training structure.

2.4. Mercedes-Benz US International (MBUSI)

Milestones in the development of the transplant MBUSI in Tuscaloosa (USA) constitute, on the one hand, different stages between 1996 and 2009. During this period, no long-lasting dual apprenticeship structures were established. The history of its development would be incomplete, on the other hand, without the actions that were drawn up in 2009.

In 1989, a weak dollar made exports from Europe to the USA more expensive and Toyota introduced a luxury car onto the premium segment of the market (Lexus). How was MB to react to this situation? At the end of 1992, the executive board decided on a risky solution: a new production facility in the USA and a new type of vehicle. At the beginning of the 1990s, MB (in contrast to Volkswagen, for example) still had little production experience abroad; its reputation and strategy had, until then, been characterised by a clear focus on the location of Germany and the label *Made in Germany*. In the US production facility, a new kind of vehicle was to be produced for the US market: a sport utility vehicle (SUV). In 1995, the first prototype was produced (Haasen, 1999). In 1993, the city of Vance in Tuscaloosa, Alabama, was chosen as the production location. MB was the first automotive manufacturer to decide on this southern state.

The establishment phase of the new plant began with intensive training. In 1996, 160 employees were sent to the production facility in Sindelfingen, Germany, in order to learn the skills that they would need to take up their role as *trainers* in the work process on their return. Another 80 skilled workers from Germany were sent to the USA to work as trainers in order to support these multipliers in the work process. Each team therefore had at least one skilled worker from Germany or one employee who was trained in Germany (Haasen, 1999).

After four years of production, the processes were well enough installed to be able to start on a second (reflexive) learning cycle in 2001: a process of continuous improvement was initiated, including the goal of improving productivity, shortening cycle times and reducing costs. The economic success of MB in Alabama attracted competition. In 1999, Honda opened its own factory in Lincoln, Alabama (80 miles from the MB factory). In 2001, Toyota announced it would open a factory in Huntsville, Alabama (135 miles from the MB factory). In 2002, Hyundai decided on a new factory in Montgomery, Alabama (115 miles from the MB factory). This did not just mean that the labour market changed hugely, but the opening of each new factory meant that a hiring and poaching process was initiated. The question became: How can potential employees be reached and existing employees kept loyal? An expansion of the MB production facility had been planned for 2005 and was to lead to a doubling in employee numbers. The factory management recognised these challenges: "So it is critical that we start preparing students to have the skills necessary to produce world-class automobiles" (Bill Taylor, quoted in Wortham, 2003, p. 1). In 2009, a central decision was made in

Stuttgart, Germany: all C-class cars for the North American market were only to be built in Tuscaloosa starting from 2013. This decision was partly a reaction to the recession in the automotive market caused by the financial and economic crisis of 2007. The production facility in Tuscaloosa that had until then specialised in SUVs, which had also been affected by the crisis, was to be expanded to produce another type of vehicle (mid-range cars) and stabilised. The German national, Markus Schäfer, became the new CEO in Tuscaloosa in July 2010.

Markus Schäfer not only brought the C-class to Tuscaloosa, but also the idea of improving qualifications. He stated: “My challenge is to develop a program geared to the workers, engineers and leadership for what is coming” (quoted in Rubinski & Writer, 2010, p. 2). With Schäfer as CEO, the role of the *power promoter* was filled. Two expatriates from Germany, who worked as training managers in Germany, had already been tasked to develop dual apprenticeship structures in 2011. The role of *technical promoter* was filled by these people. The expatriates were supported locally by a former production employee from Tuscaloosa, who had worked as a group leader until then. This employee took on the role of facilitator and *process promoter* due to his local experience (production system, education and culture).³

3. Co-construction of Boundary Objects between School and Company

We identified eight categories in the four above-mentioned types of *boundary objects*: ideal types, coincident boundaries, standardised forms and repositories (Figure 4).

These eight categories were inspired by criteria that have to be met “if dual models are to be successful” (Gonon, 2014, p. 244). In the following, we summarise our results.

