Technische Universität Dortmund

Fakultät Wirtschaftswissenschaften

THE EMERGENCE OF INTERDISCIPLINARY STRUCTURES IN ACADEMIC PROJECT SETTINGS

–

A case study of a project for inclusive teacher training at a German university

Dissertation zur Erlangung des akademischen Grades Doctor rerum politicarum (Dr. rer. pol.)

vorgelegt von Anna-Lena Margareta Rose

geboren am 05.08.1991 in Gelsenkirchen

Betreuerin: Prof. Dr. Liudvika Leišytė

Januar 2026

Acknowledgements

This dissertation would not have been possible without the support of many people in my private and academic life. I would like to express my sincere gratitude to my supervisor, Prof. Dr. Liudvika Leišytė. I first met Liudvika while writing my bachelor's thesis, and her guidance has shaped my academic journey ever since. Throughout the years, she consistently encouraged, supported, and constructively challenged me. Under her mentorship, I have grown immensely both as a researcher and a person. I also thank Prof. Dr. Uwe Wilkesmann and Prof. Dr. Christine Musselin for their guidance and for offering their time to review my work.

A big thank you goes to the rest of the 'PhD family' at the Professorship of Higher Education – Benjamin, Julia, Sude, Sheron, Panos, Nina, Lina, and Anja –, who have shared smaller and larger parts of the journey with me. Spending all these years with you has resulted in two key takeaways: You are never alone with your struggles and sorrows – and sharing them lightens the load for everyone, and: Writing is easier when there are alpacas around!

To the respondents of this study who, although remaining anonymous, are no less important: I thank you for your openness and trust, without which this study would not have been possible. I further gratefully acknowledge everyone who has provided valuable feedback at different stages of my work along the way, including, but not limited to, colleagues from other parts of the Center for Higher Education (zhb) and the colleagues whom I have met during my stay at the Centre de Sociologie des Organisations (CSO) at Sciences Po Paris.

And finally, to my family: I thank my parents for always believing in me and supporting the choices I make. I will be forever grateful to Tobias for his love and support in combining my academic aspirations with family life. And thank you, Julius, for challenging me in completely new ways and teaching me to see the world through new eyes.

Summary

This dissertation focusses on the emergence of interdisciplinary structures in academic project settings. Interdisciplinarity in higher education has gained rising importance in past decades and has become a focus of policy makers, funding agencies, and university leaders in higher education systems across the world. Theories anticipating increased collaboration and integration of the academic disciplines have existed for nearly three decades. Nevertheless, the power and institutional reach of disciplines remains strong and interdisciplinary initiatives are episodic or located in informal spaces or at the margins of organisational charts. Existing research predominantly focusses on analyses of barriers to interdisciplinarity as well as on interdisciplinarity within the context of top-down implemented structures such as graduate schools or interdisciplinary research centres. Consequently, there is limited understanding of processes resulting in the emergence of interdisciplinarity, particularly within traditionally disciplinary organisational settings at universities.

This dissertation therefore aims to contribute to an understanding going beyond barriers to interdisciplinarity by showing how and why interdisciplinary structures can successfully emerge within the context of academic projects in universities. It addresses the question of how new structures emerge across traditional boundaries in academic project settings. This research question is guided by the following sub-questions: 1) What kind of interdisciplinary structures emerge within academic project settings and which actors participate in them? 2) How do these actors contribute to the emergence of interdisciplinary structures and what motivates them to do so? and 3) Which factors inhibit or promote the emergence of interdisciplinary structures?

Using theories that bridge discourses on structure and agency in organisations – Giddens' (1984) structuration theory and Hallett and Ventresca's (2006) inhabited institutionalism – as sensitising concepts, a longitudinal,

ethnographic, revelatory single-case study of a project for inclusion-oriented and inclusive teacher training at a German university was conducted. The research questions were addressed by employing various methods of data collection and analysis. Data were gathered through participatory observation, two focus group discussions with PhD students and post-docs in the case study project, 24 problem-centred interviews with a broad range of case study participants from different status groups and the collection of documents and website information in the years 2016–2020. Analysis was guided by principles of constructivist grounded theory and enriched by a social network analysis based on co-publications.

Chapters 1 to 5 of this dissertation introduce the research problem and constitute the empirical and conceptual foundation of the study, focussing on the topics of university organisation, disciplines and interdisciplinarity, particularities of the German higher education system, as well as theories on the interconnectedness of structure and agency in organisations. In Chapter 6, the methodological approach of the study is addressed and risks and limitations associated with methodological choices are discussed. Chapters 7 to 9 contain the presentation of research findings, outlining a) what kind of interdisciplinary structures have emerged, b) which actors have been engaged in them and what has motivated them to do so, and c) which factors have inhibited and promoted the emergence of interdisciplinary structures. The dissertation concludes with a critical discussion of research findings (Chapter 10) and a conclusion (Chapter 11), containing answers to the research questions and a discussion of theoretical contributions and practical implications as well as limitations of the study.

Findings show that different kinds of interdisciplinary structures with various topical foci, operational dynamics, and varying perceptions of participants of (multi-, pluri-, cross-, inter-, and trans-)disciplinary collaboration have emerged within the context of the case study. The study underlines that the emergence of interdisciplinary structures in academic project settings

constitutes a dynamic social process shaped by both structural conditions and collective agency. Based on the study, a novel typology of interdisciplinary actors is proposed, distinguishing routine actors (continuing previous research interests and collaborations), sense-making actors (engagement in sense-making activities through search for disciplinary synergies and common definitions) and two types of strategic actors (pure interdisciplinarians and pragmatic interdisciplinarians – both strategically contributing to interdisciplinarity based on high degrees of intrinsic motivation).

Several challenges to and facilitators for interdisciplinary were identified on the individual, the organisational, and the supra-organisational level. Challenges were mostly grounded in differences in epistemic cultures and practices and the strongly discipline-based organisation of universities. Key facilitators for the emergence of interdisciplinary structures included appreciation and encouragement on a project and organisational level, addressing the diverse needs and preferences of participants through the provision of a variety of interdisciplinary formats and structures, as well as the protection of interdisciplinarity vis-à-vis demands posed by traditional university structures.

The contributions of this study are as follows: It contributes to the theoretical discussion in international literature on higher education by framing interdisciplinarity not as a purely planned structural arrangement, but highlighting its emergent properties within the context of academic project settings. It further extends the body of existing literature on interdisciplinarity by not only confirming findings regarding barriers to interdisciplinarity, but by providing evidence of facilitating factors for interdisciplinarity. The study additionally informs organisational theory in higher education by demonstrating that organisational change towards interdisciplinarity does not only depend on situated interaction and shared interpretation, but heavily relies on the types and motivations of actors – see above-mentioned typology

– as well. Moreover, the study shows how projects as a form of temporary organisation can facilitate deviation from formal structures and establish a bounded but flexible organisational framework in which disciplinary boundaries become more permeable.

The limitations of the study are mainly grounded in methodological design choices. While the ethnographic single-case design provided in-depth, concrete, context-dependent knowledge which can contribute to theory making, it does not allow for generalisation in a statistical sense. The study was further based in the context of German higher education, which may hamper generalisation to other contexts. Nevertheless, this dissertation shows how and why interdisciplinary structures can successfully emerge within the context of academic projects in universities, providing valuable insights for policy-makers, university leaders, as well as academics interested in understanding and making structured interdisciplinary collaborations work in universities across different higher education systems.

Zusammenfassung

Diese Dissertation befasst sich mit der Entstehung interdisziplinärer Strukturen im Kontext wissenschaftlicher Projekte. Interdisziplinarität hat in der Hochschulbildung und -forschung in den vergangenen Jahrzehnten zunehmend an Bedeutung gewonnen und ist zu einem zentralen Anliegen politischer Entscheidungsträger, Förderorganisationen und Hochschulleitungen in Hochschulsystemen weltweit geworden. Theorien, die eine zunehmende Zusammenarbeit und Integration wissenschaftlicher Disziplinen prognostizieren, existieren seit nahezu drei Jahrzehnten. Gleichwohl bleiben Macht und institutionelle Reichweite wissenschaftlicher Disziplinen stark und sind interdisziplinäre Initiativen häufig episodisch, informell verortet und nicht strukturell verankert. Die bestehende Forschung konzentriert sich überwiegend auf die Analyse von Barrieren für Interdisziplinarität sowie auf Interdisziplinarität im Kontext hierarchisch implementierter Strukturen wie Graduiertenkollegs oder interdisziplinärer Forschungszentren. Folglich besteht ein begrenztes Verständnis der Prozesse, die zur Entstehung von Interdisziplinarität führen, insbesondere innerhalb traditionell disziplinär organisierter Hochschulstrukturen.

Ziel dieser Dissertation ist es daher, ein über Barrieren hinausgehendes Verständnis zu schaffen und aufzuzeigen, wie und warum interdisziplinäre Strukturen an Universitäten erfolgreich entstehen können. Konkret untersucht wird die Frage, wie neue Strukturen in wissenschaftlichen Projektkontexten über traditionelle disziplinäre Grenzen hinweg entstehen. Diese übergeordnete Forschungsfrage wird durch folgende Teilfragen geleitet: 1) Welche Arten interdisziplinärer Strukturen entstehen in wissenschaftlichen Projektkontexten und welche Akteure beteiligen sich an ihnen? 2) Wie tragen Akteure zur Entstehung interdisziplinärer Strukturen bei und was motiviert sie hierzu? und 3) Welche Faktoren hemmen oder fördern die Entstehung interdisziplinärer Strukturen?

Zur Beantwortung dieser Fragen wurde zwischen 2016 und 2020 eine longitudinale, ethnographische, explorative Einzelfallstudie eines wissenschaftlichen Projekts zur inklusionsorientierter Lehrer*innenbildung an einer deutschen Universität durchgeführt. Hierbei dienten Giddens‘ (1984) Strukturationstheorie und Hallett und Ventrescas (2006) *inhabited institutionalism*, die beide objektivistische (strukturbetonte) und subjektivistische (handlungsbetonte) Ansätze verbinden, als theoretische Sensibilisierungskonzepte. Die Forschungsfragen wurden mithilfe verschiedener Methoden der Datenerhebung und -analyse bearbeitet. Die Datengrundlage umfasste teilnehmende Beobachtungen, zwei Fokusgruppendiskussionen mit Promovierenden und Postdocs des Fallstudienprojekts, 24 problemzentrierte Interviews mit einer breiten Gruppe von Projektbeteiligten aus unterschiedlichen Statusgruppen sowie die Analyse von Dokumenten und Webseiteninformationen. Die Analyse folgte den Prinzipien der konstruktivistischen Grounded Theory und wurde durch eine soziale Netzwerkanalyse auf Basis von Ko-Publikationen von Projektbeteiligten ergänzt.

Kapitel 1 bis 5 dieser Dissertation stellen das Forschungsproblem dar und bilden die empirische und konzeptionelle Grundlage der Arbeit. Hierfür befassen sie sich mit der Organisation von Universitäten, Disziplinen und Interdisziplinarität, den Besonderheiten des deutschen Hochschulsystems sowie Theorien zur Verschränkung von Struktur und Handlung in Organisationen. Kapitel 6 widmet sich dem methodischen Vorgehen sowie den damit verbundenen Risiken und Limitationen. Kapitel 7 bis 9 präsentieren die Forschungsergebnisse und zeigen auf a) welche Arten interdisziplinärer Strukturen entstanden sind, b) welche Akteure daran beteiligt waren und was sie motivierte, und c) welche Faktoren die Entstehung interdisziplinärer Strukturen gehemmt oder gefördert haben. Die Arbeit schließt mit einer kritischen Diskussion der Ergebnisse (Kapitel 10) sowie einem Fazit (Kapitel 11) ab.

Die Ergebnisse zeigen, dass im Kontext der Fallstudie unterschiedliche Arten interdisziplinärer Strukturen mit verschiedenen thematischen Schwerpunkten, operativen Dynamiken und variierenden Wahrnehmungen von (multi-, pluri-, cross-, inter- und trans)disziplinärer Zusammenarbeit entstanden sind. Die Studie verdeutlicht, dass die Entstehung interdisziplinärer Strukturen in wissenschaftlichen Projektkontexten einen dynamischen sozialen Prozess darstellt, der sowohl durch strukturelle Bedingungen als auch durch kollektive Handlungsmacht geprägt ist. Auf dieser Grundlage wird eine neue Typologie interdisziplinärer Akteure vorgeschlagen, die zwischen *routine actors* (Fortführung bestehender Forschungsinteressen und Kooperationen), *sense-making actors* (Beteiligung an Sinnbildungsprozessen durch die Suche nach disziplinären Synergien und gemeinsamen Definitionen) sowie zwei Typen strategischer Akteure (*pure interdisciplinarians* und *pragmatic interdisciplinarians* – beide mit hohem Maß an intrinsischer Motivation) unterscheidet.

Herausforderungen und förderliche Faktoren für Interdisziplinarität wurden auf individueller, organisationaler und supraorganisationaler Ebene identifiziert. Herausforderungen waren vor allem in Unterschieden epistemischer Kulturen und Praktiken sowie in der stark disziplinär geprägten Organisation von Universitäten begründet. Zentrale förderliche Faktoren waren Wertschätzung und Unterstützung auf Projekt- und organisationaler Ebene, die Berücksichtigung unterschiedlicher Bedürfnisse und Präferenzen durch vielfältige interdisziplinäre Formate sowie der Verteidigung interdisziplinärer Arbeit gegenüber Anforderungen traditioneller universitärer Strukturen.

Diese Studie leistet einen Beitrag zur internationalen Hochschulforschungsliteratur, indem sie Interdisziplinarität nicht primär als geplante Struktur versteht, sondern als emergentes Phänomen konzeptualisiert. Sie erweitert die bestehende Forschung, indem sie neben Barrieren auch fördernde Faktoren empirisch belegt. Darüber hinaus leistet

sie einen Beitrag zu Organisationstheorien in der Hochschulforschung, indem sie zeigt, dass organisationaler Wandel hin zu Interdisziplinarität nicht nur von Interaktion und gemeinsamer Interpretation abhängt, sondern wesentlich auch von Typen und Motivationen der Akteure geprägt ist – siehe auch die oben vorgestellte Typologie. Zudem wird aufgezeigt, wie Projekte als temporäre Organisationsformen Abweichungen von formalen Strukturen ermöglichen und einen Rahmen konstituieren, innerhalb dessen disziplinäre Grenzen durchlässiger werden.

Die Limitationen der Studie ergeben sich vor allem aus dem methodischen Design. Die ethnographische Einzelfallstudie ermöglicht zwar tiefgehende, kontextspezifische Erkenntnisse, erlaubt jedoch keine statistische Verallgemeinerung. Zudem ist der Kontext des deutschen Hochschulsystems zu berücksichtigen, dessen besondere Merkmale eine Übertragung der Ergebnisse auf andere Systeme erschweren können. Dennoch zeigt diese Arbeit, wie und warum sich interdisziplinäre Strukturen in wissenschaftlichen Projekten erfolgreich herausbilden, und generiert damit relevante Einsichten für Politik, Hochschulleitungen und Wissenschaftlerinnen und Wissenschaftler, die strukturierte interdisziplinäre Zusammenarbeit in unterschiedlichen Hochschulsystemen analysieren und gestalten möchten.

Table of Contents

List of tables and figures

Abbreviations

HE	Higher education
EMCR	Early- and mid-career researchers

1. Introduction

Organisational research increasingly highlights the dependence of organisations on their social and cultural environments (Meyer et al., 2006). This does also apply to universities, which are regarded as a very specific and highly complex type of organisations (Musselin, 2008), as they involve different organisational components, cultures, and interests and are inhabited by individuals and groups with multiple, often-conflicting roles and identities, while being accountable to a great variety of stakeholders at the same time. In recent years, we have witnessed rising external pressures and demands on universities, often related to contributing to certain social or economic goals (Berman, 2011; Gibbons et al., 1994; Martin, 2003). Efforts to react to these pressures and demands are expected to lead to changes in the way in which universities are organised and engage with their (social) environment, as well as to changes in the production of academic knowledge (Leišytė & Wilkesmann, 2016; Sigl & Leišytė, 2018).

One of the central phenomena related to these developments has been the rise of interdisciplinarity in higher education. Over the course of the past decades, interdisciplinarity has become a focus of policy makers and funding agencies and there is increasing demand and encouragement for academics to produce knowledge in multidisciplinary or interdisciplinary collaborations and to convey knowledge to students in interdisciplinary teaching programmes (Cummings & Kiesler, 2005; Henkel, 2007; Holley, 2009). There are growing demands for universities to address societal challenges, which are of increasingly complex nature and can oftentimes no longer be approached with the questions asked and methods applied by single disciplines. It is argued that, instead, problems such as climate change, energy shortage, or population growth require interdisciplinary approaches to knowledge production (Cummings & Kiesler, 2005; Engwall, 2018). Interdisciplinary knowledge production is said to be able to lead to "cognitive advancements […] in ways that would have been impossible or unlikely through single disciplinary

means" (Boix-Mansilla & Duraising, 2007, p. 219), and is thus regarded as a means to solving these challenges. As a consequence, policy actors and funding agencies on multiple levels as well as universities themselves are increasingly active in promoting interdisciplinary research activities (Huutoniemi et al., 2010; Jacobs & Frickel, 2009).

Calls for interdisciplinarity in universities are, however, not only limited to research, but do also extend to teaching. As Weingart (2014) points out, the massification of higher education has led to the fact that up to 50 percent of a cohort in higher education is no longer trained for research or professional fields such as medicine, law, or education, but for labour markets that have needs that reach "beyond the range of disciplines". Therefore, in many circles "discipline-based scholarship is no longer regarded as sufficient qualification for university teaching" (Henkel, 2007, p. 200). Instead, the new focus on the employability of graduates and attempts to meet an increased demand for quality in education have resulted into a shift towards interdisciplinarity in teaching in higher education.

1.1 Research problem

Theories of a 'Mode 2' of knowledge production or of 'post-normal science', both anticipating increased collaboration and integration of the academic disciplines (Funtowicz & Ravetz, 1993; Gibbons et al., 1994) have existed for nearly three decades. Yet, interdisciplinarity has still not fully arrived in universities and other research organisations. Quite the contrary: Weingart (2014) argues that the power and institutional reach of disciplines has remained impressively strong and is "constantly self-reinforcing". Other authors claim that despite the increase in external demands and pressures, universities tend to approach interdisciplinarity as a trend rather than implementing comprehensive reforms (Rhoten, 2004), and pursue episodic financial incentives (Sá, 2008) instead of creating sufficient conditions to cause lasting change. While many universities implement changes to promote interdisciplinary collaboration, structural barriers oftentimes remain

(Weingart, 2014). Interdisciplinary research units, for example, which are often referred to as best-practice examples as they offer tangible locations for interdisciplinary collaboration, tend to remain at the margins of institutional power (Eckel, 2006) and entail problems such as a lack of interplay of research and teaching and growing differentiation in universities' research and teaching structures and academic personnel (Reichert et al., 2012).

Theories from other organisational fields provide insights into topics related to organisational learning and organisational change, yet they are oftentimes not fully applicable to universities due to their specific characteristics and have to be treated with caution. While existing literature in the field of higher education includes many studies on academic collaboration, some of which with a focus on interdisciplinarity, there is a lack of knowledge specifically with regard to the emergence of structures across disciplinary boundaries. However, -although existing literature brings forward a broad range of assumptions and discussions on phenomena presumably constitutive of interdisciplinarity-, there is a lack of understanding of processes that produce and transform interdisciplinarity relationships (Jacobs & Frickel, 2009). Moreover, when they deal with the topic of interdisciplinary structures, existing studies focus predominantly on top-down implemented structures such as interdisciplinary research centres – which lack traditional faculty boundaries – or graduate schools.

Consequently, there is limited understanding of processes resulting in the emergence of interdisciplinarity, particularly within traditionally disciplinary organisational settings at universities.

1.2 Aims and research questions

In the light of increasing political, societal and institutional demands for interdisciplinary knowledge production and teaching, this study therefore focusses on the how and why of interdisciplinarity within academic project settings at universities. The following research question is posed:

How do new structures across traditional disciplinary boundaries emerge within project settings at German universities?

In order to answer this question, the research project is guided by the following sub-questions:

1. *What kind of interdisciplinary structures emerge within academic project settings and which actors participate in them?*
2. *How do these actors contribute to the emergence of interdisciplinary structures and what motivates them to do so?*
3. *Which factors inhibit or promote the emergence of interdisciplinary structures?*

In addressing these research question, the study aims at contributing to an understanding that goes beyond barriers for interdisciplinarity by showing how and why interdisciplinary structures can successfully emerge within the context of academic projects at universities. This constitutes an important empirical and theoretical contribution and provides valuable insights for policy-makers, university leaders, as well as academics interested in making structured interdisciplinary collaborations work.

1.3 Study approach

Literature calls for studies of organisations in general and universities in specific to go beyond a merely functionalist perspective (Dee & Leišytė, 2016) and integrate different theoretical perspectives (Barrier & Musselin, 2016). In the context of studies on interdisciplinarity, Vincenti (2005, p. 82) further argues that "there is little in the published literature that discloses the realities of the complex social process of interdisciplinary work" and advocates for more research on the lived experiences of academics. This study therefore takes an actor-centred approach and acknowledges the complex interplay of structure and agency in institutions, inspired by Giddens' (1984) structuration theory and Hallett & Ventresca's (2006) inhabited institutionalism. Moreover, research tends to look at academics in their role of scientists and ignores their role as teachers (Musselin, 2008). Accordingly,

this research project will look at the emergence of interdisciplinary structures that are related to both aspects of academic work, teaching and research.

The research questions are addressed through a longitudinal, ethnographic single-case study of a project for inclusion-oriented and inclusive teacher training at a German university. The ethnographic approach enables an in-depth study of social interactions, behaviour, and perceptions occurring within groups, teams, organisations, and communities (Reeves et al., 2008). The case study project serves as an example of an initiative at universities to implement change towards interdisciplinarity, crossing faculty-, disciplinary-, and other boundaries. In contrast to top-down implemented structures such as interdisciplinary research centres, which have been the focus of many studies, project participants remained based within their professorships and faculties. The German context is pertinent for studying the emergence of interdisciplinarity structures, as it combines strong disciplinary traditions and high degrees of individual academic autonomy with increasing political, societal and funding pressures toward interdisciplinary collaboration.

1.4 Structure of the dissertation

This dissertation is structured as follows: The following three chapters contain a literature review which provides a contextualization of the research project, highlights findings, contradictions and limitations of existing literature, and introduces the German higher education system as the object and environment of research. Chapter 2 revolves around the topic of university organisation, outlining structures and the particular characteristics of universities, and discussing implications for stability and change within universities. Chapter 3 focusses on disciplines and interdisciplinarity in higher education. The role of disciplines in higher education and research as well as contemporary discourses and pushes for interdisciplinarity are explored, and taxonomies of interdisciplinarity, which is defined as a rather broad term within the scope of this research project and may range from multi- or pluri- via inter- to cross – and transdisciplinarity, are discussed. The

chapter concludes with a short synthesis in which the topics of interdisciplinarity and organizational change in universities are brought together. Chapter 4 provides an introduction to the German case, beginning with a short introduction to key characteristics of the German higher education system, followed by a presentation of policies and programmes for interdisciplinarity in the German higher education system, and, finally, discussing implications of these for the emergence of interdisciplinary structures in German universities.

Chapter 5 of this dissertation addresses the conceptual frameworks and assumptions that have shaped my understanding of the research field, and, consequently, the design of this study. In this chapter I will argue that understanding organizational change within universities – in particular the emergence of interdisciplinary structures – requires theoretical approaches that bridge individual agency with enduring (organizational) structures. Two prominent sociological frameworks used to understand how social structures are created, maintained, and transformed through human action – Giddens' (1984) structuration theory and Hallett & Ventresca's (2006) inhabited institutionalism – are introduced for this purpose.

In Chapter 6, the methodological approach of this research is discussed. The chapter contains a justification of the research design and case selection, an explanation of the methods and execution of data collection (participatory observation, focus group discussions, interviews, and the collection of further materials), and an outline of the method of data analysis (following principles of constructivist grounded theory according to Charmaz, 2006). It finally addresses risks and limitations associated with these methodological choices.

The subsequent chapters contain a presentation of research findings. Chapter 7 provides an introduction to the case study project and outlines what kind of interdisciplinary structures have emerged within the case study project, focussing on their a) operational dynamics, b) participation of actors, and c) interdisciplinarity collaboration within these structures. The chapter further

contains findings regarding outputs and the sustainabiltiy of interdisciplinary structures. Chapter 8 focusses on actors, their engagement in and contribution to the emergence of interdisciplinarity project structures, and their motivation to do so. Findings are then synthesised to develop a typology of interdisciplinary actors. Chapter 9 presents findings on the factors inhibiting and promoting the emergence of interdisciplinary structures. At first, barriers and challenges to interdisciplinarity within the case study project are presented, followed by findings on facilitating factors for the emergence of interdisciplinary structures.

The dissertation concludes with a critical discussion of research findings (Chapter 10) and a conclusion (Chapter 11), containing a summary of research findings and answers to the research questions, a discussion of theoretical and practical implications as well as of limitations of the study, and suggestions for further research.

2. University Organisation: Structures, Stability and Change

> „[…] the university is among the most traditional of all the institutions of our society and, at the same time, it is the institution most responsible for the changes that make our society the most changing in the history of man“ (Hesburgh, 1971, p. 3)

In the above-cited quote, Hesburgh (1971) names the paradox inherent in universities and their role within society. On the one hand, they are custodians of long-standing norms and traditions related to the organization of the academic profession. On the other hand, they are regarded as a societal engine for new knowledge and change and face increasing demands imposed by policy, industry, as well as society as a large. Universities are commonly described as specific types of organisations (Musselin, 2006) which – despite the above-mentioned expectations and demands by external stakeholders – are unlikely to change and are sometimes even referred to as “ultra-stable” (Pellert, 1995, p. 81).

This chapter is dedicated to exploring what makes universities so ‘specific’ and to provide an overview of dynamics of change and stability within their organizational structures. It will provide a short introduction to university structures, followed by a discussion of how distinctive characteristics of universities, namely 1) the fact that they are professional organisations, 2) their loosely-coupled organisational architecture, and 3) structures and decision-making in universities result in challenges and implications for organizational change in universities.

2.1 Structures and characteristics of universities

This section focusses on the organisation of universities, in particular focussing on the questions of how universities constitute specific types of organisations, how they are structured, and how decision-making within universities works.

2.1.1 Universities as specific types of organizations

Are universities organisations? According to Brunsson and Sahlin-Andersson (2000), complete organisations are defined by three criteria: 1) identity, 2) hierarchy, and 3) rationality. The authors argue that identity is constructed by an emphasis of organizational autonomy, clear definition of boundaries between the organisation and the outside world, collective resources, and a sense of being special. Hierarchy means that the management has control and can coordinate the activities of the members of the organisation. Rationality equals the ability to set objectives, measure results and allocate responsibility (Brunsson & Sahlin-Andersson, 2000). Institutions, on the other hand, are described in sociological literature as systems that reproduce themselves through the norms and social actions of individuals or groups (see for example Esser, 2000). According to Jepperson (1991, p. 14) as cited in Mahoney and Thelen (2009), "institutions are those social patterns that, when chronically reproduced, owe their survival to relatively self-activating processes".

Following Brunsson & Sahlin-Andersson's (2000) conceptualisation, literature argues that universities can be defined as incomplete organisations (Wilkesmann, 2012). Luhmann (1992) states that universities must be understood as both organisations and institutions. On the one hand they increasingly aim at efficiency, effectiveness, and rationality, trying to implement management concepts from the private sector to reach these goals. On the other hand, they are institutions with a clear societal responsibility and mission. Further authors describe universities as specific types of organisations (Musselin, 2006) or 'multiple hybrid organizations', with a variety of sometimes contradicting structures on different levels (Kleimann, 2018, 2023).

Thus, universities, especially in continental Europe, have traditionally been regarded as institutions, but are believed to have become closer to the ideal of complete organisations over the past decades – developing into what Kleimann (2018, p. 1087) refers to as "an institution *and* (…) an

organization". Yet, they differ from other types of organisations in various regards. For a more thorough understanding of the distinctiveness of universities, I turn to Baldridge's (1983) work, who has listed six distinctive organisational characteristics of colleges and universities:

(1) Universities are goal ambiguous. While other organisations usually have a clear perception of what they are doing and how their goals can be reached, universities are characterised by uncertainty and conflict over their goals. The goals of universities include teaching and research but extend to the administration of research infrastructures, student services, and the solving of social problems, and other. Moreover, as Baldridge (1983, p. 40) claims, "not only are academic goals unclear, they are also highly contested. As long as goals are left ambiguous, people agree; as soon as they are concretely specified and put into operation, disagreement arises".

(2) Universities are expected to respond to societal needs and demands. Like other public entities, universities are expected to serve the broader society and to react to societal demands. Society as a 'client' demands input into decision-making processes of universities. Moreover, universities are "people-processing" organisations.

(3) Universities have unclear and problematic technologies. In order to properly serve their clients, the technologies of universities have to be "holistic and nonroutine" (Baldridge, 1983, p. 43).

(4) Academic work is highly professional. Academic organisations are inhabited with highly professional staff, i.e. professors, who are able to deal with the challenges resulting from the characteristics above. These professionals "demand a large measure of control over the institution's decision processes" (Baldridge, 1983, p. 43).

(5) Universities are highly fragmented. Due to the presence of a variety of different groups of professionals within universities, they are highly

fragmented, which makes decision-making processes extremely difficult and entails challenges for the internal governance of universities.

(6) Universities are vulnerable to external influences. They respond to a greater variety of stakeholders and, in the light of a retreat of the state from the financing of higher education, are becoming increasingly vulnerable to their environments.

2.1.2 Understanding university organization: Structures and decision-making

The previous section underlines that universities must thus be considered complex, fragmented organisations marked by ambiguous, contested goals and unclear technologies, making decision-making and governance inherently challenging. They must balance professional autonomy with external demands (i.e. societal demands and stakeholder influences) while operating in an increasingly vulnerable funding environment. This complexity positions universities as both adaptive and constrained institutions, which constantly have to negotiate between competing interests and priorities. The before-mentioned characteristics further lead to a complex interplay of professional autonomy, bureaucratic coordination, and external steering in university structures.

At the system level, Clark's (1983) classic triangle of coordination – state authority, market forces, and the academic oligarchy – is often used to understand how power over universities is distributed in national systems, thus setting the frameworks and constraints for internal university organisation. Recent scholarly work referring to Clark's (1983) triangle advocated for an unpacking of the market dimensions to account for both market mechanisms and field/status competition, which has developed into one of the key imperatives for higher education (Mitterle & Bloch, 2024). Literature also argues for the inclusion of further stakeholders into analytical frameworks of university coordination, particularly advocating for the inclusion of a civic society dimension (Hazelkorn, 2017, Rankings and higher education:

reframing relationships within and between states). Other writings have pointed out that, particularly within the wake of New Public Management reforms, higher education institutions and their leadership as strategic actors are not sufficiently represented in the triangle – overall resulting in proposals for hybrid and multi-level approaches to understanding the coordination of higher education institutions.

Descriptions of internal structures of organisations are often based on Mintzberg's (1979) work, who identifies five key elements of organisational structure, namely 1) strategic apex (CEOs, board of directors, senior executives responsible for setting the overall direction of the organisation), 2) the middle line (middle managers connecting the strategic apex to the operating core by interpreting strategic goals into plans and instructions and supervise work), 3) the operating core (the core of the organisation where the primary work is done), 4) the technostructure (analysts, planners, and other actors designing and implementing systems, processes, and procedures aimed at efficiency and effectiveness), and 5) the support staff (e.g. administrative staff, human resources, maintenance personnel).

In a professional organisation such as universities, the operating core of professionals, i.e. the academics, dominate the organisation. Work is not coordinated by close supervision and detailed process rules, but rather by a standardization of skills based on a long, specialised academic training and socialization into professionals and disciplinary norms. Accordingly, academics act as autonomous experts with substantial control over hiring, teaching and research – often in a disciplined manner (Becher & Trowler, 2001). Institutional decision-making is thus strongly influenced by academic autonomy and disciplinary cultures and practiced through formal structures, e.g. academic boards or senates, committees, and peer-review systems (see Birnbaum, 1988, for further writings on decision-making according to the collegial model and de Boer et al., 2007, for shifts in university governance). The top-down strategic flow (Clark, 1983; Mintzberg, 1979) is limited and

there is merely lose control from above (i.e. the strategic apex and middle line).

According to Bess and Dee (2008, p. 24), a "typical organization chart" of a public university includes a governing board, a presidential or rectoral executive level, academic line management through pro-rectors, deans, and department chairs, and collegial bodies (senate/ academic board) with authority over academic standards (Bess & Dee, 2008, p. 24). The authors underline complexity in university structure by pointing out that higher education institutions are inhabited by sub-units. Institutions usually contain several schools or colleges with distinctive curricular or knowledge-based themes, or departments containing all academics belonging to a certain discipline. These units are rather loosely coupled and operate largely independently from each other. Academic and administrative structures tend to clash at the level of middle management, i.e. department chairs, which are sometimes considered to be part of administration, sometimes of academia, and often need to fulfil expectations of both (Bess & Dee, 2008).

Recently, there has been increasing evidence of units with cross-cutting characteristics that span disciplinary boundaries, e.g. in the form of interdisciplinary centres and institutes (Lyall et al., 2011), cross-cutting schools or colleges (Lattuca, 2001), shared facilities and platforms (Bozeman & Boardman, 2014) or inter- and transdisciplinary research consortia, often aligned with a "Mode-2" of knowledge production (Gibbons et al., 1994). Such units typically use a matrix structure (Bess & Dee, 2008) with intersections of vertical (departments, schools) and horizontal lines (centre, institute). However, discipline-oriented structures such as the ones described above, remain the organisational default.

Bess and Dee (2008) argue that overall, universities can best be described as professionally dominated, open, multi-layered organisations that mix corporate governance structures with collegial authority. A similar argument has been brought forward by Manning (2012, p. 142), who, in her work on

theory on higher education, refers to the organisation of universities as a 'heterarchy' and points out that "higher education institutions have a side-by-side structure of hierarchy and collegium. The collegium acts as a powerful social network while the hierarchy provides a structure upon which to manage administrative tasks". While higher education systems and institutions around the world are known to display many of the characteristics outlined above – a phenomenon often discussed in literature with reference to processes of isomorphism and convergence (Broucker et al., 2019; Shattock et al., 2023), national traditions and regulatory systems matter and variations across systems and institutions persist. Particularities of the German higher education system, in which the case study for this research project is based, will therefore be addressed in Chapter 4.

I conclude that universities are best understood as specific and hybrid organisations. They are formally governed by boards and senates, professionally coordinated through disciplines and departments, loosely coupled across their subunits, politically negotiated among multiple stakeholders, and institutionally steered by state, market, and professional forces. The following section will delve more deeply into selected key characteristics of the organisation of and decision-making within universities and discuss which implications and challenges they raise for organisational change.

2.2. Challenges to organisational change in universities

Organisational change, sometimes also labelled innovation, adaptation, or strategic change (Hage, 1999; Kezar, 2001), can be defined as an "alteration in the structures, processes, and/or behaviours in a system (Zaltman & Duncan, 1977, in Bess & Dee, 2008, p. 796). Literature traditionally distinguishes between two different types of change: Incremental and transformational change. Transformational change takes places rapidly and radically and produces a "major overhaul of the organisation's structure and strategy" (Bess & Dee, 2008, p. 796). Incremental change, in contrast, takes

place over long periods of time and in small, gradual steps. While the term ‘change’ is often used synonymously with ‘transformation’, Eckel and Kezar (2003) noted the unique characteristics that distinguish transformational change from other organisational efforts in their work, transformation “is a particular type of change … [which] is about changing institutional cultures” (idem., p. 27) and “affects those underlying assumptions that tell an institution what is important; what to do, why and how; and what to produce” (idem., p. 33).

Different scientific traditions have different views on the relevance of change for organisations. Systems theory, which is based on a positivist tradition, claims that systems as well as organisations are characterised by stability rather than change. Change is considered a temporary state and it is presumed that organisations are self-regulating and seek to maintain a state of equilibrium (Katz & Kahn, 1978, in Bess & Dee, 2008). In contrast to this view, organisational sociology suggests that organisations are constantly changing. Equilibrium is an exception and elements within organisations that favour equilibrium, such as traditions or standard procedures, are seen as barriers to change (Bess & Dee, 2008).

Implementing and undergoing change is regarded as a challenge for organisations and depends heavily on both internal as well as external dynamics (Bess & Dee, 2008). External dynamics can be market or policy driven, internal pressures usually result from internal assessment and evaluation. Overall, literature identifies three main contexts leading to change in higher education: socio-political forces, technological forces, and market forces (Dee et al., 2023). Socio-political forces include economic conditions, the legal context, as well as relationships to external stakeholders and public values and beliefs. Technological forces manifest in the “emergence of new tools for knowledge production and dissemination, especially related to digitalization and communications technologies” (Dee et al., 2023, p. 11), whereas market forces include several dynamics of competition on both

national and international scale. Multiple actors may contribute to and engage in change in higher education, and their authority varies across higher education systems: Governments on various levels, ministries of higher education and other governmental bodies such as funding agencies and quality assurance agencies, managers of higher education institutions, professional and administrative support staff, academic staff, students, industry, as well as civil society actors (Dee et al., 2023). Change can thus depend on various forces and can be encouraged and implemented by multiple actors – both internal and external to higher education institutions.

While universities increasingly behave as organisational actors (Krücken & Meier, 2006), there is a consensus that higher education institutions differ from other types of organisations and that processes of change in higher education institutions need to be regarded in the light of specific cultural issues (Bates, 2000; Phelps et al., 2000). In the following, I will explore how three of their specific characteristics, namely 1) the fact that they are professional organisations, 2) their fragmented or loosely-coupled organisational architecture, and 3) the way in which decision-making in universities takes place and affects processes of organisational change in universities.

2.2.1. Universities as professional organisations

Universities are commonly referred to as 'professional organisations' (Baldridge, 1983; Bleiklie et al., 2016; Hardy et al., 1983; Mintzberg, 1979). They are heavily influenced by the academics they are inhabited by, who are professionals (Bates, 2000) and thus operate highly independently in both their teaching and research. According to Hardy et al. (1983, p. 429), universities "tend to exhibit a remarkable degree of stability, discouraging any form of strategic 'revolution'". They claim that there are two reasons for this. At the collective level, "responsibility is divided among so many people", and "many autonomous individuals are unlikely to change their collective mind, at least not simultaneously, radically and consistently". At

the individual level, on the other hand, the authors expect that "professors who have invested time and effort to learn their standardised skills are unlikely to change them frequently or radically" (Hardy et al., 1983, p. 429).

Academics have great influence on outcomes of change projects implemented from above and as literature shows, employ a variety of reactions to change – among which different forms of resistance (Leišytė, 2007, 2023). Moreover, as Becher and Kogan (1980, pp. 146–147) claim, "the main constraints on change are social, not psychological: they depend more on the way that the system operates than on the particular stand that its individual members choose to take". In line with this argument underlining the importance of social norms and actions, Powell (1991, p. 197) states that "things that are institutionalised tend to be relatively inert, that is, they resist efforts at change". Thus, change in higher education needs the support of the academic basis to succeed, and when it occurs top-down, "those at the top have to 'carry the field' rather than command it, building internal constituencies and coalitions to support and implement their own desires" (Clark, 1983, p. 236).

Universities as loosely-coupled systems

Universities involve different organisational components, cultures, and interests, are inhabited by individuals and groups with multiple, often-conflicting roles and identities, and are accountable to a great variety of stakeholders. They have structures that are traditionally decentralised and fragmented. They are inhabited and structured by different "academic tribes and territories" (Becher & Trowler, 2001) and characterised by a lack of communication and collaboration between different organisational units. Therefore, universities are oftentimes referred to as "loosely coupled systems" (Weick, 1976). Social systems are loosely coupled when the sub-systems within them influence each other, while nevertheless preserving their identity and autonomy. According to (Orton & Weick, 1990, p. 208), there are eight different types of loose coupling: 1) coupling among individuals, 2) coupling among subunits, 3) coupling among organisations, 4) coupling be-

tween hierarchical levels, 5) coupling between organisations and environments, 6) coupling among ideas, 7) coupling between activities, and 8) coupling between intentions and actions. The authors claim that "the loosely coupled structure of universities is an inevitable consequence of their primary production material: knowledge" (Orton & Weick, 1990, p. 206) and substantiate their claim by referring to the following quote by (Clark, 1983, p. 16): "An academic system works with materials that are increasingly specialised and numerous, knowledge-intensive and knowledge-extensive, with a momentum of autonomy. This characterization applies most strongly to advanced systems, but even the most retarded systems will be based on a half-dozen or more distinct bundles of knowledge that have their own internal logics and an inherent bent toward autonomy".

The loose coupling of universities has direct implications for their ability – or inability – to change. The retained autonomy of sub-systems bears the advantage that coordination efforts can be minimised and that sub-systems can adopt changes easier and faster. However, changes in one sub-system do not automatically lead to changes in another sub-system or at the central level. Vice-versa, changes at the central level may not necessarily lead to changes in sub-systems: Loose coupling allows for important transformation to happen in one part of the system without disturbing the other parts, but at the same time it impedes the diffusion of change from one part to another (Weick, 1982). This oftentimes prevents systematic and strategic change and poses an obstacle for organisational transformation.

According to Senge (1990), a key to the success of strategic planning is the establishment of a shared vision across an organisation. However, this is particularly difficult to achieve in universities. Academic culture and beliefs are influenced by various factors, including the discipline, employing university, national context, and the academic profession in general. Yet, as (Dill, 1982) shows, academics identify with their individual, discipline-based careers and much more than they are oriented towards their departments or

faculties or their universities. Yet, although they claim that departments or faculties are not important for their professional identities, Musselin (2006, p. 76) shows that formal rules and structures do matter to academics nevertheless, as they are relevant in "defining territories and borders and in protecting insiders", thus having a "defensive role". Therefore, attempts at changing structures in universities usually lead to strong resistance and severe conflict.

2.2.2. Decision-making and change in universities

In the past, decision-making in universities has been described with the analogy of a "garbage can" (Cohen et al., 1972). Due to a variety of interest within organisations and a lack of clear organisational goals and preferences, a lack of clear rules and structures in decision-making processes, as well as fluid participation, universities are described as "organised anarchies" (idem.). In the garbage can model, different streams of decision making, namely problems, solutions, participants, and choice opportunities, flow in and out of the garbage can in unsystemised ways and whether problems get attached to solutions depends mainly on chance. Others (Trow, 1994) have pointed out the dichotomy between collegial and managerial structures within universities. Especially since managerial reforms have been introduced to universities in the wake of New Public Management, traditional collegiate structures are overlaid by managerial superstructures and there is increasing conflict between managerial structures on the one hand and principles of academic self-governance and collegiality on the other.

Yet, the balance between managerialism and academic self-governance varies across countries (Boer et al., 2007; Broucker et al., 2019; Hüther, 2010; Želvys et al., 2021). Capano and Regini (2014) found that in contrast to the United Kingdom and the Netherlands, where deans take strongly managerial positions, the German and French higher education systems are much more collegiate. Deans in these two countries are elected by their peers and act as 'primus inter pares'. They "occupy a more peripheral position in the decision-

making process, where they perform the traditional functions of aggregating consensus and filtering the demands advanced by their constituency in an upward direction" (Capano & Regini, 2014, p. 93). Musselin (2006) identifies a lack of hierarchy partly resulting from the points discussed above as barriers to change in universities. She claims that "in universities, formal rules and structures weakly support hierarchical power. Being appointed (or elected) as an academic leader does not allow for much influence on work orientation" (p. 75). Overall, there seems to be agreement that there is a lack of leverage of leaders in universities (Bleiklie et al., 2016; Weick, 1976) and that the power of managerialism in universities is limited by a lack of hierarchy in managerial structures and high degrees of professionalism and autonomy of academics.

On the other hand, literature also shows potentials of leadership in the context of higher education institutions. As Kroll and Schubert (2023, p. 355) argue, "all staff within a university are, at least to some extent, susceptible to incentives or to directives issued by central leadership". It is argued that the deployment of soft governance approaches, including motivation and persuasion has proven particularly effective (Doyle & Brady, 2018). Similarly, based on studies of the German higher education system, Wilkesmann (2013) was able to show that change cannot be brought about through transactional governance and incentives of monetary or similar kind. Instead, he found intrinsic motivation of academics, a belief in the significance of academic teaching, and finally symbolic appreciation, which he defines as elements of a transformative governance, as effective tools for bringing about change towards the emergence of a teaching culture. Dee and Leišytė (2017) have further pointed out the central role of university managers in maintaining knowledge flows across internal, structural boundaries during initiatives for organisational change in universities.

Considering these particular characteristics of higher education institutions, (how) do they actually change? Keller (1983) claims that due to their

complexity, higher education institutions tend to change incrementally. They are adaptive to changing environments, but in unplanned ways, leading to isolated adjustments within individual organisational units. Incremental change in higher education is, however, unlikely to address effectively the needs of society (Keller, 1983). For this purpose, transformational changes that reshape not only specific practices but also the ways in which members of the university understand their work and roles are needed. Such transformations represent a "major overhaul of the organisation's structure and strategy" (Bess & Dee, 2008, p. 796), impacting the underlying frameworks that guide decision-making and interactions across the silos constituted by different faculties and departments.

However, transformational change, e.g. through the implementation of strategic innovations in universities, is often difficult and not always successful (Kallenberg, 2007). Huber (2005) even claims that there is an inability to reform of universities ("*Reformunfähigkeit der Universität*") and that change can be brought about only through external reforms, either by the state or by external expert committees. Clark (1983), on the other hand, comes to a very different conclusion and states the following:

> "Despite the belief that academic systems only change when pressured by external forces, such systems increasingly exhibit innovation and adaptation among their bottom units. Invention and diffusion are institutionalized in the work of the departments and counterpart units that embody the disciplines and professions (…) grass-roots innovation is a crucial form of change". (Clark, 1983, pp. 234–235).