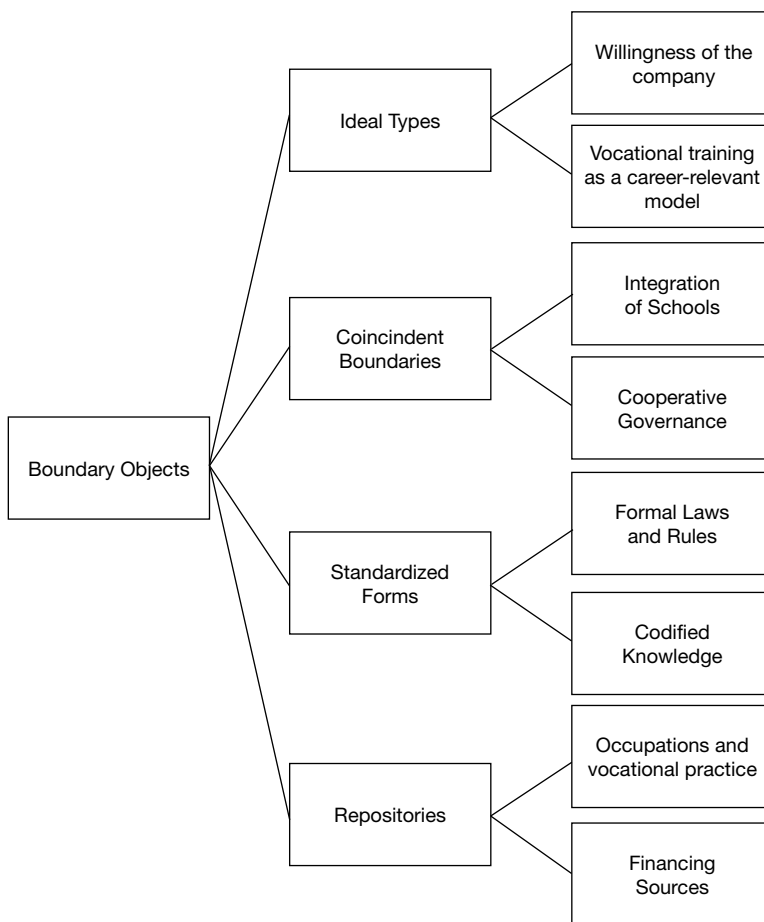
3.1. Boundary Object: Ideal Types

3.1.1. Willingness of the company to train

The willingness and need existed right from the beginning, since 1996. It was necessary since the employees had no previous experience in the production of cars. No dual apprenticeship structure was established, however, but rather an internal company training system that was based on close proximity to the work process. This training system was sufficient at the beginning and in particular, it was compatible with the production system that was based on low variability, a low automation level, the division of labour, and a low level of production and standardisation. Crucial to the choice of production system was not the local culture, but instead a combination of the given completion situation in an international market: the available, potential local workforce, the profit strategy derived therefrom and the popularity of the Toyota Produc-

3. For a detailed description of the development, see Gessler (2016).

Figure 4. Boundary objects



Source: Own elaboration.

tion System, which was used as a role model. The balance between work and knowledge worked well and it became increasingly better until the factory began producing two additional models (R-class and GL-class) instead of just one model (M-class) in the expansion phase as well as a technically more demanding successor model to the M-class. As a response to the first crisis in the training system, a linked high school/apprenticeship system was established in 2003. This system introduced initial formal structures (in particular the *apprentice* status as well as a scheduled time of 3 years), although without solving the problem of developing expertise, since quality aspects (curriculum, infrastructure, etc.) played a minor role in this system. Since the production of the new models and the successor model to the M-class was more demand-

ing (including a self-supporting chassis), although they only constituted different versions of an SUV, the production system and training system were able to remain largely unchanged, despite the existing contradiction (production growth without improving the qualification system). Another reason why the training system did not undergo any extensive modifications was because the ultimate decision rested with the CEO, Bill Taylor, who had the trust of the headquarters in Sindelfingen, Germany. Taylor, in turn, obviously had much confidence in the existing on-the-job training system, on the one hand, which epitomised his understanding of team culture in the factory and, on the other hand, it can be presumed that as a Canadian, he had little experience of the dual apprenticeship system. Still:

[...] and one day, you are running out of workforce. You need your own staff and you have to build it on your own. (Martin Kuehnel, project engineer, expatriate from Germany in Tuscaloosa)

Then, the situation changed when Taylor retired in 2009 and it was decided that the C-class, a technically complex car that was far removed from the SUV, requiring high levels of automation during production, was to be built in Tuscaloosa. The new factory manager, a German, took over the post of CEO in 2010. He immediately started the initiative to establish dual apprenticeship structures in the spring of 2011. The first training courses began in the autumn of 2011. The company's willingness to develop dual apprenticeship structures was thus based on the character of the new CEO and on the change in the product policy and system. Therefore, a new qualification system was also established that not only secured and dispensed knowledge, but also facilitated the development of expertise.

3.1.2. Vocational training as a career-relevant model

The difference between Germany and Tuscaloosa with respect to this characteristic is slight. The apprentices in Tuscaloosa are explicitly trained to have a career, whereby their career is to be regarded, on the one hand, in terms of the hierarchical corporate organisation. On this career path, the apprentices have the same opportunities as all of the employees since they have to prove themselves in the work process. Nevertheless, their chances are good: it is not only expected of leaders (including team leaders and group leaders) that they have special socio-communicative skills, but they must also (as in Germany) be suitable technically since, for example, team leaders have to be capable of filling in for any job within their field of responsibility (e.g. if one of their team members is off sick). On the other hand, their career is also to be regarded horizontally in terms of qualitatively demanding tasks, such as maintenance or quality assurance. This option is the explicit goal of the new apprenticeship model in Tuscaloosa.

3.2. *Boundary Object: Coincident Boundaries*

3.2.1. *Integration of the school learning location*

A major step in the beginning was to find an educational cooperation partner. The equivalent to the German vocational schools in the USA were the technical and vocational high schools. These schools, however, mostly had a poor reputation due to the social stigmatisation attached to vocational education; they were normally not very specific and the role they fulfilled was specific to a US vocational *orientation*. In contrast to the universities, however, they do not charge fees. With a view to the objective of an “improvement of professional *qualifications*”, the 2-year colleges were chosen.

Two-year colleges offer different services: (1) Full-time educational courses with credits (entrance requirement: high school degree), which lead to a degree, qualifying students for a profession (associate degree) in 2 years. This degree then opens up two options: entrance to the labour market or lateral entry to a 4-year college course (= university), where an academic bachelor's degree can be gained after a further 2 years. (2) Full-time educational courses with credits (entrance requirement: high school degree), which lead to a partial qualification with a short-term certificate in less than 2 years. These can lead to an associate degree when further courses are added. (3) Full-time educational courses without credits (no entrance requirements), which serve to acquire specific partial qualifications. These courses are often offered on behalf of companies and should be assigned to the field of further training for companies. The Shelton State Community College in Tuscaloosa, which was ultimately awarded the contract, was distinguished by the fact that it already offered courses for companies and had experience in industrial cooperation. Internally, the possible cooperation with MB was deemed to be good for its image, which is why the college management welcomed the cooperation.

The educational partner in the USA is a state community college, thus the apprentices have student status. The entrance requirement is a high school leaving qualification. In Germany, no school leaving qualification is required in order to begin an apprenticeship. The problem that exists in Germany, where technical work-oriented and academic university-oriented education traditionally constitute two separate systems, does not exist in this configuration in Tuscaloosa. Establishing the system at a higher educational level is further motivated by the stigmatisation of vocational education in the USA.

Another decision in this context was related to the question of personnel and equipment. Tutors were sought and newly hired for the college specifically for their teaching practice and industrial experience. Since Shelton College already ran such courses, some basic equipment was in place. Additional infrastructure was obtained for both courses via sponsorships by MB: cars for the technicians and industrial robots for mechatronics (Placklé et al., 2014).

3.2.2. *Cooperative model*

A further central difference between the dual model in Germany and the US case relates to direct cooperation: (1) In the USA, apprentices initially apply to the college and pre-selection is carried out there. In Germany, apprentices apply to the company. (2) The college curriculum was defined in direct dialogue between the company and college, taking into account local statutory provisions. In Germany, the school curriculum is developed by the state. (3) Coordination takes place continuously in order to synchronise the learning activities. In 2015, four years after the cooperation began, the training managers (MB) and course leaders (college) said they were in daily contact.

It is a one-to-one relationship. We are in a constant communication with the school all the time. [...] Several times a week. (Steve Pauls, HR MBUSI, responsible for the Automotive Technician Program)

In contrast, cooperation between the learning locations in Germany has traditionally been problematic. A further central difference relates to the involvement of the social partners (employer and employee representatives). Trade unions play an important role in Germany, for example, in the development of training curricula at the companies, and the chambers of trade and commerce have an examination monopoly in Germany. In contrast, the trade unions and the chambers are not involved in Tuscaloosa. In the same way, the role of the state differs: in Germany, it sets the framework; in Tuscaloosa, it does not.

3.3. *Boundary Object: Repositories*

3.3.1. *Relation to occupations and vocational practice*

In Germany, the training system is organised according to *occupations that require formal training* as recognised by the Federal Institute for Vocational Education. The standards are defined by the state government in agreement with the companies. In Tuscaloosa, *industry occupations* constitute the reference point: technician, mechatronics and maintenance. These three occupations also exist officially in the German apprenticeship system. However, the duration for the three training programmes is the same: 42 months. In Tuscaloosa, the duration differs: 15, 27 and 45 months. Gonon notes in his description of this criterion that in the dual system, occupations and professionalism are deeply anchored in historical development: “The culture of ‘professionalism’ is deeply dependent on historical traditions” (Gonon, 2014, p. 247; Gessler & Howe, 2013). When MB set up its factory in Alabama, the American South had a tradition of occupations that was hardly compatible or not at all compatible with its own needs (some employees were recruited from vehicle repair shops).

[...] they come here for 15 months and they get the specific training that we need them to have. (Wayne Smith, HR MBUSI, responsible for the Industrial Mechatronics Program)

Therefore, MB was able to build up a training and apprenticeship system that fit with its own needs. In Germany, the framework is set by tradition: 42 months in general.

3.3.2. *Financing*

Financing is also a significant aspect within Euler's (2013) elements regarding dual systems. The question in Tuscaloosa was how the formal structure was to be organised. Three central problems needed to be solved: (1) The college system in the USA is fee-based and tuition fees for one college year are not inconsiderable at approximately US\$10,000 US\$20,000. (2) The commitment to complete training once it has begun is low. The reasons for this are varied and range from lucrative job offers to family problems, which can rapidly become a threat to subsistence since there is no broad social welfare system as there is in Germany. (3) As well as their own living costs, the students are always faced with additional costs such as a car, since there is no public transport system, or for a family member who has got into financial difficulty. As a response to this starting position, a combination of (1) financial support, (2) an incentive system and (3) additional income options was created:

- Financial support and incentive system: MB initially pays 65% of the college tuition fees on the *Mercedes-Benz Automotive Technician Program*. Then, in the second and third terms, either 100% if good grades are achieved or 50% for poor grades. Likewise, MB initially pays 65% of the tuition fees on the *Industrial Mechatronics Program*. In the second term, it is 70% or 35%, in the third term 80% or 40% and from the fourth to seventh term either 100% or 50% of the tuition fees depending on the grades achieved at school.
- Additional income options: the second learning location, the factory, acts, in the context of these two courses, primarily as a place of work with the option of earning additional income. On the *Technician Program*, the apprentices attend college from Monday to Wednesday and work at MB on Thursday and Friday. On the *Mechatronics Program*, only one day, Friday, is scheduled for the factory. In addition, the students also have the possibility of working in the factory voluntarily on Saturdays and during the college holidays. It is intended that formal learning phases are also carried out in the factory, including at the MB training centre.