Literature further notes that structural change in universities cannot occur independently of cultural change. As Holley (2009, p. 334) has phrased, "efforts to modify the structures that organize the work of higher education occur concurrently with the manner in which people perceive of the organization and their work". Drawing on the work of Eckel and Kezar (2003, p. 41), she argues that transformative change, particularly within the context

of interdisciplinarity, is tied to building new beliefs and assumptions about academic work and the goals and aims of higher education, manifesting, for example, in new forms of interactions, new forms of language, or redefinitions of stakeholder relationships.

Building on Clark's (1983, pp. 197–199) writings, attempts to achieve and understand organisational change in higher education must consider three critical factors. First, structural predispositions and adaptive capacities which are shaped by structures and hierarchies within higher education institutions. Secondly, change efforts must account for the diverse and sometimes conflicting beliefs held by different academic groups. Finally, change processes are shaped by dynamics of authority and integration, revealing tensions between centralised versus decentralised authority as well as contests between forces of change versus forces of continuity. In addition to these internal factors, literature puts forward external drivers (Gornitzka & Maassen, 2000), including regulatory frameworks, access to resources, or factors with more indirect effect, including public opinion (Geschwind, 2019). Overall, the organisation of (change within) higher education institution is regarded as a highly complex matter, and their understanding "demand[s] multifaceted analytical tools" (Manning, 2017, p. 197).

3. Disciplines and Interdisciplinarity in Higher Education

According to Henkel (2007), there have been three major forces leading to changes in the academic profession since the 1980s: The massification of higher education, increased concerns for the quality of research and teaching, as well as a shift towards interdisciplinarity. She claims that "discipline-based scholarship is no longer regarded as sufficient qualification for university teaching" (Henkel, 2007, p. 200) and other scholars have confirmed that there have been rising demands for interdisciplinarity not only in teaching, but also with regard to research. Yet, the challenges implied in this shift towards interdisciplinarity for both academic work and academic organisations must not be underestimated. As Cummings and Kiesler (2007, p. 719) state, "policy makers in the research establishment must understand the difficulties of projects that cross distance and organizational boundaries".

Interdisciplinarity refers to the combination and integration of knowledge from two or more disciplines (Brewer, 1999; Klein, 2010; OECD, 1972). Academics have collaborated with one another for centuries, and in some disciplines in the social sciences (Brint, 2005; Jacobs & Frickel, 2009) and the natural sciences (Rhoten & Pfirman, 2007), there has been an increase in interdisciplinary scholarship. Henkel (2007), for example, states that there has been a "substantial increase in inter-disciplinary research among physicists, chemists and biologists and significant cross-disciplinary advances in methods in all areas". In other disciplines, however, there has been resilience to interdisciplinary collaboration and scientists continue to rely upon their own, disciplinary concepts, modes of reasoning, and practices (Leišytė & Hosch-Dayican, 2016).

In recent years, there has been increasing encouragement by policymakers for academics from different disciplines to collaborate in both teaching and research (Cummings & Kiesler, 2005; Engwall, 2018; Henkel, 2007; Holley, 2009; Jæger, 2021; Leišytė et al., 2022). Yet, structural, psychological and

ideological barriers to interdisciplinarity persist (Engwall, 2018; Weingart & Stehr, 2000), among other "because the formal organisation of science and engineering in universities (…) usually follows disciplinary boundaries" (Cummings & Kiesler, p. 703) and collaboration across disciplines requires the crossing of boundaries on different levels.

In this chapter, the state-of-the-art of research on interdisciplinarity in higher education and research will be presented. First, the dominant role of disciplines in higher education and research and their impact on the organisation of science, organisational structures and careers will be discussed. Secondly, an overview of contemporary discourses on interdisciplinarity will be given, covering both aspects of the function and popularity of and policies for interdisciplinarity, as well as paradoxes and barriers to interdisciplinarity. Thirdly, the chapter turns to various different forms and degrees of collaboration – both in general and across disciplinary boundaries. Taxonomies of interdisciplinarity and different approaches to measuring interdisciplinarity are discussed, and explanatory approaches to the emergence of collaboration in general and interdisciplinary collaboration more specifically are presented. The chapter concludes with a synthesis, in which scholarly discourses on university structures and change (which have been addressed in Chapter 2 above) and research findings on interdisciplinarity in higher education and research are brought together to outline the specific challenges and conditions for the emergence of interdisciplinary structures in universities.

3.1 The role of disciplines in higher education and research

Scientific disciplines have been defined in literature as the "life-blood of higher education" (Becher, 1994, p. 151). They have a tremendous impact not only on the way in which scientific knowledge is produced and scientific careers are organised, but also on the way in which knowledge producing organisations, e.g. universities, are structured. As such, "disciplines are not

only intellectual but also social structures" (Weingart & Stehr, 2000, p. xi). Weingart and Stehr (2000, p. xi) aptly state:

> "Scientific disciplines are, in a sense, the axes through which modern society sees and forms its images about the world, frames its experience, and learns, thus shaping its own future or reconstructing the past."

Each discipline has its own, distinctive cultural characteristics, which has led to authors referring to disciplines as 'academic tribes', inhabiting their own academic territories and making use of their own languages and symbols (Becher, 1994; Becher & Trowler, 2001). These tribes operate within universities as a community culture (Bailey, 1977), are bound together by a certain "'unwritten' occupational ethos" (Harman, 1989, p. 42), and are "able to understand, more or less, each other and even, when necessary, to communicate with members of other tribes" (Bailey, 1977, as cited in Becher, 1994, p. 151). Yet, the relationship between disciplines is characterised by conflict: "As social organizations, disciplines participate in and contribute to conflicts over political, economic, legal and ethical decisions, over the distribution of resources and life chances" (Weingart & Stehr, 2000, p. xi), leading to hostility between them or, as Becher (2006) puts it, even going to war with each other. Academic cultures and norms remain strongly attached to the tradition of disciplines (Becher & Trowler, 2001).

In teaching and research alike, different disciplines apply different methods and have different standards to assess success or the validity of outcomes (Brewer, 1999; Rhoten, 2003) and ensure their survival. Disciplinary education plays a crucial role as a tool for the socialisation of new members of an occupational group that holds a "quasi-monopoly for a field of work" (Stichweh, 2013, p. 311). Moreover, it is important to note that "disciplinary cultures, in virtually all fields, transcend the institutional boundaries within any given system" (Becher, 1994, p. 153): Academic identities used to and – despite an increase of organisational managerialism – still are defined by their disciplinary affiliation rather than loyalty to the institutions they are employed

at (Becher, 1994; Leišytė, 2015). Literature even argues that scientific disciplines constitute "the most important source of academic identity" (Leišytė & Rose, 2024, p. 1). This leads to struggles of academics engaging in interdisciplinary work in building and communicating their identities and finding orientation within the strongly discipline-based structures of academia and higher education (Felt et al., 2012; Woiwode & Froese, 2021).

There have been numerous attempts to group disciplines to better understand their similarities and differences and most of existing classifications distinguish between hard and soft sciences or applied versus pure science. Prominent classifications are provided by Biglan (1973) and Kolb (1981) (see Table 1 below). Biglan (1973) distinguishes between hard pure, soft pure, hard applied, and soft applied sciences, whereas Kolb (1981) uses slightly different terms and speaks of abstract reflective, concrete reflective, abstract active and concrete active.

Biglan (1973)	**Kolb (1981)**	**Disciplinary areas**
Hard pure	Abstract reflective	Natural sciences
Soft pure	Concrete reflective	Humanities and social sciences
Hard applied	Abstract active	Science-based professions
Soft applied	Concrete active	Social professions

Table 1: Groups of scientific disciplines according to Biglan (1973) and Kolb (1981)

Becher (1994) takes an anthropological view on disciplinary culture, claiming that it embraces the "traditional and social heritage of people, their customs and practices, their transmitted knowledge, beliefs, law and morals, their linguistic and symbolic forms of communication and the meanings they share" (p. 152). While anthropology distinguishes between culture and structure, Becher (1994) defines disciplinary culture in a broader sense to include both culture and structure, and argues that the "concept of culture as developed in the social anthropology does have considerable relevance to the understanding of higher education" (p. 153).

3.2 Towards interdisciplinarity? An overview of contemporary discourses

In the following sections, an overview of contemporary discourses on interdisciplinarity in higher education research will be given from two perspectives, covering both arguments for the popularity of interdisciplinarity as well as paradoxes and barriers connected to interdisciplinarity. However, this chapter does not aim at drawing conclusions on whether interdisciplinary is 'good' or 'bad', but merely takes increasing demands for interdisciplinarity and existing literature on barriers to interdisciplinarity as a starting point for investigating how processes of structural change towards interdisciplinarity take place in universities.

3.2.1 Functions, popularity and policies for interdisciplinarity

The increasing popularity of interdisciplinarity is seen by many authors as a consequence of new pressures for scientific relevance. According to Kogan and Teichler (2007), academics increasingly find themselves in settings that are not defined by their disciplines but by cross-cutting research themes. There are growing demands for universities to address grand societal challenges (Barringer et al., 2020) which are of increasingly complex nature and can oftentimes no longer be approached with the questions asked and methods applied by single disciplines (Huutoniemi, 2016). It is argued that instead, problems such as climate change, energy shortage, or population growth require interdisciplinary approaches to knowledge production (Engwall, 2018). Interdisciplinary knowledge production is said to be able to lead to "cognitive advancements […] in ways that would have been impossible or unlikely through single disciplinary means" (Boix-Mansilla & Duraising, 2007, p. 219), and is thus regarded as a means to solving these challenges.

Furthermore, collaborations across disciplinary boundaries are regarded as a means to promote innovation – both within science and society (Klein, 2000). In literature, interdisciplinarity is oftentimes presented as a way of "democratizing science" (MacLeod, 2018, p. 699), the Mode 2 of knowledge

production (Nowotny et al., 2001) being an example of theoretical models that connect collaborative processes transcending disciplinary boundaries with social accountability and reflexivity. From an organisational perspective, interdisciplinary is strongly connected to the profiling, reputation, and competitiveness of universities ((Kosmützky, 2012; Leišytė et al., 2022), with some authors even going as far as to describe interdisciplinarity as a key factor in the making of a 'world class university' (Aula & Tienari, 2011).

Calls for interdisciplinarity in universities are not only limited to research, but do also extend to teaching. As Weingart (2014) points out, the massification of higher education has led to the fact that up to 50 percent of a cohort in higher education is no longer trained for research or professional fields such as medicine, law, or education, but for labour markets that have needs that reach "beyond the range of disciplines". Therefore, in many circles "discipline-based scholarship is no longer regarded as sufficient qualification for university teaching" (Henkel, 2007, p. 200). Instead, the new focus on the employability of graduates and attempts to meet an increased demand for quality in education have resulted into a shift towards interdisciplinarity in teaching in higher education.

Based on such perceptions, policy actors and funding agencies on multiple levels have become increasingly active in promoting interdisciplinary research activities over the past two decades (Huutoniemi, 2016; Jacobs & Frickel, 2009; LERU, 2016). Existing literature shows great variety in the policies and policy instruments employed to foster interdisciplinarity and that they target teaching and/or research to different degrees. Leišytė et al. (2022) suggest a distinction between general (applicable to whole HE systems) and directed (targeting individual universities) policies as well as between enabling and prescriptive approaches of governments to promote interdisciplinarity in higher education. Studies focussing on the promotion of interdisciplinarity in universities through policies and policy instruments

further suggest a mismatch between policy discourses and policy practices (Donina et al., 2017; Woelert & Millar, 2013) and clashes between policy instruments intended to foster interdisciplinarity and funding, evaluation, and career regimes (Woelert & Millar, 2013).

This is in line with literature arguing that the perceived superiority of interdisciplinarity is not reflected in current practices of knowledge production (Bhaskar et al., 2018; Weingart & Stehr, 2000), and that experiences with and practices of interdisciplinarity vary across disciplines. Interdisciplinary research is more likely to be conducted in some disciplines than in others (Brint, 2005; Henkel, 2007; Jacobs & Frickel, 2009; Leišytė & Hosch-Dayican, 2016; Rhoten, 2003; Rhoten & Pfirman, 2007). According to literature, interdisciplinarity is stronger in fields which deal with research problems with a practical objective. The disciplines listed in literature are usually from the natural sciences. Alvargonzález (2011) and Henkel (2007), for example, state that physicists, chemists, biologists, and medical scientists are especially likely to engage in interdisciplinary collaborations. Weingart and Stehr (2000) show that for certain research problems, other disciplinary areas are needed and take cognitive sciences as an example of the involvement of computer sciences, but also of disciplines from the humanities and social sciences, such as psychology and philosophy. In some disciplines, integration is so strong that new, independent disciplines emerge, as has been the case with biochemistry, bioinformatics, or geophysics (Alvargonzález, 2011).

Engwall (2018) theorises that interdisciplinarity depends on the degree of dependence among researchers and on the degree of task uncertainty that a discipline is characterised by. He argues that in fields where there is high dependence and low task uncertainty, peers within a discipline have a strong control and integration within the discipline is high. In disciplines with low dependence and high task uncertainty, in contrast, integration within the

discipline is low and collaborations beyond disciplinary boundaries are more likely to occur.

But, as Weingart and Stehr (2000, p. 2) rightfully ask: "How is it possible that interdisciplinarity has such positive connotations if at the same time it is often contradicted by the reality of intellectual and social organizations of the scientific community?". This question will be explored in more detail in the following section, which deals with paradoxes of and barriers to interdisciplinarity in higher education and research.

3.2.2 Paradoxes of and barriers to interdisciplinarity

As Cummings and Kiesler (2005, p. 704) state, "there is a tension between the benefits to innovation of working across disciplinary and organizational boundaries versus the risks that arise from the costs of coordination and relationship development in these collaborations". Critiques of interdisciplinarity go back as early as the 1980s. For example, Benson (1982) calls out interdisciplinary teaching for a lack of in-depth disciplinary knowledge and criticises it a s conceptually confused and too time consuming. Boix-Mansilla and Gardner (2003) show that interdisciplinary knowledge is often regarded as of "dubious quality". Common organizational models according to which interdisciplinarity is conducted within research centres or other units separated from the organizational core are further criticised for a lack of interplay between research and teaching (Reichert et al., 2012), which is regarded with particularly critical views in higher education systems with a Humboldtian tradition, such as in Germany.

Existing literature is rich of findings and theories of barriers to interdisciplinary academic work. These barriers can be divided into three groups: psychological, ideological, and organizational (Weingart and Stehr, (2000), or, in same sense and merely using other terms, cognitive, philosophical, and institutional barriers (MacLeod, 2018). A clear-cut distinction between these types of barriers is not possible, since disciplines – as already discussed above – do not only influence the way in which scientific

knowledge is produced and scientific careers are organised, but also the way in which knowledge producing organisations are structured.

The existence of different academic tribes and territories (Becher & Trowler, 2001), as discussed above, constitutes the main barrier to interdisciplinary collaboration within universities. Academic cultures and norms remain strongly attached to the traditions of their disciplines and communication between disciplines is difficult to achieve. In teaching and research alike, different disciplines apply different methods and have different standards to define appropriate research problems and assess success or the validity of outcomes, which can cause conflict in interdisciplinary collaborations (Brewer, 1999; Defila & Di Guilio, 1999; Engwall, 2018; Rhoten, 2003).

Moreover, different disciplines speak different languages. In order to make interdisciplinarity work, an interdisciplinary language or another means that ensure mutual understanding has to be established (Brewer, 1999; Defila & Di Guilio, 1999). Additionally, academics from different disciplines usually have different educational backgrounds, have had different supervisors, have used different publication outlets, and have attended different conferences, which leads to weak social bonds (Granovetter, 1973) and difficulties with establishing trust (Cummings & Kiesler) among participants in interdisciplinary collaborations.

The reach of disciplines is furthermore apparent in their influence on professional factors such as the hiring, promotion, status, and recognition of an individual academic (Brewer, 1999). Interdisciplinary career paths remain scarce and academics who engage in interdisciplinary collaboration tend to be sanctioned, both for deviating from disciplinary standards as well as because universities generally favour individual achievements (Brewer, 1999). Even literature published as recently as 2025 finds that “tenure and promotion norms in academic departments have remained mostly unchanged” (Mäkinen et al., 2025). Incentives and funding for teaching and research are usually allocated based on disciplinary principles and priorities

are given to disciplinary rather than interdisciplinary work (Brewer, 1999; Louvel, 2016; Sá, 2008). Literature does, however, highlight disciplinary differences with regard to the valuing of interdisciplinary research output. As Mäkinen et al. (2025) have found, academics from the social sciences and humanities struggle to publish interdisciplinary research outputs in recognised journals, whereas it is easier for academics from STEM fields to publish interdisciplinary research in highly ranked journals.

Further, not only processes of knowledge production, but also the organisation of institutions of knowledge production depends heavily upon disciplines. In most universities world-wide, we still find institutional designs that support fragmentation in faculties or departments with a disciplinary focus (Engwall, 2018). and conflicts about the allocation of resources oftentimes prevent collaborative work across disciplinary- and faculty-/department boundaries (Brewer, 1999; Engwall, 2018; Sá, 2008). Moreover, power relations between disciplines can lead to imbalances in interdisciplinary collaborations, as Albert et al. (2015) have shown in a study of collaborations of biomedical with social scientists, the latter of which were forced to adapt their research practices to that of their biomedical colleagues, who assigned a lower value to social research. Disciplinary research scripts and the power of disciplinary communities (Stichweh, 1992; Vereijken et al., 2022) can thus be regarded as a main inhibitor for the emergence of interdisciplinarity in universities.

Thus, every act of multi- or interdisciplinary collaboration requires boundary crossing (Cummings & Kiesler, 2007) and can lead to conflicts on various levels.

3.3 Multi-, Pluri-, Inter-, Cross-, or Trans-?: Taxonomies of Interdisciplinarity

Up to this point in this thesis, interdisciplinarity has been used as a generic term to refer to the combination and integration of knowledge from two or more disciplines (Brewer, 1999; Klein, 2010; OECD, 1972). Yet, it is

necessary to note that interdisciplinarity is a highly complex concept and that different forms of ties between scientific disciplines can be identified. A review of literature reveals that distinctions between the following types of ties between disciplines are common: Multidisciplinarity, pluridisciplinarity, crossdisciplinarity, interdisciplinarity, and transdisciplinarity, whereas multidiscplinarity is constituted by weaker and transdisciplinarity by the strongest ties.

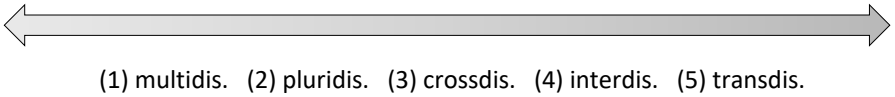

Figure 1: Different forms of ties between scientific disciplines (own visualisation, based on Klein, 2010)

Multidisciplinarity refers to a mere juxtaposing of knowledge from different disciplines. Pluridisciplinarity is when disciplines cooperate about a common theme. Crossdisciplinarity is when theory or methods from one or more disciplines act as support for another discipline. Interdisciplinarity is when two or more disciplines are involved in solving the same problem and pro-actively interact with each other, and integrate or blend their knowledge and approaches (Klein, 2010). Hereby, interdisciplinarity is characterised by a substantially higher degree of interaction between academics and therefore integration of knowledge: the theories and methods used to approach problems as well as the knowledge gained from interdisciplinary collaborations are not merely accumulated in the additive sense, but integrated to result into a new, comprehensive view (Defila & Di Guilio, 1999).

According to Ulrichsen (2001, in Jankvist, 2011), especially the three middle types of collaboration across disciplinary boundaries (pluri- cross- and interdisciplinarity, see Figure 2) are relevant when talking about interdisciplinarity in teaching and education. Therefore, I assume that the interdisciplinary structures observed within this study comply with characteristics of these three forms of interdisciplinary ties.

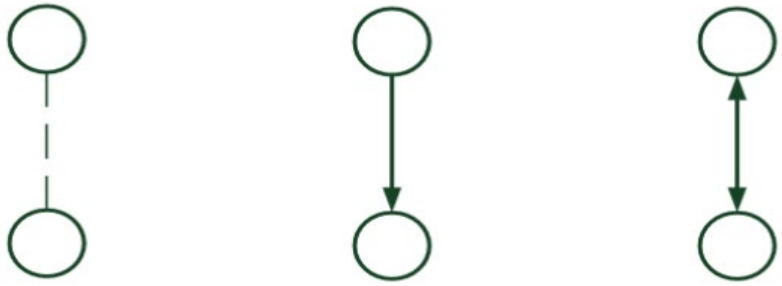

Figure 2: Integration of knowledge and approaches between different disciplines (Source: Jankvist, 2011)

Hutooniemi et al. (2010) distinguish between different types of interdisciplinary interaction between scientific fields. Their typology is somewhat more complex than the ones presented above and is based on reflections on the scope, type, and goals of interaction across disciplinary boundaries. The authors propose a distinction between different classes of multi- as well as different types of interdisciplinarity. Multidisciplinary interaction can either be a) encyclopedic multidisciplinarity, characterised by a loose link between disciplines by a topical focus, b) contextualizing multidisciplinarity, characterised by a joint identification of a research problem, but not by interaction in research, as well as composite multidisciplinarity, implying a technical combination of expertise from different disciplines in sequential manner. Interdisciplinarity, on the other hand, is categorised into a) empirical interdisciplinarity, where empirical data from different disciplines is integrated to investigate phenomena, b) methodological interdisciplinarity, characterised by the integration of methodological approaches in novel ways, and c) theoretical interdisciplinarity, where different disciplinary theoretical concepts, models and approaches are contrasted and synthesised, resulting into the development of new theoretical tools. Hutooniemi et al. (2010) further argue that an analysis of interdisciplinarity should take into account the underlying rationales. In this regard, the authors distinguish between epistemological approaches, which are derived from a motivation to create a more profound

scientific understanding from a phenomenon, and instrumental approaches, according to which interdisciplinarity is regarded as pragmatic and "a practical solution to complex problems" (p. 85).

Despite a plethora of literature dealing with typologies and characteristics of different types of interdisciplinary work, interdisciplinarity remains a multifaceted and hard to study concept which remains to be measured inconsistently (Wang & Schneider, 2020). Quantitative attempts to measure interdisciplinarity mostly stem from bibliographic and scientrometric research (Leydesdorff & Ivanova, 2021; Porter et al., 2007), sometimes including co-citation network analysis (Hernández & Dorta-González, 2020). Such research is often restricted to the analysis of research outputs, in particular articles listed in scientific databases. Qualitative measures, on the other hand, are more concerned with processes of collaborative work across disciplinary boundaries and factors influencing interdisciplinary research (Lattuca, 2002; Wagner et al., 2011). Ávila-Robinson et al. (2021) show that there is disagreement in the findings of quantitative, e.g. bibliometric, and qualitative measures, e.g. such focussing on scientist perceptions of interdisciplinary work. They conclude that thus, "there is no 'holy grail' measure for interdisciplinarity" (p. 7477). Literature therefore proposes a combination of qualitative and quantitative measures in order to fully understand interdisciplinarity (Ávila-Robinson et al., 2021).