The financing structure is formalised in Tuscaloosa, and comes from a mixture of financial support for attending college and the possibility of an additional income by working in the factory (see above). MB covers 100% of the costs if the student's performance is good. The rate goes down to 50% if the performance is not sufficient. In Germany, the companies pay around 75% of the costs in the apprenticeship system, while the state pays 25%. A central difference is that the amount of pay for apprentices is variable and dependent on the apprentice's work and learning achievements (at college as

well as in the company). In Germany, pay for apprentices is standardised according to occupation and varies depending on the company and sector, but not depending on personal achievement.

3.4. Boundary Object: Standardised Forms

3.4.1. Formalisation

The established training structure has a high level of formalisation. The apprentices conclude a training contract, albeit not directly with MB in Tuscaloosa but rather with an assigned labour service provider. In Germany, the contracts are concluded directly with the company. Receiving an employment contract after completion of the training is, therefore, a special privilege since this is then concluded with MB. Apart from the legal status, another reason can be seen in the reward and incentive structure of this rule as a reaction to the low level of commitment by students to finishing training once they have started it. This low level of commitment in turn has its origins in the high personal risk as a result of the lack of a broad social welfare system.

Thus far, only two courses have been described that are run in cooperation with the college: automotive technician and industrial mechatronics courses. Automotive technicians are destined for the assembly area (assembly line production based on the division of labour) and are to be employed at the factory in the future and possibly for higher value work such as quality assurance. The level of automation during assembly is low. The industrial mechatronics students are destined *to operate* the industrial robots and are, therefore, employed in the areas of chassis building and the paint shop in particular. The *maintenance* and service work on the industrial robots is technically more demanding. The *Mercedes-Benz Industrial Mechatronics Maintenance Program* course was created for this. It lasts 18 months altogether, takes place in the factory without the cooperation of the college and is only intended for selected students who have completed the *Industrial Mechatronics* course. A curriculum was created for the maintenance course that consists of a 12-month (from 18 months) off-the-job course and it has a modular structure. The courses are integrated into practice: the apprentices are given learning and work tasks that have to be put into practice. At the beginning of the course, these “apprentices” receive a regular employment contract and regular pay.

Three courses were therefore established: (1) the Mercedes-Benz Automotive Technician Program (dual, 15 months); (2) the Industrial Mechatronics Program (dual, 27 months); and (3) the Mercedes-Benz Industrial Mechatronics Maintenance Program (only in the factory, 18 months, apprentices are required to complete the Industrial Mechatronics Program). Boundary objects between institutions (school and company) are only necessary for the first two programmes. But inner-institutional boundary objects seem to be necessary for the establishment of the third program, but this is another topic.

3.4.2. Codified knowledge

The second step was a matter of which qualifications and degrees the students completing the course should be awarded. It was decided that they should be awarded regular degrees (associate degrees and short-term degrees) since these are known and accepted in North American society. The option of being awarded a German occupational qualification via the German-American Chamber of Commerce USA-South was not pursued. The curriculum was also partly decided by the chosen college. Accredited courses are subject to the supervision of the Alabama Department of Postsecondary Education. This department defines the *instructional goals* and the *student learning outcomes* to be achieved for each course at community colleges. For the *Mercedes-Benz Automotive Technician Program* (length: 15 months), courses from the existing *Automotive Mechanics* college program were selected for the award of a short-term certificate. For the higher grade *Industrial Mechatronics Program* (length: 27 months), courses from the existing *Industrial Electronics Technology* programme were selected for the award of an associate degree in conjunction with an additional short-term certificate. General educational courses from the fields of *History, Social and Behavioural Sciences* were added to the specialist courses. The structure of the course content, therefore, followed an existing standard, on the one hand, and was organised according to the wishes of MB, on the other hand.