3.4 Antecedents of Collaboration: Understanding academic and interdisciplinary collaboration

As the previous sections have underlined, there have been both pushes for and against interdisciplinarity, stemming from societal expectations, policy demands, as well as dynamics within academia itself. But: why do academics chose to collaborate across different types of boundaries? This section is dedicated to a short introduction of different types of collaboration within academia as well as interdisciplinary collaboration beyond academia.

Academic collaboration is defined in different ways in literature. Hackett (2005, p. 671) takes a broad approach by defining collaboration as a "family of purposeful working relationships between two or more people, groups or organisations". Katz and Martin (1997, p. 7) further clarify the purpose of collaborative relationships by defining collaboration as the "working together of researchers to achieve the common goal of scientific knowledge". Sonnenwald (2007, p. 645) further concretises this by describing collaboration as an "interaction taking place within a social context among two or more scientists that facilitates the sharing of meaning and completion of tasks with respect to a mutually shared, superordinate goal".

Literature argues that collaboration has become a defining feature of contemporary academic research. As Duysburgh et al. (2012, p. 267) state, collaboration is the "main characteristic of academic research." Beyond being a practical necessity, it is increasingly regarded as a normative value in the scientific community. Parker et al. (2010), as cited in Müller (2012, p. 291), frame collaboration as "a value in itself, a standard requirement of scientific labour". The motivations for engaging in collaborative research are manifold. At the epistemic level, collaboration allows researchers to address complex and multifaceted problems more effectively by integrating diverse expertise and perspectives (Biagioli, 1998; Wray, 2002, 2006). In addition to epistemic benefits, collaborative work tends to be more highly cited (Biagioli, 1998; Wray, 2002, 2006), suggesting that it has a greater impact within the scientific community (Laudel, 2001). Overall, factors influencing the initiation and sustainability of collaboration relate to individual motivations, personal characteristics, and contextual conditions (Börner et al., 2010), and include access to knowledge, access to resources, access to infrastructure or equipment, tackling large and complex systems, as well as fun and pleasure (Bozeman & Corley, 2004).

Literature points to the importance of acknowledging the broader social and institutional fabric of scientific practice for understanding why and how

academic collaboration emerges. As Knorr-Cetina (1981) emphasises, knowledge production is not an isolated cognitive activity but is influenced by the social organisation of scientific environments. It is constructive and embedded in temporal and spatial contexts. Academic collaboration can thus not be regarded as a mere rational means to solve complex scientific problems, but rather a socially situated activity shaped by both the temporal and spatial contexts in which academic operate. Whitley (2000) argues that the structure of knowledge production is shaped by the degree of pluralism and flexibility available for setting research agendas and methodologies. The degree of pluralism, i.e. diversity of approaches and ideas, and flexibility, i.e. freedom in defining research goals and methodologies in knowledge production systems influence collaborative behaviour, whereas collaboration is more likely to flourish in systems with high pluralism and flexibility that are more open to diverse perspectives.

Rip's (1990) three levels of scientific activity – researching, scientizing, and politicking – further offer a framework for understanding how collaboration functions across different layers of academic life. The researching level concerns the everyday, practical level of doing science. At this level, collaboration is often informal and operational. Researchers work together to accomplish specific academic tasks. The scientizing level refers to the formal communication and codification of scientific work, e.g. through publication, grant application, the development of theoretical frameworks and other activities through which academics contribute to a broader scientific discourse and/or legitimise their work. At this level, collaboration becomes more visible and institutionalised. The politicking level refers to contextual or strategic questions and reflects the intersection of science with broader political, institutional, and social interests. It includes the navigation of funding landscapes, aligning with political or organisational demands and priorities, and the competition for resources, prestige, or leadership. Collaboration at this level is often influenced by strategic considerations, including access to networks, securing resources, or increasing visibility and

influence in scientific fields. Following these perspectives, collaboration needs to be understood not just as a choice made by individual researchers, but as a product of complex dynamics at the interplay of social structures, disciplinary norms, strategic considerations and institutional pressures – and thus the very conditions under which academic work is practiced.

Collaborations can be typified along various axes, including disciplinary, geographic, and organisational boundaries (Sonnenwald, 2007), with each of these dimensions bringing specific challenges and opportunities. Kraut et al. (1988) underline the importance of spatial proximity and suggest that informal communication among physically proximate colleagues often leads to collaboration. Bozeman and Corley (2004, p. 602) reinforce this by stating that "the closer two potential collaborators are in spatial proximity, the more likely they are to engage in informal communications that will lead to collaboration". Similarly, Laudel and Gläser (1998) establish a hierarchy of collaboration with increasing difficulty for boundary-spanning, ranging from collaborations from the same community working in the same institute (least difficult), different communities working in the same institute (moderate difficulty), to different communities working in different institutes (most difficult).

At the structural level, funding mechanisms also play a role. Large-scale collaborative projects are often incentivised through funding schemes designed to promote interdisciplinarity and cross-institutional research (Hansson & Mønsted, 2012; Salonius, 2007). Nonetheless, individual predispositions towards interdisciplinarity vary, and these personal inclinations also influence the likelihood of collaborative engagement (van Rijnsoever & Hessels, 2011). Power relations and institutional hierarchies further shape collaborative behaviour. Collaborations can be crucial for academic reputation and career advancement, yet they can also be sites of tension and competition. For example, Müller (2012) illustrates how postdoctoral researchers in the life sciences may hesitate to engage in

collaborations due to concerns about authorship credit and the impact on tenure-track evaluations, which often prioritise first-author publications. This reveals a broader contradiction within academia: the simultaneous pressures to collaborate and to compete.

Finally, interdisciplinary collaboration is addressed beyond academia in other professional organisations in which highly trained professionals work with considerable autonomy, yet are required to coordinate - hospitals being a prime example. With regard to interdisciplinary collaboration in hospitals, Sicotte et al. (2002) have developed a framework (see Figure 3) distinguishing a) contextual variables (e.g., characteristics of programme managers and the programme's financial/structural features), b) intragroup processes (beliefs about the value of collaboration, social integration, conflict levels, adherence to disciplinary vs. interdisciplinary logics, and relevant organisational rules), and c) the nature of the task as a mediating variable shaping d) the outcome—graded forms of collaboration ranging from care sharing to co-ordination (see Figure 3 below). The authors conclude that "the main factors (…) are closely linked to work group internal dynamics" and attach less importance to contextual factors, claiming that their results are congruent with literature on work group organisation in professional organisations (Sicotte et al., 2002, p. 999).

While developed for hospitals, this example of interdisciplinary collaboration within a professional bureaucracy with structures strongly based on professional training and peer communities (Mintzberg, 1980) also bears parallels with literature on higher education. Studies of team science and epistemic cultures emphasise that interdisciplinarity depends on building common cognitive ground (Brewer, 1999; Defila & Di Guilio, 1999), cultivating trust, and installing coordination and credit-allocation mechanisms – precisely the intragroup factors highlighted by Sicotte et al. (2002).

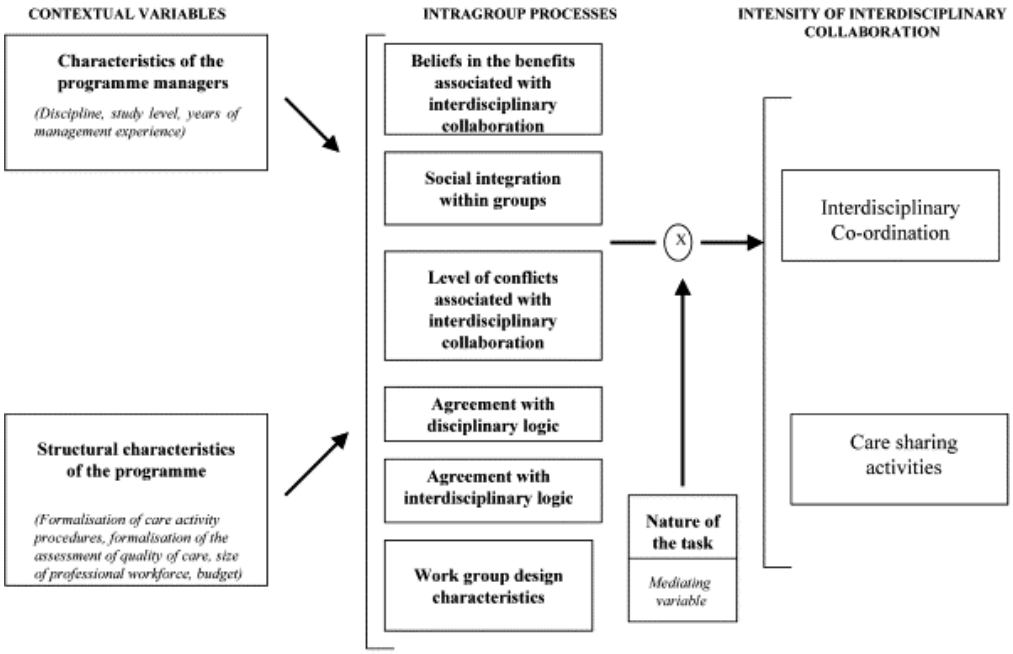

Figure 3: Input-Process-Output Model of interdisciplinary collaboration within hospitals (Sicotte et al., 2002, p. 994)

Work on disciplinary tribes (Becher & Trowler, 2001), collaboration at a distance (Cummings & Kiesler, 2008), and the (mis-)alignment of credits and incentives (Bromham et al., 2016; Leahey et al., 2017) on the other hand show that the macro-context – including evaluation regimes, funding rules, as well as disciplinary and organisational boundaries – often influences collaboration indirectly by shaping behaviour within groups: who shows up with which expectations, how often can they meet, and how do they interpret risks and rewards of collaboration. The nature of the task is treated by Sicotte et al. (2002) as a mediator between intragroup processes and collaboration outcomes. Within the context of universities, this may refer to their two core tasks – teaching and research – and to the functional logics (Nickel, 2012) and related coordination mechanisms. Collaboration intensities are distinguished by Sicotte et al. (2002) as ranging from care sharing to interdisciplinary coordination. This is mapped in literature on higher education in similar continuum – ranging from multidisciplinary parallel contribution through interdisciplinarity with integrated methods to

transdisciplinarity (e.g. Klein, 2010, as discussed in detail in Chapter 3.3 above).

3.5 Synthesis: Interdisciplinarity and organisational change in universities

It is argued that interdisciplinary research is strongly connected to the emergence of new modes of knowledge production (e.g. Mode 2, Gibbons et al., 1994; Nowotny et al., 2001) and leads to fundamental changes in the traditional, discipline-based structures of universities (Defila & Di Guilio, 1999). Defila and Di Guilio already argued in 1999 that the institutionalisation of interdisciplinarity would help to define certain aspects of interdisciplinary collaboration and therefore reduce the complexity of disciplinary boundary crossing to a certain degree.

Yet, scholars are still divided on the question of how much change towards interdisciplinarity has taken place in universities to this date. Some claim that higher education institutions have undertaken innovative, transformational change efforts in response to demands for interdisciplinarity (Clark, 1998; Eckel and Kezar, 2003; Kogan, 2000). A study conducted by Holley (2009) shows that transformational change towards interdisciplinarity takes place at universities but is usually implemented as part of a pursuit of other institutional priorities.

Others argue that although discourses on interdisciplinarity have become prominent over the past decades, it has "had little or no effect neither on the level of organisation nor on that of actual conduct of researchers and teachers" except in some pioneer universities that have implemented structural changes towards interdisciplinarity in recent years (Weingart, 2014, p. 151). They argue that, usually, interdisciplinarity is not structurally embedded in universities but exists in the "white space of organisational charts" (Klein, 2000) and that interdisciplinarity has been approached "as a trend rather than a real transition", leading to "piecemeal, incoherent, catch-as-catch-can" rather than "comprehensive, root-and-branch reforms" (Rhoten, 2004, p. 6).

Another possibility is that interdisciplinarity does take place in universities, but it not recognised as such. Klein (2010, p. 21) refers to this as the "concealed reality of interdisciplinarity" and argues that interdisciplinarity flourishes where it is not labelled as such and develops through grassroots activities rather than top-down implemented change.

Instead of being embedded in the structures of universities, interdisciplinarity therefore either exists at intersections – trading zones of interaction – between disciplines, or in enclaves, in which collaborating researchers may define new boundaries, form new identities and even develop new cultures (Klein, 2000). An example of the latter are interdisciplinary research centres or other units established top-down with a focus on certain research topics. Although the number of such centres has significantly increased in the past two decades, authors report a "frustration with a lack of administrative leadership in bringing about organizational change to facilitate interdisciplinarity in universities" (Sá, 2008, p. 542). In most cases, universities create a 'matrix' structure by establishing distinct structures for interdisciplinary research in the form of such institutes, centres, or other units, pursuing strategic aims such as the building of research profiles and increasing the visibility of universities (Henkel, 2007). Such interdisciplinary research units provide new opportunities for boundary crossing and are often referred to as best-practice examples as they offer tangible locations for interdisciplinary collaboration, but nevertheless they tend to remain at the margins of institutional power (Eckel, 2006).

Speaking in disfavour of the top-down establishment of such interdisciplinary research units, some authors have pointed out that interdisciplinarity best occurs bottom-up without much institutional interference irrespective of the policy or organisational policies and structures (Klein, 1996), e.g. based on networks of academics sympathetic to interdisciplinary work (Brint et al., 2009). Yet, recent studies suggest that the role of university management in processes of change towards interdisciplinarity must not be underestimated. Louvel (2016)

gives examples of the bottom-up development of interdisciplinary structures that strengthen linkages between departments while preserving the autonomy of these departments, and points out the relevance of support by university management for such bottom-up processes. There is evidence that university managers and leaders are important gatekeepers of interdisciplinarity (e.g. Fini et al., 2021) and that they can mitigate barriers and challenges to interdisciplinarity (Jacob, 2015; Kroll & Schubert, 2023; Yang et al., 2020) such as the ones mentioned in the previous sections of this chapter. Taking a more critical stance, Jacobs (2014) states that "interdisciplinarity seems likely to result in a shift of power away from faculty toward the central administration of the university" (p. 210) and thus claims that processes of change towards interdisciplinarity might lead to increasing power of university management and could endanger academic autonomy.

Overall, little is known about processes of change towards interdisciplinarity and literature calls for further ethnographic studies needed to identify organisational conditions for interdisciplinarity in universities (Sá, 2008), which is one of the aims of this study.

4. Towards the Emergence of Interdisciplinary Structures in German Universities

This research project focusses on the emergence of interdisciplinary structures within the setting of German higher education – a system strongly influenced by federal organisation and Humboldtian principles of higher education. In Germany, like in the rest of the world (see Chapter 3.2), interdisciplinary is increasingly emphasised as a strategic response to complex societal challenges. Yet, it is crucial to explore the contextual background of the German case to understand how interdisciplinarity is approached and may be implemented.

Therefore, this chapter addresses the particularities of the German higher education and research system, providing an overview of key characteristics of the system and of the internal organisation of university. It further focusses on the particularities of the organisation of teacher training in German universities, which is pertinent for understanding the context of the case-study project studied within the scope of this dissertation. The chapter then turns to an exploration of policies and frameworks for interdisciplinarity in German higher education before turning to implications for organisational change towards interdisciplinarity in German universities.

4.1 Introduction to the German higher education system

Germany has moved from an elite to a mass-higher education system in the 1960s. In the winter semester 2024/2025, there were 422 higher education institutions in Germany, among which 109 full universities, 209 universities of applied sciences, 52 arts and music colleges, 30 public administration and 16 theoretical colleges, as well as six colleges of education. These higher education institutions educate a total of 2.9 million students, the majority of which (57.6%) are enrolled at universities. On average, a university has about 15.000 students. Altogether, the German higher education institutions employ around 792.000 staff, among which a full-time equivalent of around 281.588 academic and creative arts staff, only 51.873 of which are professors (German

Federal Statistical Office, 2025). Although the number of students enrolled in and attention given to state-recognised private higher education institutions has significantly increased over the course of the past decade (Leišytė et al., in press), the German higher education system is a predominantly public system. Moreover, it is a federal system, in which competencies for (higher) education lie with the 16 individual states, which are responsible for the legal regulation and funding of universities. This restricts influences by the federal government which can only act in agreement with all 16 states. Within the public higher education sector, up to 90% of an institution's budget is derived from public funding, and around 75% of this are allocated to HEIs by state governments (Hochschulrektorenkonferenz, 2020).

Until the 1990s, German higher education institutions were subject to regulatory governance through the state, with strong power vested in the academic oligarchy. While the administrative parts of higher education institutions largely acted as if they were part of the state apparatus, teaching and research were controlled by academics, organised as a 'learned republic' (Orr & Jäger, 2009). Since then, German higher education has witnessed the development of increasingly competitive conditions related to world-wide trends of internationalization and globalization of higher education and society in general. In the wake of New Public Management-inspired reforms, shifts of power from the state to the university level could be witnessed, e.g. with regard to regulating study programmes and exams and the recruitment of professors (idem.), leading to stronger managerial freedom and stronger internal hierarchy in higher education institutions (Hüther & Krücken, 2018; Nickel & Zechlin, 2005). Increasingly, elements of competition have been introduced such as state-steering based on target- and performance agreements between ministries and higher education institutions in the respective states, report systems for annual finances, partly performance-based allocation of state funding (Orr & Jäger, 2009). Further, university boards ("Hochschulräte") (Lange, 2010), staffed with representatives from within and outside of the higher education sector (other HEIs, industry,

politics, societal organisations), were established in all but one of the sixteen states to ensure that universities act in and respond to demands of the wider society (Hüther, 2009).

While German universities were referred to as "institutions" possessing an "organisational shell" but lacking an integrated core (Huber, 2005, p. 394) before the introduction of NPM reforms, literature argues that they have increasingly developed into strategic, organisational actors (Krücken & Meier, 2006). Yet, as Huber (2005) argues, the fact that they fulfil tasks in two different societal spheres, namely science and education, prevents them from developing into fully organizational actors in either or both of these spheres. Therefore, German universities must be regarded as 'specific organisations' in the sense of the term shaped by Musselin (2006).

In the following, two of the key characteristics distinguishing the German higher education system, namely the highly fragmented organisational structures of universities as well as core values of the system, will be discussed in more detail.

4.1.1 Structures and organisational fragmentation within the German university

The central governance bodies of German universities include a president or rector (elected for a term, formal head of the university), a chancellor (chief administrator, responsible for finances, infrastructure, and human resources), the senate (the central collegial body with elected representatives of professors, academic and non-academic staff, and students, which makes decisions regarding academic affairs, such as teaching and research matters) and, usually, a university board (Hochschulrat, supervisory board often including external stakeholders from industry and society, which provides oversights on strategy, development, and finances) (Hüther & Krücken, 2018). Internally, German universities are usually organised into faculties, which are large internal units that usually cover a discipline or group of disciplines and are headed by a dean, supported by a vice-dean and an elected

faculty council. Many academic decisions, including study programmes, examination rules, and the recruitment of professors are handled on faculty level (Hüther & Krücken, 2018). Within the faculties, there are a number of professorships or chairs, led by a professor with associated staff (junior academic staff, assistants, and administration) (Wilkesmann & Wagner, 2024). Chairs are largely autonomous in the control of their budgets, research priorities, and teaching offer. Sometimes, faculties contain institutes or departments as mid-level sub-units between faculties and chairs.

As discussed above with regard to barriers to organisational change, universities are characterised by traditionally decentralised and fragmented structures and are therefore commonly referred to as "loosely coupled systems" (Weick, 1976). This characteristic, which can be observed in universities world-wide, is especially strong in the German higher education system and is reinforced by the strong faculty- and professorial chair system (Hüther & Krücken, 2018). Faculties in the German higher education system and elsewhere have distinctive cultures and interests are inhabited by individuals and groups with multiple, often-conflicting roles and identities. Individual professors as well as faculties within German universities compete for students, reputation and resources (Krücken, 2017), and the strong autonomy of professors leads to power over staff and resources being dispersed even within individual faculties. Therefore, collaboration of (individual) members of different faculties is rare and where it happens, it is further complicated: Financial administration is strongly decentralised and resources and staff cannot be easily shared. Moreover, faculties have to fulfil clearly specified teaching loads and prefer to cater the needs of their own students. This fragmentation extends to doctoral training. The majority of German doctoral students is not included in structured doctoral programmes and is highly dependent on their supervisors (Hüther & Krücken, 2018) – professors which are usually also their superiors in work relationships. Literature shows that there has been an expansion of the number of academic staff below the professorial level, but no increase in professorships, which

makes academic careers in Germany particularly insecure (Hüther & Krücken, 2018).

German higher education has witnessed shifts in decision-making, most notably over the course of the last three decades. These shifts include a move from collegial governance (with a strong dominance of professors in the traditional, so-called *Ordinarienuniversität)* to shared governance (entailing decision-making of different actors such as academic and non-academic staff as well as students in governance bodies such as the senate, faculty councils, and committees) as well as towards managerial governance principles, strengthening organisational actorhood and the role of HE leadership. These shifts have resulted in a "'wild' hybridization of the principles of the university of professors, of the group university and the managerial university" (Hüther & Krücken, 2018, p. 260). However, the German higher education system displays relatively low degrees of managerialism (Boer et al., 2007). Professors continue to dominate decision-making within German universities and traditional governance structures limit the influences of hierarchical authority (Schimank, 2005a).

4.1.2 Core values within German higher education: Freedom of teaching and research and (professorial) autonomy

The German higher education system is characterised by an extraordinarily high degree of academic freedom and autonomy. According to Article 5, Paragraph 3 of the German Constitution (*Grundgesetz*), "Art and Science, Research and Teaching are free. The freedom of teaching shall not release any person from allegiance to the constitution".

According to Nickel (2012) different functional logics can be ascribed to the tasks of universities (see Table 2 below). Whereas the management and administration of universities are highly formalised, can easily be organised and follow a top-down logic similar to that of formal work organisations, teaching and research remain at the discretion of academics. However, Nickel (2012) points to differences between the functional logics of teaching and

research: According to the author, both follow a bottom-up orientation. Yet, while research has a low level of formalisation and is strongly self-organised, teaching has a medium level of formalisation and can more easily be controlled, managed and organised on the basis of internal (examination regulations, results of student feedback) and external (state regulations) mechanisms.

	Management and administration	**Academia**	
		Teaching	**Research**
Degree of formalisation	High	Medium	Low
Logic of Organisation	Very good organizability	Good organizability	Strong self-organisation
Orientation	Top-down	Bottom-up	Bottom-up

Table 2: Functional logics of organisational spheres in German universities (based on Nickel, 2012)

Overall – while we witness high degrees of academic freedom and autonomy with regard to both research and teaching – German universities take stronger responsibilities for the qualitative and quantitative development of their teaching than of their research, the latter of which remains primarily controlled by loosely-coupled, epistemic communities (Nickel, 2012; Stichweh, 2005, 2013).