4. Conclusion

Finally, the question remains as to whether the boundary objects of the dual vocational training system in Tuscaloosa constitute an imitation, adaption or innovation. It is obviously not an imitation. The differences are too marked (e.g. vocational high school in Germany/college in the USA, standardised wages in Germany/flexible wages in the USA, standardised duration in Germany/staggered duration in the USA). It is not an adaption either, however, since new contexts (such as cooperation between the college and company) had to be developed in the context of an expansive learning process. Lewis (2007) calls this conceptual borrowing with the following characteristic: “The borrowing country abstracts the intent of the model of interest and designs a system that maintains its essence but takes on local character” (p. 474). Is it by implication an innovation? With a view to initial vocational education and training in the USA, this question can be answered with a “yes”. The fact that companies assume responsibility for the training of their employees, negotiate curricula with colleges and understand learning as a value that is worthy of being paid is unusual in the USA. The close cooperation practised every day by the company and college would nevertheless also constitute an innovation in Germany, too. In Germany, the existing cooperation between the learning locations of the company and school is rated as unsatisfactory and the non-cooperation often constitutes the statistically “normal case” (Zlatkin-Troitschanskaia, 2005, p. 1). The staggered duration of apprentice-

ships is currently a controversial topic in Germany and the idea of training wages in relation to personal achievement has not yet been taken up in Germany. An interesting question would therefore be if the experiences abroad initiate an *educational retransfer* from MBUSI in the United States to Mercedes-Benz in Germany (Gessler, 2016).

Bibliographical references

- ABERCROMBIE, N., HILL, S., & TURNER, B. S. (1984). *Dictionary of sociology*. Harmondsworth: Penguin.
- AKKERMANN, S. F. & BAKKER, A. (2011). Boundary crossing and boundary objects. *Review of Educational Research*, 81(2), 132-169.
- BAKKER, A. & AKKERMANN, S. F. (2014). A boundary-crossing approach to support students' integration of statistical and work-related knowledge. *Educational Studies in Mathematics*, 86(2), 223-237.
- BATESON, G. (1972). *Steps to an ecology of mind*. San Francisco: Chandler.
- COHEN, M. & BESHAROV, D. J. (2002). *The role of career and technical education: Implications for the federal government*. Washington: Office of Vocational and Adult Education. Retrieved from <<http://files.eric.ed.gov/fulltext/ED466939.pdf>>.
- DAIMLERCHRYSLER (1999). *Mercedes-Benz Produktionssystem: Systembeschreibung*. Stuttgart, Germany. Retrieved from <http://engp-download.daimler.com/docmaster/en/doc/MPS_-_SYSTEMBESCHREIBUNG.2000-01-17.DE.pdf>.
- DEUTSCHER AUSSCHUSS FÜR DAS ERZIEHUNGS- UND BILDUNGSWESEN (ed.). (1965). *Empfehlungen und Gutachten 7/8: Gutachten über das Berufliche Ausbildungs- und Schulwesen, Bonn 10. Juli 1964*. Stuttgart: Klett.
- EISENHARDT, K. & GRAEBNER, M. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal*, 50(1), 25-32.
- ENGESTRÖM, Y. (1987). *Learning by expanding: An activity-theoretical approach to developmental research*. Helsinki: Orienta-Konsultit.
- (1999). *Lernen durch Expansion*. Marburg: BdWI.
- (2008). *Entwickelnde Arbeitsforschung. Die Tätigkeitstheorie in der Praxis*. Berlin: Lehmanns.
- (2009). The future of activity theory: A rough draft. In A. SANNINO, H. DANIELS, & K. D. GUTIÉRREZ (eds.). *Learning and expanding with activity theory* (pp. 303-328). Cambridge: Cambridge University Press.
- ENGESTRÖM, Y., ENGESTRÖM, R. & KÄRKKÄINEN, M. (1995). Polycontextuality and boundary crossing in expert cognition: Learning and problem solving in complex work activities. *Learning and Instruction*, 5(1), 319-336.
- ENGESTRÖM, Y. & SANNINO, A. (2010). Studies of expansive learning: Foundations, findings and future challenges. *Educational Research Review*, 5(1), 1-24.
- EULER, D. (2013). *Germany's dual vocational training system: A model for other countries?* Gütersloh: Bertelsmann Stiftung.
- FLYVBJERG, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, 12(2), 219-245.
<<http://dx.doi.org/10.1177/1077800405284363>>
- FLYNN, M., PILLAY, H. & WATTERS, J. (2015). Boundary crossing: A theoretical framework to understand the operational dynamics of industry-school partnerships. *TVET@Asia*, 5, 1-17. Retrieved from <http://www.tvet-online.asia/issue5/flynn_etal_tvset5.pdf>.