Professorial autonomy at German universities is further strengthened by the chair system, which is traditionally inherent in universities in Central European countries, and has been based on the Humboldtian principle of '*Einsamkeit und Freiheit'* – solitude and freedom (Schimank, 2005b). In such chair systems, academic and administrative staff are direct subordinates of individual professors (Höhle, 2015) and professors autonomously control resources provided to them by the state, make hiring decisions, and set the course of research within their chairs. As Neave and Rhoades formulated in 1987, "(p)rofessors are the masters, and the subordinate academic staff serve either as their apprentices or, in a slightly less humble station, as their journeymen" (p. 215). More recent literature has confirmed the particularly powerful positions and high degree of autonomy of German professors

(Kleimann, 2019), with Hüther and Krücken (2018, p. 260) even referring to individual professors as the "center of power at German higher education institutions". Therefore, the German chair system is very different from the department system prominent in Anglo-Saxon countries, in which power is dispersed, strong independencies between members prevail, and the allocation of resources lies in the hand of the university administration (Höhle, 2015).

In the discourse on academic freedom and autonomy, academic self-governance plays a crucial role. In Germany, the involvement of academics in self-governance can be regarded as very high. Despite the introduction of managerial reforms, the German higher education system remains largely based on a collegial model strongly dominated by professors (Dobbins & Knill, 2015), in which external actors, such as the state, remain incapable of implementing reforms top-down against the interest of the "academic oligarchy" (Dobbins & Knill, 2015, pp. 197–198). Whereas the past decades have witnessed the introduction of elements of quality assurance and competition that influence teaching and research at universities (Osterloh, 2012), peer-review as the central concept in ensuring autonomy of science (Stichweh, 2016) prevails.

4.2 The organisation of teacher training within German universities

This section focusses on the organisation of teacher training within German universities. In order to investigate the emergence of interdisciplinary structures in academic project settings within German universities, this dissertation draws on a case study of a project conducted within the context of teacher training. An understanding of how teacher training is organised at German universities and how this differs from other higher education systems is thus pertinent for the interpretation of findings generated within the context of this dissertation.

German teacher training has a long tradition of university-centred formation with a strong disciplinary depth coupled with extensive didactic training. The federal organisation of higher education is mirrored in teacher training and the detailed structuring of teacher training follows regulation of respective states (Makrinus, 2013). Nevertheless, there are commonalities across the states. In general, teacher training is structured into two different main phases: a university phase (bachelor and master degree), followed by a theoretically-based practical phase (*Referendariat*) in schools. Teacher training within the first phase at university aims at a basis of knowledge and reflexivity that is needed for teaching at schools. To this purpose, study programmes include courses from the educational sciences as well as courses from two disciplines which students chose to be their later focus as teachers (Makrinus, 2013).

In contrast to other higher education systems, German teacher training is not organised in central schools of teacher training that encompass disciplines. Instead, it is characterised by constant conflict between the scientific discipline versus the profession and, respectively, discipline-based research-oriented formation versus the practice-oriented training of future teachers (Hericks & Meister, 2020; Terhart, 2005). In contrast to other professional fields – e.g. medicine or law, where there is a high degree of overlap between the profession, respective study programmes, and a scientific discipline –, the study offer within teacher training is regarded as "fragmented" and "dispersed across many disciplines and subjects" (Terhart, 2005, pp. 16–17).

In order to deal with these challenges, centres for teacher education as central, academic units have been established since the 1990s. These centres act as horizontal structures with the task of coordinating curricula, mentoring, and the organisation of practical study phases across faculties within universities. Their reception has been inhomogeneous. On the one hand, they are described as "catalysts for processes of organisational change" (Blömeke, 2000, p. 126) in literature and praised for their ability of bundling of activities and facilitating communication between different phases of teacher training,

between different disciplines and faculties, as well as between academic and non-academic staff and students. On the other hand, existing literature underlines their reception as disruptive and disturbing, in particular clashing with the strongly discipline-based faculty and chair system in German universities (Terhart, 2005). It can be argued that in practice, centres for teacher training act as superstructures with traditional university structures remaining largely unchanged underneath and disciplinary boundaries continuing to be upheld.

For students, and thus future teachers, this entails exposure to multiple disciplinary cultures which, depending on the combination of disciplines that they have chosen, may lead to a clash or reinforcement of disciplinary identity (Huber, 1990, as referenced by Hericks & Meister, 2020). Recent literature therefore calls for increasing reflexivity of disciplines and subjects – both in the context of university-based teacher training and at schools –, which, according to Hericks and Meister (2020) can only be achieved by increasing communication and exchange between different disciplines at university and subjects within schools.

To conclude, German teacher training is strongly dispersed across faculties and – despite students simultaneously attending courses from the educational sciences and two further disciplines – remains strongly grounded in traditions of individual scientific disciplines.

4.3 Policies and programmes for interdisciplinarity in German higher education

The global shift towards the knowledge-based society and underpinning of the economic and societal significance of universities have also occurred in Germany (Hüther & Krücken, 2018). As Schimank (2005a, p. 362) has argued, in the wake of such shifts, "science penetrates the 'knowledge society', and, in turn, is increasingly subject to public expectations". This also extends to demands for interdisciplinarity, which appear in the German case on different levels: a) through influences of legal regulation and performance

agreements on a state level, b) through competition and increased profiling induced by the excellence strategy on federal-state level, as well as c) through targeted programmes of funding agencies.

As outlined in the sections above, academic freedom in the German higher education system is particularly strong. Nevertheless, Germany is what Nyhagen et al. (2017) have referred to as a '*Rechtsstaat regime'*, which means that governmental regulation plays a significant role in higher education and – as previously argued in Leišytė et al. (2022) – the promotion of interdisciplinarity in universities. As previously shown (Leišytė et al., 2022), all German states promote interdisciplinarity, although to a varying degree and by varying means, either through state HE laws or through performance agreements between states and their universities. The states employ enabling and/or prescriptive approaches to promote interdisciplinarity. Enabling approaches aim at providing a legal basis for universities to deviate from traditional organisational and decision-making structures to incorporate interdisciplinarity in teaching and research, e.g. manifested through *studium fundamentale* programmes or interdisciplinary research centres. Prescriptive approaches are usually found in performance agreements and contracts between state ministries of higher education and universities, which often contain detailed prescription of actions in order to facilitate interdisciplinarity, sometimes even referencing concrete funding lines that are to be addressed. Overall, enabling approaches, often found in state HE laws, provide a legal basis for interdisciplinarity predominantly with regard to teaching, whereas interdisciplinarity research is more dominantly targeted through performance agreements between state ministries and universities (Leišytė et al., 2022).

Despite the *Rechtsstaat regime* argument made above, German higher education is known for high degrees of professional and particularly professorial autonomy, which may limit the effect of interdisciplinary policies on actual practices of knowledge production. We could partly confirm this in

a study of institutional logics in interdisciplinary research centres at a German university which has revealed state logics as largely absent and a prominence of professional (problem solving, curiosity, reputation) and market logics (competition, acquisition of funding, commercialization) (Leišytė et al., 2026).

Many of the above-described performance agreements between ministries and universities contain direct references to the excellence initiative, a programme initiated in collaboration between the German federal state and the individual states in order to increase excellence and international visibility of German research – with interdisciplinarity being a central selection criterion (Pasternack, 2008; Zuber & Hüther, 2013) for funding via three programme lines: clusters of excellence, graduate schools, and the development of future concepts.

Another central lever for fostering interdisciplinarity is based on competition for non-governmental, third-party funding. Third-party funding has been established as the "focal scarce good of competition" (Kosmützky & Meier, 2025, p. 9) in German higher education. Literature shows that developments of important providers of third-party funding within the German higher education system, in particular the German Research Foundation (DFG), increasingly promote interdisciplinarity, for example through the funding of collaborative research centres and coordinated research programmes (Hüther & Krücken, 2018). Kosmützky and Krücken (2024, p. 36) argue that in the light of such developments, the "imperative to compete also creates new requirements for cooperation", and show that there is strategic collaboration of academics and institutions in order to increase chances at obtaining third party funding. Overall, there seems to be a trend of moving from informal cooperation towards formalised forms of cooperation with competitive project funding (Georghiou, 1998) – which, in many cases, requires the crossing of disciplinary or institutional boundaries.

4.4 Synthesis: Implications for the study of organisational change towards interdisciplinary in German universities

Looking at formal organisational structure, there are not too many differences between German universities and descriptions of universities in other systems, such as the US (Bess & Dee, 2012). The descriptions of the German higher education system made above do, however, underline important distinctions.

German higher education is characterised by high levels of freedom of teaching and research, by high degrees of professorial autonomy, by geographical fragmentation as education is regulated to a wide degree by the 16 federal states, as well as by low degrees of implementation of principles of New Public Management in comparison to many other higher education systems (Hüther, 2010). Academics, in particular professors, are highly autonomous in their work and the resulting, strong degrees of individuality and fragmentation lead to competition – between and even within faculties of the same university. Considering these circumstances, it can be assumed that hierarchical, planned implementation of innovation or change arouses more resistance and does therefore not work as well as collegial implementation, which emerges bottom-up. Within the context of interdisciplinarity, this assumption has partly been confirmed by literature discussed above, according to which interdisciplinary policies have limited or indirect effects on actual practices of knowledge production.

Literature further shows that interdisciplinary teaching and research units geared towards professional fields (among which, for example, teacher training, which is examined within the scope of this study) are traditionally not given in Germany (Weingart & Padberg, 2014). The academic project for inclusive teacher training, which has been chosen as a case study for this research project, is thus particularly pertinent for a study of the emergence of new structures that span disciplinary and faculty boundaries.

5. Theoretical Considerations

This chapter addresses the conceptual frameworks and assumptions that have shaped my understanding of the research field and, consequently, the design of this study. Within this chapter I argue that understanding organisational change within universities – in particular the emergence of interdisciplinary structures – requires theoretical approaches that bridge individual agency with enduring (organisational) structures. Two prominent sociological frameworks used to understand how social structures are created, maintained, and transformed through human action – Giddens' (1984) structuration theory and Hallett & Ventresca's (2006) inhabited institutionalism – are introduced for this purpose. In the second section of this chapter, definitions of key terminology of the research project are presented.

5.1 Bridging structure and agency in organisations

Sociological analysis has traditionally been organised around three core levels: the micro, the meso, and the macro level (Jepperson & Meyer, 2011). Each level offers distinct yet complementary insights into the dynamics of life within social structures. The macrosociological view on social structures, based on system or institutional level analysis, usually focusses on large scale populations, such as entire societies or groups within society and has traditionally been strongly based upon functionalist paradigms (Ritzer, 1985). Microsociology, on the other hand, based on individual-level analysis, emphasises individual agency and social interaction and often draws on social constructivist paradigms. At the meso-level, based on analysis on a social-organisational level, the role of institutions, organisational cultures, and social networks in producing and reproducing social order are analysed (Jepperson & Meyer, 2011), often drawing on perspectives from institutionalism and organisational sociology (Powell & DiMaggio, 1991; Scott, 2013).

Sociological inquiry has long grappled with bridging these levels of analysis and resolving tensions between different analytical foci – from individual agency and social interaction to institutional process and large-scale social

structures (Turner, 2005). Organisational studies in particular have been criticised for a "decoupling of institutions from social interactions" (Hallett & Ventresca, 2006, p. 215). Following this criticism, I argue that understanding organisational change within universities – in particular the emergence of interdisciplinary structures – requires theoretical approaches that bridge individual agency with enduring (organisational) structures. Specifically, I turn to structuration theory (Giddens, 1984) and inhabited institutionalism (Hallett & Ventresca, 2006) as two prominent sociological frameworks used to understand how social structures are created, maintained, and transformed through human action.

Giddens' (1984) structuration theory offers a framework bridging different levels of analysis by conceptualizing the dynamic interplay between structure and agency in the (re-)production of social systems. Giddens (1993, p. 4) has criticised previous approaches to understanding social organisation as either "strong on action, but weak on structure", or "strong on structure, but weak on action" and has developed structuration theory in an attempt to show how structures and agency are intertwined. Structuration theory, at its core, challenges the dichotomy between structure and agency. Giddens (1979) argues that structures do not constitute an external, one-way influence on action, but rather exist – and can be changed – through the form of their enactment in practice. Through the concept of duality of structure, Giddens (1984) emphasises that structures are both the medium and outcome of practices that they recursively organise and are organised by human action. From this perspective, organisational change cannot be regarded as a simple product of either top-down directives or bottom-up agency but must be acknowledged as an ongoing, recursive processes of interaction between actors and structures over time and space.

Among the central dimensions of structuration theory are the duality of structure, agency, knowledgeability, as well as time-space distanciation. According to Giddens (1984), structures are the rules and resources

organising social systems. They are not external objects, but instantiated through practices. The duality of structure is constituted by structures as both the medium and outcome of social practices. Agency, which is exercised within structural contexts and at the same time influences them, becomes meaningful when actors have the power and capacity to "act otherwise" (Giddens, 1984, p. 12), thus to resist, alter, or reproduce structures with their actions. In order to gain this capacity, social actors need to understand, interpret, and act competently within the social world. Giddens (1984) frames this under the term of knowledgeability. Only through knowledgeability of social conditions and alternative practices can authors take action and establish new routines. Giddens (1984) finally highlights the relevance of time-space distanciation, which follows the core idea of social practices extending across spatial and temporal divides. Structures are not always localised, but can be influenced and reproduced from distant settings or lifted from local situations into established routines in the broader organisation.

Giddens (1984) claims that interactions across time and space are facilitated by symbolic tokens and expert systems. Symbolic tokens are abstract, generalised communication forms that help organise social relations and coordinate behaviour in an extended system. These may include money, language, credentials, or regulation. In the context of higher education institutions, they may include academic records, publications as tokens for expertise and contribution, research grants, or academic titles and roles. These tokens are embedded in rules and norms, e.g. through criteria for hiring or advancement in the academic career, and constitute resources that contribute to individuals' agency. Expert systems, on the other hand, are defined by Giddens (1990, p. 27) as "systems of technical accomplishment or professional expertise that organise large areas of the material and social environments". They regulate behaviour based on institutional knowledge frameworks developed and maintained by professionals. In the context of academia, they may include peer review and evaluation systems, methodological standards, or academic publishing infrastructure. Reflecting

a variation in knowledge production, validation procedures, and institutional norms, such expert systems are expected to differ across academic disciplines. Disciplines, for example, employ distinct evaluation systems and draw upon different research strategies and knowledge structures (Becher, 1994; Engwall, 2018; Stichweh, 1992). Consequently, this study recognises that the structuration of academic practices is discipline-bound and that disciplinary tokens and systems may enable or constrain actors in challenging or reproducing disciplinary practice.

Giddens' structuration theory has been criticised by other scholars in multiple regards. Barley and Tolbert, (1997), for example, raise concerns about a reduction of either structure to action or vice versa when employing the theory, while Mouzelis (1989) accuses Giddens of an over-integration of structure and agency, resulting in a blurring of analytical distinctions. The theory is further criticised for a high level of abstraction and limited empirical applicability (Barley & Tolbert, 1997), although literature shows that is has been used in numerous studies in management and organisation studies in the past (Hond et al., 2012). Critique also invokes a lack of attention to creative and emergent action (Joas, 1987), underestimation of historical and contextual factors (Barley & Tolbert, 1997), as well as a lack of definitional clarity and empirical operationalizability (Barley & Tolbert, 1997; Thompson, 1989). While the latter points in particular enjoy wide-spread criticism in literature, Giddens' (1984) structuration theory nevertheless provides important insights for the design of this study. Rather than a strict theoretical framework, which pre-frames empirical analysis, I employ structuration theory as sensitizing tool, which allows me to design this study in acknowledgement of structure-agency relationships.

Based on the criticism above and following suggestions from earlier literature, I combine insights from structuration theory with institutional theory. As Barley and Tolbert argue:

> "Structuration theory and institutional theory provide complementary insights. Both share the premise that action is largely organized by institutions, widely held definitions of the behaviour and relationships appropriate for a set of actors. Both acknowledge that institutions are created, maintained and changed through action." (Barley & Tolbert, 1997, p. 112)

Institutional theory and structuration theory both explore links between institutions, or structures, and actions, or agency. Yet, institutional theory yields additional perspectives for this research. Inhabited institutionalism (Hallett & Ventresca, 2006), specifically regards people as carriers of institutional processes, but looks beyond individual agency to understand how social interaction and actors' interpretation and sense-making of these shape organisations. As Becker (1986, as cited in Hallett & Ventresca, 2006, p. 217) state: "it is not simply what people "do" that matters, but how they do so "together". Levels of analysis are bridged by not only focussing on "interaction rituals of the immediate situation", thus the micro-level, but studying links to "formal organizational structures, and the broader conditions of possibility", thus the meso- and the macro-level (Hallett & Ventresca, 2006, p. 231).

According to inhabited institutionalism, structures are reproduced or challenged through everyday interactions, meaning-making, and negotiation within local contexts. As such, the theory puts a much stronger focus on localised, situated enactment of institutions in specific contexts, as well as on (individual) actors' interpretation of such. A disembedding potential, and operation of structures across time and space as foreseen in structuration theory, is not addressed.

The assumptions drawn for this study from institutional theory are the following: First, gathering rich data on specific local contexts as well as regarding temporal dimensions of structural change matter. Secondly, in order to understand agency and resulting interaction rituals, it is important to focus on processes of meaning-making and negotiation. Consequently, this

study will not only draw on records of interactions (who with whom in what ways at what time), but also aim at creating an understanding of 'why' actors contribute the emergence and development of interdisciplinary structures and how they make meaning of their behaviour (Barley & Tolbert, 1997).

Theoretical synthesis is pertinent for the examination of the emergence of interdisciplinary structures in academic project settings. Understanding this phenomenon requires acknowledgement of social structures to be simultaneously shaped by individual agency, institutional context, and broader structural forces. Within the scope of this study, I thus use both insights from structuration theory (acknowledging the recursive relationship between emerging interdisciplinary practices and organisational change), as well as insight from inhabited institutionalism (which underlines the role of sense-making, negotiation, and contestation of practices shaping interdisciplinary structures in daily organisational life) as sensitizing tools.

Although this study follows an ethnographic approach and principles of constructivist grounded theory, the above-mentioned conceptual frameworks and assumptions have shaped my understanding of the research field. This chapter aims at ensuring transparency regarding these assumptions and providing a foundation for theoretical sensitivity. Ideas and assumptions raised within this chapter are not used to predetermine analytical codes or categories, but act as sensitizing tools and flexible lenses that support the collection and interpretation of data. By engaging with existing theory, this chapter builds the theoretical sensitivity that allows for deeper analysis of field data while maintaining an openness to emergent insights. As such, this approach is consistent with Charmaz' view that constructivist theory allows for researchers' engagement with theory as sensitizing and reflexive resource:

> "Constructivist grounded theorists use theoretical frameworks as points of departure for developing analyses—not as tools for verification. We use theoretical perspectives as sensitizing concepts that help us to see and make sense of empirical

phenomena, while remaining open to emergent categories and grounded interpretations." (Charmaz, 2014, p. 30-32).

5.2 Definitions

Based on empirical and theoretical considerations presented in the previous chapters, key terminology – specifically interdisciplinarity, structures, and interdisciplinary structures – is defined as follows in the context of this study.

Interdisciplinarity	Collaboration across two or more disciplines or scientific fields.	Participation of representatives of at least two disciplines or scientific fields; involves bringing together theories, methods or questions from these disciplines or scientific fields for purposes of either or both teaching and research.
Structures	Patterned relations, influencing the way in which goals are pursued within social networks and organisation.	Regular and repetitive interactions of networks of individual organisational members with defined goals and purposes related to the core tasks of universities (teaching and research) and defined and controlled modes of achieving these goals.
Interdisciplinary structures	Patterned relations bringing together perspectives and practices from at least two disciplines or scientific fields.	Regular and repetitive interactions of networks of individual organisational members from at least two disciplines of scientific fields with a defined goal and format, bringing together theories, methods or questions from multiple disciplines or scientific fields.

Table 3: Definitions of key terminology of the study

(Scientific) Disciplines: As outlined in Chapter 3, definitions of scientific disciplines either speak to their infrastructural or their social, cultural and historical dimensions. As infrastructure, disciplines are defined as "sets of problems, methods and research practices" or "bodies of knowledge that are unified by any of these". The social, cultural and historical dimension refers to disciplines as "social networks of individuals interested in related problems or ideas" (Lattuca, 2001, pp. 23-24). Lattuca (2001, p. 24) argues that "while many studies stress one or the other of these foci, neither is complete in isolation". Scientific disciplines are further reflected in a structural manner, among other through curricular structures and standardised forms of scientific

publication (Stichweh, 1992). Disciplines are thus regarded as social structures characterised by shared assumptions, behaviours, cultures and beliefs about the problems, goals, and practices of teaching and research within the context of this research. They are regarded as stand-alone areas of research based on their own theories, networks, and organs of publication. In order to approach the concept of disciplines within the context of this research, I draw on what the German Research Foundation (DFG) refers to as 'research areas' in their classification of scientific disciplines.

Interdisciplinarity is defined here as a form of collaboration bringing together multiple perspectives and practices from two or more disciplines or scientific fields. It entails the participation of representatives of at least two disciplines (or research areas, as outlined above) who bring together theories, methods or questions from these disciplines or research areas for purposes of either or both teaching and research.

Structures, both social and/or organisational, are defined in manifold ways in literature. As Giddens (1984) argues in reference to social structure, it is "both the medium and the outcome of the practices which constitute social systems" (p. 25) and is upheld through "routinized practices" (p. 60) and "recursive reproduction of routines" (p. 282) within a social system. Merton (1938) claims that social structures are specified by culturally defined goals, purposes and interests, as well as by defined, regulated and controlled modes of achieving these goals, either institutionally or morally regulated. Organisational structure refers to the formal system of tasks, roles, relationships and authority within an organisation, defining how activities are coordinated and goals are achieved – also referred to by Mintzberg (1979, p. 2) as "the sum total of the ways in which its labor is divided into distinct tasks and then its coordination is achieved among these tasks". Abell (1996, p. 433) further distinguishes between formal and informal organisational structure, whereas formal structure refers to "organizational hierarchy, the officially sanctioned incentive schemes and the routines, procedures and

monitoring which support these", and informal structure is shaped by "patterns, behaviours and interactions that stem from personal rather than official relationships" and thus is similar to definitions of social structure. According to Clark (1983), academic systems fall between organizations and society. Models of integrated organizations that are based on division of labour, differentiation of tasks and notions of hierarchy and authority, are not applicable to universities, which are characterised by a high complexity of tasks, diversity, fragmentation, and lose coupling between units (idem.).

In order to understand the emergence of interdisciplinarity structures in universities, I therefore employ a definition leaning towards that of informal organisational and social structures. Structures are regarded as patterned relations which influence academic work within universities. They are characterised by regular and repetitive (i.e. recurring several times a year on a regular pattern – e.g. weekly, bi-weekly, monthly, every tri- or semester) interactions of networks of individual organisational members; with defined goals and purposes related to the core tasks of an organisation (for universities: teaching and research) and defined and controlled modes of achieving these goals (participants have agreed upon a format in which they interact). Following the concept of duality of structure outlined in the previous section of this chapter, changes in structures are observed by looking at "recurrent social practices" (Giddens, 1989, p. 252), thus activities and actions which are repeatedly performed by actors within a social group and which have the power become routines, thus to re-produce or alter existing structures.

Interdisciplinary structures are accordingly defined as patterned relations in which multiple perspectives and practices from two or more disciplines or scientific fields are brought together and shape the teaching and research activities of their participants. They are characterised by regular and repetitive interactions of networks of individual organisational members from at least two disciplines of scientific fields with a defined goal and format; leading to

an integration of theories, methods or questions from multiple disciplines or scientific fields in the teaching and/or research activity of participants. Interdisciplinary structures can differ in both scope and degree. The degree of interdisciplinarity depends on the degree of integration of theories and methods in teaching and research (here, Klein's, 2010, taxonomy of interdisciplinarity is used). The scope of interdisciplinary structures is determined by the number of participants as well as the scope of disciplines represented.

As den Hond et al. (2012) claim, searches for **changes** in structures and actions according to Giddens' (1984) structuration theory require the application of 'temporal bracketing'. In order to be able to grasp organisational change, in particular the emergence of interdisciplinary structures in academic project settings at universities, this research thus employs a longitudinal approach. Further rationales for the design of this research are outlined in the following chapter on research methodology.

6. Methodology

This chapter outlines the methodological framework employed to investigate the emergence of interdisciplinary structures in academic project settings. It provides a detailed account of the research design, case selection, data collection methods, data analysis procedures, as well as reflection of the risks and limitations connected to this study. The chapter begins with presenting the overall research paradigm and justification of the research strategy as well as of the case selection. It then contains a description of data collection instruments and processes, as well as a discussion of the data analysis process – for both qualitative approaches and a social network analysis. The final section of this chapter addresses the risks and limitations inherent in the methodology.

6.1. Research design

This study is based on an ethnographic single-case study of an academic project for inclusion-oriented and inclusive teacher training at a German university. According to Yin (2003), a case study design should be considered when a) the study focusses mainly on "how" and "why" questions"; b) the researcher cannot manipulate the behaviour of those involved in the study; c) the researcher wants to cover contextual conditions because they believe that they are relevant to the phenomenon under study; or d) the boundaries between the phenomenon and the context are not clear. All four criteria hold true for the presented study.

My research is based on a social constructionist paradigm. It follows the assumption that there is no such thing as one objective truth or single reality, but that there are multiple realities, all of which are socially constructed and which cannot be studied in pieces but only studied "holistically and in situ in those natural contexts that shape them and are shaped by them" (Lincoln & Guba, 1986). Lincoln and Guba (1986) state that there is a need to abandon "the assumption that enduring, context-free truth statements – generalizations

– can and should be sought" and call for research approaches that acknowledge that all "behaviour is time- and context bound" (p. 17).

Within the scientific discourse there is disagreement on the range of theories to be developed; grand theory versus deep insights (Lounsbury & Ventresca, 2002). Some authors claim that instead of pursuing grand theories which reveal broad patterns across a variety of cases, researchers should conduct in-depth, empirical studies, and focus on processes, mechanism, and boundary conditions on a middle range (Hedstrom & Swedberg, 1998; Merton, 1968; Somers, 1998), rather than aspiring grand theory (Kiser & Hechter, 1991; Parsons, 1949). Therefore, a single case study design, which allows for in-depth study and for a focus on micro- and meso-level processes has been chosen.

Acknowledging the above-mentioned discourses, this study follows the logics of an ethnographic research approach. Ethnographic research does not aim at testing hypotheses but seeks to explore explanations and develop theories for previously inexplicable phenomena. Ethnographic researchers are not concerned with generating objective truth from representative samples (Singh & Dickson, 2002). Instead, ethnographic studies aim at an in-depth study of social interactions, behaviour, and perceptions that occur within groups, teams, organisations, and communities (Reeves et al., 2008). Ethnography has become a popular method in the study of organisations, as it does not rely on artificial settings, but takes account of what Singh and Dickson (2002) refer to as "the living history of the phenomenon under exploration" (p. 121). By combining a variety of methods, ethnographic research enables the researcher to look beyond claims made in the mission statements of organisations or corporate reports and to investigate how are things are done in real life (Singh & Dickson, 2002). It can thus help to generate "local knowledge" (Gerring, 2011, p. 175), or, in the words of van Maanen (1979), "uncover and explicate the ways in which people in particular work settings come to understand, account for, take action, and otherwise manage their day-to-day situation" (p. 540).

In organisational ethnography, organisations are regarded as "settings within which social relations take place between actors", based on rules that "are constructed and (…) interpreted by the actors for that particular context" (Singh & Dickson, 2002, p. 120). In large and complex organisations, e.g. universities in the case of this study, one encounters a plurality of such settings and of frameworks of meanings, which is why organisational ethnography is usually not concerned with describing the culture of whole organisations but focusses on a phenomenon of interest and the particular setting it is based on (Singh & Dickson, 2002, p. 120).

Literature argues that higher education research can be regarded as a form of self-ethnography (Alvesson, 2003) in which researchers simultaneously are members in and study higher education institutions. According to Bleiklie et al. (2015), this bears a number of advantages as well as disadvantages. An advantage of ethnographic approaches in higher education research is tied to access. Researchers studying their own institutions can obtain more information as well as access tacit knowledge more easily than externals. Moreover, longitudinal studies can be conducted much more easily when studying settings in own institutions. Finally, the authors argue that self-ethnographic approaches are advantageous when conducting explorative studies and in order to avoid compliance and convenience biases that may occur in semi-structured interviews conducted by researchers external to a higher education institution (Bleiklie et al., 2015). Disadvantages of self-ethnography are tied to self-objectivation and self-overestimation. These issues and strategies to avoid possible biases resulting from them will be reflected in more detail in Chapter 6.5 below.

Literature states that in order to be able to observe and understand actions, meanings, and interrelationships of actors, ethnographic studies should follow a longitudinal design (Singh & Dickson, 2002). They should involve stages of observation, interpretation, and reflection, whereas these stages are not to be seen as successive but iterative (Singh & Dickson, 2002). The

research questions of this study aim at an investigation of a process of emergence of interdisciplinary structures. Thus, a longitudinal design is prerequisite, and data was conducted at different points in time divided over the case study project's duration.

In the following paragraphs, a justification for the case selection will be provided, followed by a detailed description of the process of data collection and analysis.

6.2. Case selection

A single case was selected for this study using purposeful sampling – based on theoretical, contextual and practical considerations, rather than aiming at representativeness. Following Yin's (2018) typology, the case was justified as a revelatory case. Revelatory cases enable researchers to examine and analyse phenomena which had not been previously available for observation by giving them rare access to situations or processes that are ordinarily hidden, restricted, or inaccessible (Yin, 2018). The chosen case grants access to materials and processes that are typically confidential and not publicly documented and allow unique insights into how interdisciplinary structures are negotiated, legitimised, and institutionalised within the setting of an academic project. This access enables the analysis of factors and mechanisms that are usually hidden from external scrutiny and are rarely described in literature. The ethnographic research design – based on prolonged on-site engagement, participatory observation, and access to project participants – provides precisely such access and helps to reveal otherwise opaque social processes through which interdisciplinary structures emerge.

The case selected for this research project is an academic project at a large, German research university. The context of the German higher education system is expedient for this study since universities in Germany are characterised by high levels of freedom and research (which is even stipulated in the German constitution, Article 5 of the Basic Law of the Federal Republic of Germany) and a high degree of professorial autonomy, partly derived by

the civil servant status of professors. As such, they still show traditional characteristics of universities, which used to be conceptualised as organised anarchies or loosely-coupled organisations (Cohen et al., 1972; Weick, 1976), but have increasingly changed towards stronger hierarchical organisation (Maassen & Stensaker, 2019). At the same time, German universities have been subject to managerial reforms and increasing international competition, which have been strengthening their organisational actorhood (Kleimann, 2019; Krücken & Meier, 2006).

The selected case study project aims at increasing the quality of university teacher training and was funded within the scope of a government-initiative between 2016 and 2019 (first project phase) and subsequently from 2019 to 2023 (second project phase). It has been chosen as a typical example of an initiative of universities to implement change towards interdisciplinarity, crossing faculty-, disciplinary- and other boundaries. In contrast to top-down implemented structures such as interdisciplinary research centres, which have been the focus of many studies, all project participants remain to be based within their chairs and faculties. Although only a small part of staff at the case study organisation is involved in the studied project, findings concerning the project might nevertheless be applicable to a wider organisational setting, as organisational complexity of universities is reflected within the project. A wide range of organisational actors, including the rectorate, administrators, the professoriate, as well as post-docs and PhD students are directly involved in the project.

The project brings together a huge variety of academic disciplines from eight faculties. The represented academic disciplines include Educational Sciences, Chemistry, Linguistics, Arts, Mathematics, Music, Rehabilitation Sciences, Social Education, Sports, Theology, Politics, Philosophy, Psychology, and Informatics. Additionally, the project was assumed to reflect dynamics of a general conflict between managerial and collegial decision-making by incorporating elements of both bottom-up and top-down implementation of

change: It is influenced by federal research-policy specifications, the rectorate as well as administrators are involved, but professors and their research groups still work on individual projects within an overarching project design. The project has furthermore been chosen as a case for this research project, as accessibility throughout the project lifetime was ensured through association of the researcher with the project.

6.3. Data collection

This section focusses on the study's data collection and contains a discussion of and justification for the choice of data sources and data collection methods. The different types of data collection included 1) longitudinal participatory observation in a wide range of project meetings and events, 2) focus group discussions 3) problem-centred interviews (Witzel, 2000), and 4) the collection of further materials, including relevant document and website information as well as project communication.

Data collection and analysis took place in an iterative process, allowing for a co-construction of meaning with research participants and emergence of insights from iterative interaction with the field (Bryant & Charmaz, 2007). On the basis of initial insights from participatory observation, a first focus group discussion was conducted among early- and mid-career researchers. Questions and assumptions arising from a preliminary analysis of this focus group discussions were then used to inform problem-centred interviews with a broad range of project participants. This cycle was repeated once with a second focus group discussion and another round of interviews.

The methodological choices concerning data collection were grounded in the following theoretical and methodological claims and assumptions: Structuration theory, which was discussed in the previous chapter, assumes that organisational structure and agency of individuals and groups are inevitably interconnected: Individuals and groups produce organisations, but, at the same time, their actions are products of organisations as well. Brown-Saracino et al. (2011) claim that in order to understand such processes,

"ethnographic observations of interactions occurring within and across social actors and groups" (p. 93) is prerequisite. They do, however, argue for the inclusion of further materials, e.g. interviews, text, or quantitative data, for reasons of practicality and generalizability (Brown-Saracino et al., 2011). In line with this line of argumentation, Clarke (2003) proposes the reliance on multiple data sources, "including discursive textual, visual, and archival historical materials and documents, as well as ethnographic (interview and observational) transcripts and field notes to more fully take into account the sea of discourses in which we are continually awash in the postmodern era" (p. 559).

Literature on the ethnographic study of organisations proposes triangulation in research methods and data sources to ensure validity (Singh & Dickson, 2002). Data sources should include externally available information, e.g. websites, press coverage, reports, and internally available information, e.g. minutes, memos, reports, as well as informants' accounts which can be derived either through formal interviews or informal conversations. Informants need to be chosen carefully and in order to avoid bias or misleading information, a variety of informants should be selected (Singh & Dickson, 2002). Singh and Dickson (2002) state further that organisational ethnography should consider sources that serve as "artefacts of organizational symbolism" (p. 125), e.g. leadership style, management, and policies, which can be observed in events, rituals, and ceremonies. This study uses triangulation by applying both a combination of different data sources and by applying different research methods.

In the following sections of this chapter, the process and different methods of data collection will be described in more detail.

6.3.1. Participatory observation

Between 2016 and 2020, participatory observation of several project meetings and events has been conducted. The appropriate role of researchers in participatory observation is heavily debated in literature with "emphasis on

either the participation side or the observer side of the concept" (Johnson et al., 2006). Johnson et al. (2006) show that references as to which of these sides should prevail differ in existing literature. Some authors prefer full participation of researchers in the settings they study to be able to gain deeper insights into and easier and better documentation of phenomena. Other authors argue for an immersion of researchers into social realities of people to observe the phenomena under study without fully participating. A certain degree of distance between researchers and studied groups is regarded as an advantage, as problems with separation from the field-work context (which in ethnography can go beyond the usual dilemma caused by problems such as worrying about career, status, and future relationships) can be avoided (Johnson et al., 2006).

Singh and Dickson (2002) make a distinction between observation as participant and participant observation. They define observation as participant as a process which "is undertaken by a researcher included in but on the fringe of the activity, who seeks understanding through similarity of experience without being a real participant", while participant observation entails a deeper involvement and shared social understanding with fellow participants and can therefore be regarded as more subjective (p. 122). Another perspective on the different roles of researchers in participatory observation is taken by Patton (1987), who examined the extent to which people know they are being studied and distinguishes between overt observation, covert observation, and a range of other forms in between these two forms. Johnson et al. (2006) state that the choice on openness or covertness depends on ethical considerations and refer to van Maanen's (1975) policy study to show that openness about research intentions can still lead to acceptance in the field. They claim that ethnographers need to acquire a "social role that is culturally definable": participants of the study need to develop understanding and assign an identity different from that of the "unfamiliar role of the ethnographer" (Johnson et al., 2006, p. 114).

The role taken for participatory observations in the context of this study fits best to Singh and Dickson's (2002) notion of observation as participant. In my role as an associated researcher of the case study project, I was able to participate in all project meetings and events. Yet, my participation was motivated by factors different from that of other participants. The status as associated researcher gave me access to the field while allowing for a certain degree of independence from the case study project when needed. My research intentions were openly communicated to all participants from the beginning of the project. Acquiring a culturally definable social role as a researcher in a higher education context is usually not difficult (although the role of researchers in higher education research bears other dangers, which will be discussed in the chapter on risks and limitations below). Throughout my participation in project meetings and events as well as during targeted data collection phases I felt accepted by project participants as a fellow researcher, some accepting me as a fellow junior researcher who is struggling to collect data for a qualification project, others framing my research as 'accompanying research' which could be of use for the project or future project at the case study university.

Observation notes were taken at project meetings and events only if observations were deemed relevant for the understanding of the phenomenon under study – the emergence of interdisciplinary structures. Notes were taken on paper or by using a digital memo format on a smartphone and were converted into Word-format as soon as possible afterwards. Observation notes include information about the date, time, place and type of meeting or event, the subject discussed at the time of observation, the persons present at the time, and the observation itself.

6.3.2. Focus group discussions

In order to explore the perceptions of early- and mid-career researchers, which constituted the biggest group among the project participants, two focus groups were conducted in March 2018 and December 2019. These focus

groups were used for a first validation of insights from participatory information and a preparation for the problem-centred interviews which followed after the focus groups in the first and last targeted data collection phase.

Focus groups were selected as a technique which is useful to explore topics that do not directly lend themselves to observational techniques, including, for example, personal experiences, attitudes, decision making, and interactions that occur within group settings (Morgan, 1997; Sim & Snell, 1996). They can encourage participants to be spontaneous in the expression of their views and to make connections that would not occur in individual interviews (Butler, 1996). While Morgan, 1997, p. 13) has described focus group as a "quick and easy" technique, literature acknowledges several advantages of including them into a research design: Group discussions lead to valuable group dynamics which can positively influence the readiness of participants to provide information (Schulz, 2012).

In contrast to individual interviews, group discussions are believed to create settings that are closer to participants' daily routines and experiences (Littig & Wallace, 1997), and therefore likely to result in valid accounts. Furthermore, literature argues that dialogue between participants in focus groups can help to mitigate interviewer or moderator effects (Schulz, 2012). Additionally, participants can switch between active and passive participation in the discussion, whereas power relations and other intragroup processes influencing (non-)participation have to be taken into account. Schulz (2012) even claims that focus groups can mitigate social desirability biases, as it is more difficult for participants to persist on socially desirable statements when engaging in dialogue with the other participants in the group. This statement does, however, need to be treated with caution, as group processes – especially those in not artificially designed but pre-existing groups – might actually increase socially desirable statements.

While focus groups might not be suited as the only means of data collection in a research project, they can easily be used to complement other methods. Literature proposes that "depending on the varied needs that a qualitative study has for breadth and depth" (Morgan, 1996, p. 134), focus group discussions can be used for initial exploration and identification of experiences and perceptions, while individual interviews can be used to follow up on these and explore specific aspects in more depth (Morgan, 1997). Based on these perceptions, this study relies on a combination of both methods, focus groups and interviews, the latter of which will be described in the following sub-chapter.

Literature contains varying opinions regarding the selection of and the number of participants for focus group discussions. Recommendations in literature regarding the ideal number of participants for a focus group range from only three to as many as 20 persons (Lamnek, 2005). Freeman (2006) shows that best practice in the design of focus groups with respect to sampling, group composition, and group interactions, depends on a researcher's underlying epistemological assumptions. While studies built on realist assumptions aim at reducing bias and increasing the transferability of results and therefore use random sampling and sub-group comparisons, studies that follow constructionist assumptions are interested in "naturalistic" exchange and are advised to make use of pre-existing groups (Freeman, 2006, p. 494).

In the context of this study, a pre-existing group, specifically the early- and mid-career researchers' group, in which all PhD students and post-docs of the case-study project participated, was used to facilitate group discussions. All participants of this group were invited by e-mail to attend the two discussion sessions which took place in March 2018 and December 2019 at a time and place reserved for the group's meetings. In the first focus group discussion in March 2018, there were 11 participants, two of which were post-docs and nine of which were PhD students. The participants came from 5 faculties. The

participants were members of two different scientific fields (three participants from the natural sciences and eight participants form the Humanities and Social Sciences), four subject areas and five disciplinary areas according to a classification used by the German Research Foundation (DFG, 2017). In the second focus group discussion in December 2019, there were ten participants, two of which were post-docs, eight PhD-students, four male and six female. Again, two scientific fields, four subject areas and six disciplinary areas were represented. Only three participants from the first focus group discussion participated in the second discussion round, leading to a total of 18 project participants from two scientific fields, four subject areas and seven disciplinary areas that participated in the two focus group discussions.

Discussions lasted around 90 minutes in both focus groups. After an explanation of the aim of the discussions and the provision of a working definition of the term 'interdisciplinary structures', both discussion rounds roughly followed moderation guidelines to ensure that all relevant aspects were covered. During the first focus group, discussions were voice recorded, and a member of the group was asked to take notes covering the main aspects mentioned during discussions and note people who raised them. This person was recruited from the early-career researchers' group to ensure they knew all names and their presence did not disturb the rest of the group. During the second focus group, discussions were video recorded, allowing for an assignment of statements to persons.

6.3.3. Interviews

Some authors (Silverman, 2007) are opposed to conducting interviews in ethnographic research, claiming that in contrast to the 'naturally occurring data' generated through observations and in conversations, interviews are 'manufactured' data and thus less valid. Yet, other scholars (Brown-Saracino et al., 2011; Watson, 2011) welcome the inclusion of multiple methods of data collection in ethnographic studies and propose the incorporation of interviews, which, according to Watson (2011), allow for a variety of topics

to be discussed with individuals and for comparing their perceptions with those of others. Following the arguments of the latter, I have used interviews to explore the perceptions of a broad range of project participants on the emergence of interdisciplinary structures in the case study project.

Interviews were conducted with a broad range of project participants during two targeted data collection phases in August-November 2018 and January-February 2020. Interviews followed the principles of the problem-centred interview (Witzel, 2000), which literature describes as a "theory generating method that tried to neutralise the alleged contradiction between being directed by theory or being open-minded so that the interplay of inductive and deductive thinking contributes to increasing the user's knowledge" (Witzel, 2000, p. 1). The problem-centred interview adheres to three basic principles:

1) It has a "problem centred orientation" and is based on awareness and usage of preceding interpretation to engage in continuous questioning and re-questioning to gradually address the research problem more precisely.
2) It is object-oriented and anchored in a concrete, real problem or social phenomenon. Participants are hereby treated as experts in relation to the object or problem and their perspectives and lived realities are explored deeply and systematically.
3) It is process-oriented and acknowledges that results are always produced in collaboration between the interviews and their respondents (Witzel, 2000).

Witzel (2000) refers to Bahrdt (1975) in underlining the importance of seeing conversations as a whole: there are no "isolated answers to isolated questions"; rather, the researcher has to consider interviews as cohesive conversations and should pay attention to redundancies, which oftentimes contain new formulations that facilitate interpretation, as well as contradictions, which can show dilemmas, individual ambivalences, but also misunderstanding on behalf of the interviewer.

In a first step, strategic actors in the case study project, including the principal investigators, members of the project steering-group, potential multipliers – e.g. through their positions as vice-rectors or deans –, a member of the project evaluation team as well as spokespersons of the early- and mid-career researchers' group were chosen as interview partners. Interviewees were identified through previous observations as well as by recommendations from other interview partners (referral sampling), whereby project participants that were mentioned by others to contribute particularly strongly, or, in contrast, not at all to project activities and the emergence of interdisciplinary structures within the case study project were approached.

Nr.	Gender	Career-level	Scientific field
1	male	Post-Doc	Humanities and Social Sciences
2	male	PhD student	Humanities and Social Sciences
3	male	Professor	Humanities and Social Sciences
4	female	Administrator	Not applicable
5	female	PhD student	Humanities and Social Sciences
6	female	Professor	Humanities and Social Sciences
7	male	Professor	Humanities and Social Sciences
8	female	Post-Doc	Humanities and Social Sciences
9	female	Professor	Humanities and Social Sciences
10	female	Professor	Humanities and Social Sciences
11	male	Professor	Natural Sciences
12	female	Post-doc	Humanities and Social Sciences
13	female	Professor	Humanities and Social Sciences
14	female	Professor	Natural Sciences
15	male	PhD student	Natural Sciences
16	male	Professor	Engineering
17	male	Post-Doc	Humanities and Social Sciences
18	female	Post-Doc	Humanities and Social Sciences
19	female	PhD student	Humanities and Social Sciences
20	male	PhD student	Humanities and Social Sciences
21	female	PhD student	Humanities and Social Sciences
22	female	PhD student	Humanities and Social Sciences

Table 4: Overview of interviewees by gender, career-level, and scientific field

In total, 24 interviews were conducted with 22 interviewees from ten faculties and 15 disciplines (see Table 4 above). Nine of these interviewees were male and 13 were female. In terms of disciplinary distribution, the vast majority

(17 interviewees) came from the Humanities and Social Sciences, while only three interviewees were from the Natural Sciences and one interviewee came from Engineering. Based on the classification used by the German Research Foundation (DFG, 2017), the interviewees can be placed in six different subject areas and 11 disciplinary areas, which are not listed in the table below in order to preserve the anonymity of respondents.