- GAL, U., YOO, Y. & BOLAND JR., R. (2005). *The dynamics of boundary objects, social infrastructures and social identities* (Paper 57). Paper presented at the ECIS 2005 Proceedings. Retrieved from <<http://aisel.aisnet.org/ecis2005/57>>.
- GEITHNER, S. (2014). Arbeit als Tätigkeit. In J. SYDOW, D. SADOWSKI & P. CONRAD (eds.). *Managementforschung 24* (pp. 1-32). Wiesbaden: Springer Fachmedien.
- GESSLER, M. (2016). Educational transfer as transformation: A case study about the emergence and implementation of dual apprenticeship structures in a German automotive transplant in the United States. *Vocations and Learning*. Advance online publication. <<http://dx.doi.org/10.1007/s12186-016-9161-8>>
- (2017). Areas of Learning: The Shift Towards Work and Competence Orientation Within the School-based Vocational Education in the German Dual Apprenticeship System. In M. MULDER (ed.). *Competence-Based Vocational and Professional Education. Bridging the World of Work and Education* (pp. 695-717). Cham: Springer International Publishing.
- GESSLER, M. & FREUND, L. (eds.) (2015). *Crossing Boundaries in Vocational Education and Training: Innovative Concepts for the 21st Century*. Bremen: Institut Technik und Bildung.
- GESSLER, M. & HOWE, F. (2013). The German dual vocational training system: The origin of the current architecture. *Bulletin of Institute of Technology and Vocational Education, Nagoya University Japan*, 10, 17-28.
- (2015). From the Reality of Work to Grounded Work-Based Learning in German Vocational Education and Training: Background, Concept and Tools. *International Journal for Research in Vocational Education and Training*, 2(3), 214-238.
- GONON, P. (2014). Development cooperation in the field of vocational education and training: The dual system as a global role model? In M. MAURER & P. GONON (eds.). *The challenges of policy transfer in vocational skill development* (pp. 241-259). Bern, Switzerland: Peter Lang.
- HAASEN, A. (1999). M-Class: The making of a new Daimler-Benz. *Organizational Dynamics*, 27(4), 74-78.
- GOMM, R., HAMMERSLEY, M. & FOSTER, P. (eds.) (2000). *Case study method*. London: Sage.
- HSIEH, H.-F. & SHANNON, S. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research*, 15(9), 1277-1288.
- KEROSUO, H. (2006). *Boundaries in action: An activity-theoretical study of development, learning and change in health care for patients with multiple and chronic illnesses*. Helsinki: University of Helsinki.
- KEROSUO, H. & TOIVAINEN, H. (2011). Expansive learning across workplace boundaries. *International Journal of Educational Research*, 50, 48-54.
- KIMBLE, C., GRENIER, C. & GOGLIO-PRIMARD, K. (2010). Innovation and knowledge sharing across professional boundaries: Political interplay between boundary objects and brokers. *International Journal of Information Management*, 30, 437-444.
- LEWIS, T. (2007). The problem of cultural fit: What can we learn from borrowing the German dual system? *Compare: A Journal of Comparative and International Education*, 37(4), 463-477.
- LOMPSCHER, J. (2004). *Lernkultur Kompetenzentwicklung aus kulturhistorischer Sicht. Lernen Erwachsener im Arbeitsprozess*. Berlin: Lehmanns.
- MEYER, J.-A. (2003). Die Fallstudie in der betriebswirtschaftlichen Forschung und Lehre. *Wirtschaftswissenschaftliches Studium*, 32(8), 475-479.