The interview guidelines consisting of three problem areas each were prepared in advance of each interview round to guide the conversation if needed; however, precedence was given to the natural flow of communication. The average duration of an interview was 53 minutes. In total, 1281 minutes of interview material were collected. The vast majority of interviews was voice recorded. The recorded interviews were transcribed according to the extended rules formulated by Dresing et al. (2015), which includes a verbatim transcription comprising notion of repetitions, discontinuations, stutter, interjections, speech overlaps, pauses, affirmative noises and filling words. For two interviews, which could not be voice recorded, hand-written notes were taken during the interviews, aiming at capturing important phrases in verbatim.

6.3.4. Further material

In addition to the data sources discussed above, a variety of further material has been collected. Further data include screenshots of relevant e-mail communications, protocol of project or project sub-group meetings, official documents and reports issued by the project, university documents relevant for the case study project, participant lists of project groups on online learning platforms, as well as relevant website information on project participants, their collaborations in teaching and research as well as their publications. These materials were archived at several points in time between 2018 and 2020, allowing for a reconstruction of processes of change.

6.4. Data analysis

This section outlines the analytical strategies employed to address the research objectives. This study has mainly employed qualitative approaches, with support of quantitative approaches in the form of a social network analysis of co-authorship in the case study project. Qualitative data was analysed based on principles of constructivist grounded theory (Charmaz, 2006) which allows for the development of insights grounded in participants' perspectives and experiences. The network analysis, on the other hand, provides a structural understanding of outcomes of collaborative relationships within the case study project.

The first part of this section describes the qualitative data analysis procedures, in particular the coding process informed by Charmaz' (2006) constructivist grounded theory methodology, including initial coding, focused coding, and theoretical coding. The second part of this section introduces the network analysis framework, outlining the data collection from bibliometric sources, the construction of the co-authorship network and the use of methods to analyse collaborative patterns.

6.4.1. Qualitative data analysis

For the analysis of the data presented above, a constructivist grounded theory approach has been chosen. Singh and Dickson (2002) state that "ethnography shares with grounded theory the purpose of generating understanding through iterative comparisons of data and theory" (p. 117). Both ethnography and constructivist grounded theory emphasise the interdependence between theory and data and "use data to ground theoretical claims and facilitate theoretical development" (Brown-Saracino et al., 2011, p. 92). While they share constructivist principles, the two approaches mainly vary with regard to their aim (theory generation versus generation of holistic, etic and emic insights). Although not commonly applied yet, there are assumptions that the combination of ethnographic approaches and constructivist grounded theory offers potentials to develop particularly detailed understanding of complex phenomena (Bamkin et al., 2016; Pettigrew, 2000). I have opted for this

combination within the context of this study as it provides a valuable tool for generating holistic, in-depth insights while still aiming at the identification of patterns that support theory conceptualization.

Traditional grounded theory as presented by Glaser and Strauss (1967) has enjoyed considerable criticism by scholars in organisational research for its strictly inductive nature and for neglecting the usefulness of existing theory and literature in research processes:

> "To observe a work supervision event in an organisation without an awareness of such concepts as, say, bureaucratic authority (Weber, 1947) or 'indulgency pattern' (Gouldner, 1954), would be as unfortunate as observing an organisational meeting without being aware of the concept of micropolitics (Burns, 1961) or the 'garbage can theory' of decision making (Cohen et al., 1972)." (Watson, 2012, p. 19)

As Watson (2012) claims, "innovation and creativity in making organisational ethnographies can only be achieved by building with and building upon what has come before" (p. 19). Therefore, this study follows a constructivist grounded theory approach to data analysis, based on the work of Corbin and Strauss (1990) and especially Charmaz (2006). This approach differs from grounded theory in its original form (Glaser & Strauss, 1967) by including both inductive and quasi-deductive approaches to analysis. While traditional grounded theorists work exclusively inductively and deny external influences on analysis, constructivist grounded theory acknowledges both the role of the researcher and of existing literature and theory for research (Charmaz, 2006). Yet, it remains a theory-generating approach, including the establishment of codes, concepts, categories, and, finally, new theory.

Analysis according to constructivist grounded theory follows three steps: initial, axial, and theoretical coding. During the first step, initial or open coding, the researcher sticks closely to the data rather than applying pre-existing categories to the data. Following Charmaz (2006), line-by-line and – where it made sense to include the context of a scene – incident-by-incident

coding was applied to the data in this study. For special terms that are shared among participants, in-vivo coding was applied. Charmaz (2006) proposes to be open about own observations and ideas during this coding step, as – even if they initially do not mirror the data – they may "rest on covert meaning and actions". Despite this openness, she advises caution with regard to including own ideas and states that it is important to "rather than seeing your perspectives as truth, try to see them as representing one view among many" (Smith et al., 1995, p. 38). Open coding was applied to break down data into more manageable segments and to identify first key concepts, patterns, and emerging themes in data. Coding density was higher for focus group discussions than for interviews. The open coding of focus group discussion resulted in 157 and 149 codes respectively, while interviews were coded with an average of 96 codes, ranging from a mere 44 to 126 open codes. Other data sources, such as observation notes, documents, or e-mail communication, were omitted from the open coding process and introduced into analysis in the focused coding stage. The process of open coding was facilitated in Microsoft Word, using tables with data segments constituting a first and open codes constituting a second column.

In a second step, focused coding, these codes and the data are revisited and compared to identify patterns and establish more focused codes. This process is often referred to in literature as axial coding, which is applied in order to develop major categories, sub- and main categories and establish relationships between categories (Corbin & Strauss, 1990). While axial coding has received criticism as it encourages researchers to apply analytical frames to data and may thus limit their insight in the studied world (e.g. Charmaz, 2006), it has proven an important heuristic tool in this research project to reassemble the data fractured during open coding into a more coherent structure. In order to create a deeper understanding of the context, the conditions, interactions, and consequences with regard to the emergence of interdisciplinary project structures, I mirror Strauss and Corbin's (1990) coding paradigm for axial coding. Data was interrogated with regard to

context and conditions (when, where, why?), actions and interactions (who, how?) and consequences/ outcomes (what?). This process resulted in a focused coding tree with four main themes: 1) interdisciplinary structures and their characteristics, 2) the nature of collaboration within them, 2) actors involved in (the emergence of) interdisciplinary structures and their motivation to engage in interdisciplinarity, 4) barriers to and facilitators for (the emergence of) interdisciplinary structures. Analysis resulted in 14 main codes with a total of 82 sub-codes (see focused coding tree in annex of this dissertation for more detailed information).

The final step involved theoretical coding. Focused codes were explored in more depth to identify relationships among them and develop theoretical narratives. This technique was applied in particular to narratives revolving around actors, agency, and motivation and resulted in a typology of interdisciplinary actors. For support in organising and analysing qualitative data during focused and theoretical coding, the software MAXQDA (version 22) was used.

During the last two steps, constructivist grounded theory allows the application of quasi-deductive approaches in addition to inductive coding. Pre-existing theoretical and empirical considerations were carefully revisited and questioned in relation to the data and have only been adopted if they were useful to understand the indications and explain (segments of) data, and if data could not be interpreted adequately without them. If existing theory and conceptions are not integral for understanding the data, they may not be adopted in the process of analysis in constructivist grounded theory (Charmaz, 2006).

Throughout the process of qualitative data analysis, certain – highly intertwined - key features of constructivist grounded theory were respected:

1) *Research and analysis as an iterative*: Throughout the field stage (2016-2020), I was moving back and forth between data collection and different

stages of data analysis in order to ensure a constant comparison of interpretation and the derived codes with further incidents from data. Analysis began with the first data collected and preliminary insights from analysis guided further data collection.

2) *Research as a reflexive process:* Throughout the research process, biases, values and assumptions based on the researchers' personal and disciplinary background were questioned. This process was facilitated through regular discussions of preliminary findings in interactions both with project participants as well as researchers not related to the case study project.

3) *Co-construction of meaning*: Knowledge was regarded as co-created between the researcher and research participants. Rather than being considered passive sources of data, participants were regarded as active agents, interpreting their experiences of interdisciplinary collaboration and communicating these interpretations during interviews and in focus group discussions. The co-construction of meaning was also proactively approached during this research project: Preliminary findings were communicated to and validated (or, sometimes, questioned) within the scope of interviews and focus group discussions as well as in personal communications with selected research participants at several points of time during and beyond the field stage.

4) *Research as an interpretive approach*: Research was regarded as a process of meaning-making. Rather than taking a positivist of objectivist stand, research focused on the subjective experiences and lived realities of participants. Theoretical codes reflect constructed meaning and provide explanations deeply grounded in participant meaning.

During analysis, particular attention was paid to the background of research participants (i.e. their status group and disciplinary area) (see Schulz, 2012, for proposals on grouping respondents during analysis). Barley & Tolbert further suggest a grouping of data according to categories meaningful for the

purposes of the study, including types of actors and behaviour. Accordingly, data was pseudonymised and labelled to reveal categorizations (including type of data source, particular project roles, status groups, and scientific fields) that were considered important for an understanding of the emergence of interdisciplinary structures, while ensuring the confidentiality of data sources and respondents. For reasons of confidentiality, a breakdown into disciplines beyond scientific fields was not always possible in data presentation. In order to facilitate an in-depth understanding of the context of the studied phenomenon, findings were illustrated with quotes derived from data. Sensitive information and information potentially leading to the identification of respondents or persons that were referred to during interviews or focus group discussions were omitted from or pseudonymised from these quotes.

All interviews and focus group discussions were conducted in the German language. Direct quotes used for the illustration of arguments in the findings chapter of this thesis were translated using the neural machine translation engine DeepL. Translations were then checked for accuracy and, if necessary, revised by the researcher.

6.4.2. Social network analysis

In order to corroborate findings derived from the qualitative content analysis, a social network analysis of bibliometric information on interdisciplinary co-authorship between case study project participants has been conducted.

Literature is divided on the question of how useful co-publications are as a predictor of collaborative practices. Newman (2004, p. 5200) claims that "It has long been realised that the co-authorship of articles in learned journals provides a window on patterns of collaboration within the academic community" and that co-publications "can be thought of as documenting a collaboration between two or more authors". Laudel (2002), on the other hand, argues that co-authorship alone is not enough to depict collaborations and states that assumptions that scientists who collaborate become co-authors

(e.g. brought forward by Gordon, 1980) have been contradicted by studies (e.g. Katz & Martin, 1997). However, as Burt (2008) has argued, the investigation of network connections in organisations can provide value by helping to identify individuals who cross boundaries and possess the social capital of spanning networks (brokerage activity). While co-authorship is thus not sufficient to investigate interdisciplinary collaborations within the case study project, it can reveal patterns in publication and collaboration practices of case study project participants and inform further data analysis by indicating which actors engage in boundary-spanning behaviour in terms of publishing.

The social network analysis considered all co-publications among project participants in the years 2016, 2017, 2018 and 2019. In a first step, all publications declared as project publications were collected from a publicly available section on the project website. Only written publications, such as articles, books, book chapters, and reports, were included. Conference presentations were omitted from the analysis. In a second step, the database was cleaned so it only contained authors that are or were project participants between 2016 and 2019. Finally, all single-authored publications as well as publications of which only one author was a project participant were removed from the database.

The social network analysis was conducted using the software Gephi (version 0.9.2; Bastian et al., 2009) . The database was prepared for import into Gephi by creating a node-table with IDs for each project-participant involved in co-publications and an edges table describing the relationships between nodes. Collaborative ties were considered to be non-directional and all publications were weighted equally, irrespective of their type or characteristics. If two project participants had only one co-publication, their relationship has thus been assigned the value 1, if two project participants had more co-publications, the weight of their relationship increased accordingly (Number of co-publications = edges weight).

The social network created in Gephi was visualised using the ForceAtlas layout algorithm, which is designed for the spatialization of small-world and scale-free networks and is suited for the exploration of real data as well as further investigation with as little bias as possible (Jacomy et al., 2014). Velden et al. (2010) criticise co-author network analysis for commonly failing to recognise the team-based organisation of research in most fields and propose an investigation into the substructures of networks in order to identify modules of "closely interconnected actors" in co-authorship networks based on connectivity patterns. In a second step, I therefore conducted a modularity analysis based on algorithms and solutions proposed by Blondel et al. (2008) and Lambiotte et al. (2014) in order to identify community structures within the co-author network. These community structures or modules of closely interconnected actors were then systematically compared with the disciplinary affiliations and participation of actors in interdisciplinary structures in the project.

Descriptive metrics of the social network are displayed in the annex of this dissertation.

6.5. Risks and limitations

As with all approaches based on interpretative paradigms, ethnography is prone to different biases connected to the sources and methods of data collection it is based on as well as the role of researchers in the research process.

Advocates of a realist research paradigm strive to represent reality (Hammersley, 1992; Mays & Pope, 2000) and traditional notions of quality derived from quantitative research, including notions of validity and reliability, may be re-formulated to be applied to qualitative studies that are conducted in this sense (Miles & Huberman, 1994). In contrast, the social constructionist approach that this study is based on rejects assumptions of a single reality, tries to gain multiple views of a phenomenon (Charmaz, 2006), and emphasises the provisional and context dependent nature of knowledge,

which is constructed through interaction with others. Consequently, as Freeman (2006) shows, social constructionism does not aim at fulfilling the above-mentioned traditional quality criteria. Yet, there are other strategies to ensure methodological rigour, e.g. reflexivity (Wilkinson, 1988), triangulation of methods of data collection for richness instead of consensus in analysis (Fielding, 2012), or constructs such as credibility, dependability, and transferability as put forward by Lincoln and Guba (1986).

In the design of this study, the following criteria for credibility according to Lincoln and Guba (1986) have been acknowledged: prolonged engagement and persistent observation (longitudinal participatory observation), triangulation (use of different data sources and data collection methods) and negative case analysis (active search for negative instances and continuous adjusting of categories). Transferability and the application of findings in other contexts are difficult to reach in interpretative studies, but can be facilitated by what Lincoln and Guba (1986) refer to as "thick description" (p. 17), which enables a detailed comparison of findings with other contexts.

Due to the design of ethnographic studies, researchers are deeply immersed in and have a high degree of influence on the research process. The personal involvement required for ethnography may lead to bias in observations. This effect may be reinforced by the peculiar role of researchers in higher education research. According to Wilkesmann (2019), higher education researchers are confronted with two epistemological issues: self-objectivation ("Selbstobjektivierungsproblem", Rindermann, 2000), and self-overestimation ("Selbstüberschätzung", Wilkesmann, 2017). As higher education researchers focus on phenomena within higher education institutions and thus their own world (Rindermann, 2000), the scientific norms of disinterestedness might be endangered. Furthermore, higher education researchers are usually confronted with respondents who are academics themselves, regard themselves as experts on higher education, and oftentimes tend to incorrectly generalise their perceptions (Wilkesmann,

2019) and the research process might be influenced by hidden interests of researchers and respondents alike (Lauer, 2019).

A solution to these risks proposed in organisational literature in general (Alvesson et al., 2008; Sjoberg et al., 1991) and higher education literature more specifically (Lauer, 2019) are reflexivity and multiperspectivity. Reflexivity can be reached "through critical reflection, through recognition that one's research results may well be shaped by one's position in the power structure and by the ideological context within which one carries out social scientific activities" (Sjoberg et al., 1991, p. 36). Furthermore, literature shows that the adoption of multiparadigmatic views and the acknowledgement of multiple perspectives can lead to a more comprehensive understanding of phenomena in organisations (Gioia & Pitre, 1990; Lewis & Kelemen, 2002). As the method of analysis in this study, constructivist grounded theory, constitutes a tool that promotes reflective thinking per se (see for example Dunne, 2011) and includes a constant comparison among different perspectives portrayed in data (Charmaz, 2006), criteria of both reflexivity and multiperspectivity are fulfilled.

6.6. Chapter summary

This chapter has focussed on the methodological approach of the study at hand, providing justification of the research strategy and case selection as well as describing the instruments and processes of data collection and analysis. Based on a social constructivist research paradigm, a longitudinal, ethnographic, revelatory single-case study approach is approached. The case selected for this study is an academic project at a large, German research university, which allows for the study of the emergence of interdisciplinarity in a setting still largely adhering to traditional characteristics of universities, including freedom of teaching and research, high degrees of professorial autonomy, and strongly fragmented, discipline-based structures.

The types of data collection presented in this chapter included 1) longitudinal participatory observation in a wide range of project meetings and events, 2)

focus group discussions 3) problem-centred interviews (Witzel, 2000), and 4) the collection of further materials, including relevant document and website information as well as project communication. This data was analysed according to principles of constructivist grounded theory (Charmaz, 2006), which differs from traditional grounded theory in acknowledging the role of the researcher and of existing literature and theory for research and allows for the development of insights grounded in research participants' perspectives and experiences. Findings based on the qualitative content analysis are further corroborated by a social network analysis of bibliometric information on interdisciplinary co-authorship between case study project participants.

The chapter has further addressed possible risks and limitations of the proposed research strategy, which are grounded in the ethnographic design of the study in conjunction with the peculiar role of researchers in higher education research.

7. Interdisciplinary Structures in an Academic Project for Inclusion-Oriented Teacher Training at a German University

This chapter focusses on the question of which interdisciplinary structures have emerged within the case study project. I briefly introduce the case study project, highlighting its main aims, functions and characteristics, before providing an overview of the interdisciplinary structures and formats that have evolved during the project's lifetime. The various types of structures (early- and mid-career researchers' group, thematic working groups, teaching collaborations, as well as other formats) will be described with regard to their aims, scope, organisation and participation, and processes of emergence. The chapter then turns to an exploration of outputs of interdisciplinary structures as well as perspectives regarding their sustainability.

7.1. Introduction to the case study project

The case study project is an academic project for inclusive and inclusion-oriented teacher training at a large, technical university in Germany. It was funded in two project phases over the course of seven years (2016-2019; 2019-2023) by the German Federal Ministry for Education and Research within the scope of a funding line intended at increasing the quality of teacher training. The project aimed at a re-structuring of university and school curricula and making both teacher training at university and teaching at schools accessible to all learners through the development of new teaching and learning formats. In doing so, the project employed a broad concept of diversity, encompassing not only gender, religion, ethnicity, and social-economic status, but also disability and special learning needs, including those of highly gifted students.

The project was purposefully designed for inducing sustainable, structural changes within the university rather than complementing existing organisational structures for the duration of the project only. Official project documents refer to the aim of "strategic change management" and underline

the importance of fostering collaborations not only among different disciplines involved in teacher training at the university, but also between disciplines (*Fachwissenschaften*) and the corresponding subject didactics (*Fachdidaktiken* – sciences of teaching and learning of subject matters of specific disciplines (Vollmer, 2014) , which – in contrast to some other higher education systems – are not based in overarching schools of education in the German system, but located in the same faculties as their corresponding disciplines).

Due to funding organisation requirements, the application for project funding was submitted by central university management. Overhead cost funding was waived within the scope of the funding project, requiring a substantial amount of support from central university management as well as from faculties of project members involved in order to ensure the provision of infrastructure and equipment needed for the project.

The case study project was led by a team of two professors, one of whom was a member of the rectorate at the university. Project management further consisted of a project coordinator, an administrative assistant, and of a project steering-group. In the first project phase, the steering-group included eight professors, the project leaders, and two project administrators. Further, two elected representatives of early- and mid-career researchers in the project were invited to join steering group meetings. In the second project phase, the steering group consisted of five professors, seven early- and mid-career researchers and three administrators. Over the course of the two project phases, at least 61 participants (26 professors, 35 early- and mid-career researchers and a number of early- and mid-career researchers who were associated with, but not employed by the project) from more than 16 different scientific disciplines were part of the project.

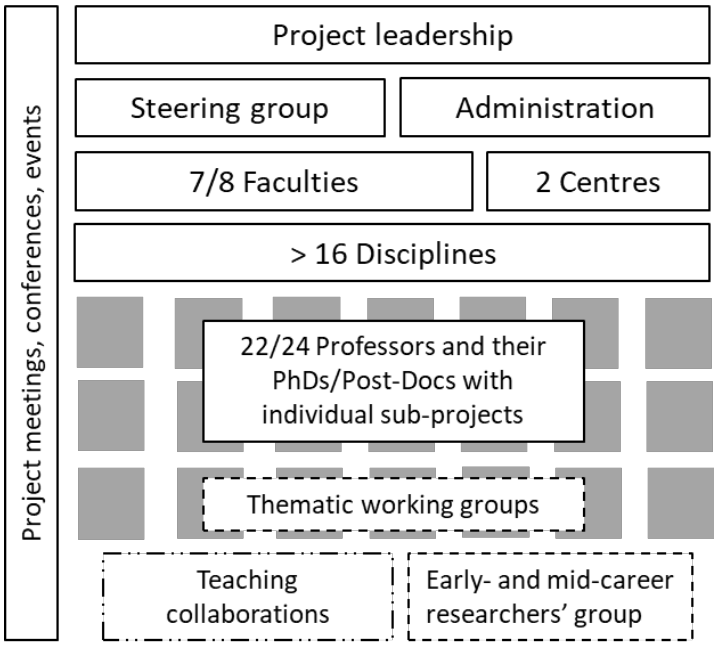

Figure 1: Illustration of case study project architecture (own visualization)

As usual in the German context, professors were involved in the project on a part-time basis, but did not receive additional salary through project funds. Most professors received funding to finance a PhD or Post-Doc position and additional funding was available for the development of a research laboratory and dissemination (including conference travel and publication). The PhD-students and post-docs working for professors within the scope of the case study project conducted their own sub-research projects to obtain their doctoral or postdoctoral degrees. Most project participants were involved in teacher training as well as in research. Research activities of project members focused on general, (disciplinary) inquiry or on educational research, either on teaching at the university or school level. The project further involved a number of participants from central university research and service units focussing on the topics of higher- and school education as well as university teacher training.

As noted in the project proposal (Document 1, page 6), the establishment of interdisciplinarity constitutes one of the fundamental elements of the project. In order to foster inclusion-orientation at the university, the project thus aimed

at providing spaces exchanges across faculties and disciplines. These efforts have indeed been fruitful: The emergence of several different structures spanning disciplinary and faculty boundaries within the scope of the case study project has been observed. These included an early- and mid-career researchers' group, several working groups with different thematic or methodological focus, teaching collaborations, as well as other, sometimes more ad-hoc formats, including project meetings and events, joint conference talks and co-publications. In the following, these structures will be presented in more detail, focussing on the questions of how they have emerged (top-down versus bottom-up), which operational dynamics prevail within them, who participates in them, and what kind of (inter-)disciplinary collaboration patterns can be observed.

7.2. Early- and mid-career researchers' group

The early-and mid-career researchers' (EMCR) group was established as a forum for exchange among PhD student and post-docs in the case study project and comprised around 30 members in different stages of the case study project. It was part of the case study project's project proposal. According to this proposal (Document 1), the group supposed to a) act as a forum for exchange on developments and progress of individual research projects within the case study project, and b) support EMCRs' professional development through the regular provision of workshops on academic writing, research methodology, and theory development. Project reports and the project website further underline the group's role in facilitating cross-disciplinary linkages to integrate knowledge from educational sciences, subject didactics, special education, and the scientific disciplines.