- OELTJENBRUNS, H. (2000). *Organisation der Produktion nach dem Vorbild Toyota. Analyse, Vorteile und detaillierte Voraussetzungen sowie die Vorgehensweise zur erfolgreichen Einführung am Beispiel eines globalen Automobilkonzerns*. Aachen, Germany: Shaker.
- OKHUYSEN, G. A., LEPAK, D., ASHCRAFT, K. L., LABIANCE, G., SMITH, V. & STEENSMAN, H. K. (2013). Theories of work and working today. *Academy of Management Review*, 38(4), 491-502.
- OSWICK, C. & ROBERTSON, M. (2009). Boundary objects reconsidered: From bridges and anchors to barricades and mazes. *Journal of Change Management* 9, 179-194.
- PASSOTH, J.-H. (2012). Dinge der Wissenschaft. In S. MAASEN, M. KAISER, M. REINHARD & B. SUTTER (eds.). *Handbuch Wissenschaftssoziologie* (pp. 203-212). Wiesbaden: Springer Fachmedien.
- PLACKLÉ, I., KÖNINGS, K., JACQUET, W., STRUYVEN, K., LIBOTTON, A., MERRIËNBOER, J. & ENGELS, N. (2014). Students' preferred characteristics of learning environments in vocational secondary education. *International Journal for Research in Vocational Education and Training*, 1(2), 107-124.
- PRIOR, L. (2003). *Using documents in social research*. London: SAGE Publications.
- ROWLEY, J. (2002). Using case studies in research. *Management Research News*, 25(1), 16- 27.
- RUBINSKI, P. & WRITER, S. (2010, November 14). Schaefer was key to bringing the C-Class to Vance. *Tuscaloosa News*. Retrieved from <<http://www.tuscaloosanews.com/article/20101114/NEWS/101119885/0/>>.
- SCHAAL, S. (2009). Arbeitstätigkeit in Organisationen: Betrachtung aus Sicht der Tätigkeitstheorie, der Akteur-Netzwerk-Theorie und des boundary object. In K. P. SCHULZ & S. GEITHNER (eds.). *Lerntätigkeit und Arbeitsgestaltung Nr. 01/2009* (pp. 1-54). Chemnitz: TU Chemnitz.
- STAR, S. L. & GRIESEMER, J. R. (1989). Institutional ecology, "translations" and boundary objects: Amateurs and professionals in Berkeley's museum of vertebrate zoology. *Social Studies of Science*, 19(3), 387-420.
- STAKE, R. E. (1978). The case study method in social inquiry. *Educational Researcher*, 7(2), 5-8.
- TANGGAARD, L. (2007). Learning at trade vocational school and learning at work: boundary crossing in apprentices' everyday life. *Journal of Education and Work*, 20(5), 453-466.
- TROMPETTE, P. & VINCK, D. (2009). Revisiting the notion of Boundary Object. *Revue d'anthropologie des connaissances*, 3(1), 3-25.
- WORTHAM, A. (2003, February 6). Mercedes-Benz announces West Alabama apprenticeship program. *Tuscaloosa News*. Retrieved from <<http://www.tuscaloosanews.com/article/20030206/NEWS/302060002/0/>>.
- ZLATKIN-TROITSCHANSKAIA, O. (2005). Kooperation zwischen Ausbildungsinstitutionen und Lernorten in der beruflichen Bildung – eine multidisziplinäre Analyse. *Bildungsforschung*, 2(1), 1-26.