The EMCR group was described as the projects' "roof" (Focus group 1, pos. 44), facilitating exchange on what a focus group participant referred to as the "lowest common denominator" (Focus group 1, pos. 53) of all project participants, namely the pursuit of inclusive and inclusion-oriented teaching. In addition, workshops on various topics, coaching offers, as well as

discussions among EMCRs on organisational matters related to the case study project were based in the group.

7.2.1. Operational dynamics of the early- and mid-career researchers' group

According to project proposal (Document 1), the EMCR group was intended to convene on a monthly basis. In the first year of the project, group organisation was highly structured. There were weekly meetings, which mostly focused on exchange on formal and organisational project matters, and project administrators kept lists and records of each meeting. During early project stage meetings of the group, discussions usually did not entail content of (individual) research projects, which decreased the motivation of EMCRs to participate and resulted in a low participation rate. Focus group data shows that group participants experienced a lack of purpose during early meetings, as is underlined by the following quote:

> "I think we were a bit disoriented at the beginning. I always had the feeling that we were somehow discussing important areas that we wanted to address, for example the definition of inclusion, which I also believe is the foundation that we should actually have, but it was very much like - we look here, we look here, we look here and now we have new goals to pursue." (Focus group 1, pos. 49)

Over the course of the first year of its existence, the group struggled to develop an aim and mode of work which they regarded as purposeful both for their own research projects and the further course of the project. Group participants often described this process using spatial terms. They referred to their group as a predesigned space or framework within the scope of which they now needed to create meaningful experiences:

> "It was of clear that a format like this had to be established somehow, I think that was also part of the project proposal, and that we would meet regularly every week. And at the beginning, there also was an order, so to say, for us to meet at a certain time. But I think the first six months at least, or perhaps even longer, the question was how to actually

> use this framework or this space that had been created."
> (Focus group 1, lines 140-141)

As participants succeeded in establishing what they referred to as room to create, the focus of meetings shifted from mainly organisational matters to content-wise exchange on topics defined more autonomously by the group. Towards the end of the first year of the project, the role of EMCR group speakers was created. This decision was made by the steering group as a reaction to a conflict between project leaders and EMCRs about aims and priorities in the project during the first project conference. These speakers were elected among PhD students and post-docs. In addition to organizing group meetings, speakers were invited by the project steering group to join their meetings "in order to facilitate communication between the steering group and the EMCR group" (Protocol 4, steering group; protocol 21, EMCR group).

Overall, focus group and interview data show that participants perceived the EMCR group as increasingly democratic, stating that organisation of the group was taken into the hands of several people from their own ranks, including the groups' elected speakers. The groups work was described as largely "autonomous" (Focus group 1, pos. 152), whereas a project leader still offered "guidance" (idem.), telling the group whether they are "going in the right direction or going in the wrong direction" (Focus group 1, pos. 164).

Periodically, sub-groups formed in order to accommodate the different research and teaching foci of participants and to ensure that different aspects of broader topics, e.g. different angles on design principles for inclusive teaching, could be discussed. Perceptions of how these sub-groups formed vary. Some EMCR group participants regarded them as a self-evident process, resulting from the larger group's previous work and input from an external speaker at a project conference and aiming at creating tangible outputs. Other participants perceived a continuing influence of one of the

project leaders in shaping the emergence of sub-groups, as is illustrated by the following quote:

> "And it was [PI1] who said, 'So, it would be nice if you could now continue working on the design principles in groups.'. And I totally understood that, this process. But it was a rather – not dictated process, but rather some kind of a suggestion that would be nice if we continued to work on it. But it didn't come from the EMCR-group." (Interview 23, PhD_hum, pos. 293)

Data thus reveals a dichotomy in perceptions of EMCRs, pointing to a conflict between top-down and bottom-up developments in the project. Even when experiencing external influences over their work, PhD students and post-docs still pointed to a certain degree of own discretion, highlighting that decisions are not completely imposed or dictated on them.

7.2.2. Participation in the early- and mid-career researchers' group

Participation in the group was formally obligatory to all PhD students and post-docs who were hired via the project (protocol 4, steering group). Project leaders referred to two different rationales in order to legitimise this obligation both in documents and during interviews. On the one hand, they underlined the importance of collaboration within the project for reaching the project aim of implementing inclusive and inclusion-oriented teaching throughout the university. On the other hand, the project leaders employed a resource-based argument, stating that all EMCRs paid through the project should have a similar workload and contribute to the project evenly. However, interview data underlines the fact that obligations expressed by project leaders were not necessarily binding for all EMCRs in the project, as only their professors had the power to instruct them. One interviewee mentioned a "quasi-pressure to participate" (Interview 2, PhD_soc, pos. 118) and meeting protocols show that EMCRs were encouraged to switch time slots for teaching in order to ensure participation in the group (Protocol 34).

Participation in the group was therefore rather framed as "advisable" (Interview 16, PhD_nat, pos. 113) and depended on individual factors as well as on the interests of professors supervising the respective PhD students or post-docs. This resulted in differing degrees of participation throughout the project lifetime, whereas EMCRs prioritising their individual research projects were observed to be less active. In contrast, a handful of what can be characterised as 'interdisciplinarians', either motivated by interdisciplinary exchange in general or by the aim of implementing inclusive and inclusion-oriented teacher training throughout the university, were observed to be strongly engaged in the EMCR group.

Despite a corresponding reference in the project proposal (Document 1), professors did not participate regularly in the EMCR group, unless they were invited to speak about or advise on selected issues. Further, a change in participation of project leaders and administration was witnessed. Whereas during early project stages, a project leader and representatives of project administration had attended all meetings, they gradually retreated and eventually only attended meetings upon request of EMCRs.

7.2.3. Interdisciplinary collaboration within the early- and mid-career researchers' group

As a focus group participant has voiced, the EMCR groups' "fundamental idea is to create a transdisciplinary – or however exactly you call it – moment" (Focus group 1, pos. 238) and to identify knowledge or approaches transcending disciplines that are relevant for improving teacher training at the case study university. Yet, perceptions and characterisations of work in the EMCR group in the data vary. Some PhD students and post-docs took the existence and participation in the group as granted and did not attach specific significance to it during interviews with the exception of acknowledging that it facilitates exchange among all EMCRs in the project. For these participants, the group primarily served to get to know the project as well as other project participants. In interview data, it is referred to as a "first anchoring point" (Interview 13, postdoc_soc, pos. 14) in the project for project participants,

bridging all of the sub-projects conducted by EMCRs in the project and providing a space for exchange on organisational matters.

Data shows that in many cases, exchange within the group led to a confrontation with new perspectives – not necessarily in a negative, but oftentimes in a positive sense, as interviewees (e.g. Interview 1, postdoc_hum, pos. 41) oftentimes remarked after having used the term. Input and ideas from other disciplines were sometimes adopted, sometimes rejected, but exchange across disciplinary boundaries within the scope of the EMCR group was described as mostly fruitful.

> "And at the same time, I find it exciting that we always ask ourselves: What is actually specific to each individual discipline? And this even intensifies the differences. So, on the one hand, we cross disciplinary boundaries and that is necessary but one also notices that one reflects more strongly on questions such as: Why do I find it so difficult to think in the same way as, for example - as a standard - someone from mathematics? [Laughter in room] And I find that really productive." (Focus group 1, lines 58-60)

Both project leaders underlined the strategic importance of the EMCR group in establishing communication between representatives of different disciplines, thus making sure that "PhD students try something different and enjoy a different socialisation" (Interview 25, PI2, pos. 4). This is in line with data collected through focus groups and interviews with PhD students and post-docs, which underlines the importance of the EMCR group in learning how to do interdisciplinarity. Participants describe the group as a "protected" and collegial space (Interview 21, postdoc_soc, pos. 266) which encourages participants to engage in discussions and propose ideas in larger, interdisciplinary settings.

Despite differences in experiences of interdisciplinarity in the sense of integrating knowledge from multiple disciplines by EMCRs, data clearly underlines the central role of the group in the project ("motor of the project", Interview 9, postdoc_hum, pos. 210).

7.3. Thematic working groups

The thematic working groups within the case study project focused on research as well as on the development of inclusive and inclusion-oriented teaching concepts. Over the course of data collection, the emergence of five working groups was witnessed, which were later restructured into four working fields and a methods workshop. The different groups were each based on a specific theoretical or methodological perspective, and included a group focussing on the universal design for learning as a principle for inclusive teaching, a group on inclusion-oriented didactic development and research, a group focussing on video vignettes as resource for teaching, a qualitative social research group, and a group focussing on cultural participation.

The emergence of working groups was not regarded as a self-evident process by project participants. According to the data, their emergence could be attributed to a) promises made in the project proposal (Document 1), b) the identification of central project themes during the first project conference as well as discussions within the project's steering group, and c) research interests of influential professors. An interviewee referred to the working groups as the "babies" of certain professors, who furthered their own research interest and previous work within the scope of the groups and kept shaping them strongly throughout the project lifetime (Interview 21, PhD_hum, pos. 201). An exception was constituted by a working group on qualitative social research which was established autonomously by EMCRs without professorial participation.

In the second funding phase, the working groups were formally developed into key thematic areas of the project. Project leaders and steering group members bundled working groups from the previous project phase with the aim of optimising project structures and improving the generation of tangible project outcomes. The PhD-student and post-doc led group on qualitative

social research was not developed into a key thematic area but continued to exist as an official project structure, as a methods' workshop.

Overall, the emergence of working groups seems to have been a complex process involving both top-down pressures and bottom-up developments, as illustrated by the following quote:

> "I think it has been both, bottom-up as well as top-down. So there has been a certain wish to meet with and exchange with people working on similar things, so that is the bottom-up development, but on the other hand, the project leaders have shaped it top-down, for example by making it compulsory for early- and mid-career researchers to participate." (Interview 3, prof_hum, pos. 51)

7.3.1. Operational dynamics of thematic working groups

There was great variation in the operational dynamics and aims of the working groups within this study. Two of the groups, focussing on universal design for learning and video case teaching respectively, were strongly teaching-oriented. The group focussing on video vignettes aimed at developing and filming educational scenarios while exploring how video vignettes can stimulate learning and reflection processes among students of teacher training.

The group focussing on universal design for learning approached inclusive teaching from an interdisciplinary perspective, exploring the application of the model into different disciplines. Its content and operational dynamics were centred around a previous collaboration of persons both from within and outside of the case study project which aims at preparing teacher training students for their internship at schools.

The working group on inclusion-oriented didactic development focused on the evolution of teaching and the research thereof within various disciplines. It resulted from two thematically similar pre-groups that had been run in parallel for a couple of months at the beginning of the project, before being merged after the first project conference. While maintaining a strong focus

on the quality of teaching, empirical research on the delivery of teaching was at the centre of most discussions in this group.

All of the groups above were usually organised around the presentation of individual research projects of PhD students and post-docs and discussion thereof from different disciplinary perspectives.

Different aims and dynamics were observed for the remaining two working groups, namely the working group on cultural participation and the qualitative research working group. The working group focussing on cultural participation aimed at identifying concepts that enable the sharing of diverse aspects of language, culture, and religion. In addition to meetings in which group members discussed such concepts, methods, and research questions from the perspectives of different disciplines, the group collaborated with an external educational venue aiming at the integration of refugees. This collaboration served as a living lab for the group, which could test concepts and ideas emerging from their discussions in an experimental setting involving civil society actors. In interview data, the group's aim was described as "allowing complexity instead of denying it" (Interview 11, prof_hum, pos. 136) and in contrast to other working groups, the focus of collaboration was geared less towards the creation of tangible outputs.

The group focussing on qualitative research constitutes a special case due to the absence of professorial involvement. It was established by EMCRs without the involvement of project leadership, administration, or professors. Work within the group was characterised by flat hierarchical structures and did not pursue concrete content-wise aims but rather focused on research processes. Despite a strong sense of autonomy among group participants, the lack of professorial involvement was compensated by other control mechanisms: Data shows that the group was asked to report about their work at steering group meetings. Group meetings oftentimes entailed a discussion of methodological approaches – either in general or with regard to individual research projects – or collective interpretation of data. Despite its research

orientation, this group was frequently engaged with topics related to inclusive teacher training through the discussion of individual research projects. The qualitative research group was not included when the other groups were restructured into working fields for the second project phase. Instead, it continued to exist as a methods workshop.

Except for the qualitative research group, all working groups – and later: working fields – were led by a designated professor. In the second project phase, a "tandem of responsibility" (Interview 22, PhD_hum, pos. 190) was introduced – a model under which professors continued to (formally) lead the groups, but in which selected post-docs were given the task to coordinate them. This task was integral to the selected post-docs' job descriptions and in order to ensure a sustainability of working fields beyond the end of the case study project, the duration of their contracts within the project was prolonged. Overall, working groups were experienced as more structured in the second phase, and communication was described as easier and more "reliable" (Interview 18, postdoc_hum, pos. 72), among other due to the creation of the coordinator roles, which is further illustrated by the following quote:

> "Um - what else has changed in the second phase of work through these coordinators, there are other structures and there is a feeling of concrete contact persons. So it suddenly becomes um - more reliable and I don't shout something into an empty room - well, it was never an empty room, but shouting something into a crowd and hoping that someone hears it - the right person hears it." (Interview 18, postdoc_hum, pos. 71-72)

The role of postdocs as coordinators was further seen as pivotal in acting as intermediaries between the project steering group and the working groups, negotiating the needs and demands from both sides (Interview 18, postdoc_hum, lines 73-74).

7.3.2. Participation in thematic working groups

The project steering group imposed top-down demands on EMCRs to affiliate to at least two working groups. However, actual attendance as well as degrees

of active participation varied. The data contains accounts of participants that have reported to just “serving time, because I have to” (Interview 23_PhD_hum, pos. 120) at working group meetings instead of productively participating, and other accounts of participants searching for good excuses to miss meetings in groups which they do not perceive as valuable for their own work. As a consequence, members of the PhD and post-doc led working group on qualitative social research jokingly referred to their group as a “non-working group”, as they did not want to commit to “yet another working group” (Interview 9, postdoc_hum, pos. 65).

(Non-)participation and inclusivity in the working groups presented a complex landscape especially within the first project phase. In principle, participation was open to all project members and was linked with expectations of regular attendance. However, the working group on cultural participation was perceived as less accessible by some participants and was sometimes even referred to as "the exclusive club" (observation EMCR group meeting, PhD_nat; Interview 23, PhD_hum, pos. 164). This perception of exclusivity may have depended on the group's format, specifically its living lab approach, which seemingly complicated sporadic or one-off participation.

Data reveals disparities in the participation levels of professors across the working groups. While in some groups, a high degree of active engagement from professors was observed, other groups witnessed a markedly lower frequency and intensity of professorial involvement. These differences could potentially be attributed to the distinct aims and formats of the groups. High professorial activity was especially observed in a group characterised by its focus on community outreach, operating under the concept of a 'living lab'. This contrasts with groups adhering to more traditional formats and organisation mainly based on the presentation and discussion of PhD and post-doc projects. Interestingly, professorial participation increased in the second project phase. While data does not allow precise conclusions regarding the underlying reasons for this, factors influencing professorial

participation in the second project phase may have included modifications in the structure and organisation of groups (transformation into working fields, see above) and stronger requests for participation by project leaders.

Data points to a broad scope of disciplinary representation in most working groups. An exception was constituted by the working groups focussing on the topics of qualitative social research and cultural participation. Due to their thematic and methodological foci, they predominantly attracted scholars from the social sciences and humanities and, in the case of the first, especially those working with qualitative methodology, consequently resulting in a certain degree of disciplinary selectiveness.

7.3.3. Interdisciplinary collaboration within thematic working groups

Analysis show that the working groups have actively promoted a departure from discipline-centric thinking. EMCRs in particular have noted that the groups foster an environment conducive to thinking beyond traditional disciplinary patterns. In a group discussion, they noted the value of receiving feedback from a range of disciplinary perspectives, contrasting with the more discipline-specific viewpoints typically provided by their doctoral supervisors:

> "(…) and then you get really constructive criticism from all the participants. Normally, your doctoral supervisor is from your own discipline and has a strong bias towards the own discipline, which is important, but if you then imagine that you really think in other directions. I find that very enriching." (Focus group 1, pos. 40)

Interdisciplinary collaboration within the working groups usually entailed the discussion of research and/or teaching methods from different disciplinary perspectives. Discussions served as important feedback for EMCRs in designing and conducting their research projects, but sometimes also led to further collaborations of (smaller groups of) working group participants for the purpose of joint conference presentations or publications. The disciplinary diversity within the working groups and the opportunity to learn about the

different methods and research approaches used by other disciplines have emerged as important aspects in interviews and group discussions

Again, it was observed that experiences of interdisciplinarity vary between participants – even of the same working groups. On the one hand, data points to the fact that significant learning often occurs within disciplines similar to those of respondents. Exchange with more distant disciplines was oftentimes framed as valued by respondents for providing reassurance and affirmation of their chosen, discipline-based approaches – or, as a PhD student formulated during an interview, "simply to reassure myself somehow that the method I have chosen is good for me and the other one for others" (Interview 21, PhD_hum, pos. 304).

Such narratives often go hand-in-hand with an elaboration of difficulties arising when collaborating with distant disciplines (see section on barriers to interdisciplinarity in Chapter 9 for a more detailed account of this). Yet again, data collected from other respondents suggests the existence of more integrative approaches to disciplinary diversity in working groups. For example, a professor regarded the identification of common research problems consistent across disciplines and subsequent identification and formulation of "critical questions" as fundamental for the further course of the project (Interview 14, prof_soc, pos. 209). This approach underscores the value of interdisciplinarity in addressing complex, multifaceted issues.

A special case was constituted by the working group on cultural participation, which through its involvement in a living lab and subsequent collaboration with civil society actors outside of academia introduced aspects of transdisciplinarity to the project beyond its focus on preparing future teachers for school education.

7.4. Teaching collaborations

Interdisciplinary teaching collaborations were originally part of an earlier version of the case study project proposal but were subsequently removed. They presented an insightful case for the emergence of interdisciplinary

structures beyond fulfilling external obligations. The dynamics and trajectories of teaching collaborations within the case study project were highly diverse. Teaching collaborations differed in scope, topical focus, types of actors and disciplines involved, as well as their frequency and duration.

Teaching collaborations often resulted from interactions of project participants within other interdisciplinary project structures, particularly the thematic working group, or inspiration gathered in other project formats, e.g. project conferences or broader discussion rounds based within the project. Data suggests that there were two pathways leading to the emergence of teaching collaborations. The first involved the initial formulation of an idea by a project participant, followed by a search for a suitable collaborator within the project. The second and apparently more likely path entailed the development of a collaborative idea subsequent to meeting a potential collaborator within the project framework. Additionally, it was observed that some teaching collaborations stemmed from pre-existing contacts, which were further intensified due to joint participation in the project.

Rationales for engaging in teaching collaborations were centred around the provision of high-quality teaching and setting examples of collaborative, educational settings to students of teacher education. In a focus group discussion among EMCRs, interdisciplinary teaching collaborations were referred to as a "best practice example" (Focus group 1) for students in teacher training programmes, who, later on in their professional lives, would have to collaborate with colleagues teaching other subjects in schools as well. Respondents acted upon a perceived lack of collaboration across disciplinary boundaries in university teaching, as further illustrated by the following quote:

> "That's what they have to do later at school when they are trained teachers, but at university they don't learn this cooperation, and that's why I try to implement it that way." (Focus group 1, pos. 74-75)

Overall, the emergence of interdisciplinary teaching collaborations in the project was described as intrinsic and dependent on bottom-up developments. At the same time, teaching collaborations proved to constitute the interdisciplinary structure associated with the strongest challenges for respondents – not with regard to doing interdisciplinarity itself, but rather due to organisational issues. Respondents across academic ranks reported that setting up courses across disciplinary and faculty boundaries was difficult due to study-programme specific examination rules and the strongly faculty-based administration of resources –a common element at German universities. The latter became apparent with regard to strong faculty control over the fulfilment of teaching obligations as well as to the availability and booking of rooms for teaching. In consequence, to avoid these challenges, EMCRs within the project reverted to collaborating informally, sometimes even in addition to regular workload:

> "So coming back to the teaching collaborations, it has already been mentioned that it is sometimes very complicated in terms of university organisation. Where is it based, how am I allowed to do it, what examinations do students have to take, so that's why I - like many others - give my collaborative seminar beyond my regular teaching load. So that you don't have any stress, you just do it voluntarily and then it always works out a bit better." (Focus group 1, pos. 176)

7.4.1. Operational dynamics of teaching collaborations

The operational dynamics of interdisciplinary teaching collaborations within the project were highly diverse and depended on an array of factors, including organisational influences, challenges and demands as well as the time and resources, personality, and interests of actors involved in them.

Overall, data points to three different operational modi of teaching collaborations. The first modus was a full teaching collaboration, characterised by the joint design and delivery of seminars by typically two – at times three – project participants from different disciplines. The second modus was collaboration in the shape of so-called 'diversity dialogues' which

entailed having seminars take place at the same time and bringing together the teachers and students of both seminars during one or multiple sessions throughout a semester. During these sessions, teachers and students exchanged their views on selected topics or questions from different (disciplinary) point of views. The third modus was less structured and was based on project participants visiting the seminars of representatives from other disciplines during selected sessions.

Teaching collaborations had different topical foci. Some collaborations were specifically designed to prepare teacher-training students for their internships at schools. Other collaborations focused on school-education related topics, e.g. media education and the use of media at schools. At last, there were collaborations concerning topics that concerned both educational settings at schools and in higher education, including reflections of power and norms in education, heterogeneity and inclusive education, or exploring the potential of team teaching for education.

7.4.2. Participation in teaching collaborations

Whereas participation in the EMCR group and in working groups was framed as obligatory (see the Chapter 9 on barriers and facilitators for a reflection of obligation and voluntariness within the case study project) – at least for PhD students and post-docs – and most project participants were involved in these structures, the vast majority of project participants was not involved in teaching collaborations.

Throughout the project lifetime, less than a third of the participants were engaged in interdisciplinary teaching collaborations at least once. Most of those who collaborated belonged to the social sciences, followed by the humanities and lastly the natural sciences. Oftentimes, interdisciplinary collaborations emerged between a discipline and the educational sciences or special education. However, collaborations were also observed between representatives of disciplines belonging to different scientific fields, e.g. the natural sciences and the humanities. Data further reveals the existence of

interdisciplinary teaching collaborations beyond project boundaries. A respondent engaged in such a collaboration reported that while she collaborated with a non-project participant, the case study project provided impetus for her to pursue the collaboration (Interview 6, PhD_soc). Unsurprisingly, collaborations among participants from the same discipline and oftentimes the same professorship remained more common than interdisciplinary collaborations.

While data highlights the bottom-up nature of interdisciplinary teaching collaborations, the analysis has also revealed subtle influences of project leadership. For one, data suggests a project leader systematically and partly successfully promoted teaching collaborations. Due to their influence, at least one newly-appointed professor perceived not only an expectation but rather a culture of collaboration in teaching when they arrived at the university: “Well, that is how things are being done here at this university, right?” (Interview 7, PI2, pos. 32). Interdisciplinary teaching collaborations were further incentivised through a teaching award, which was at first granted in the project internally and later institutionalised, and which listed interdisciplinarity as a main criterion.

7.4.3. Interdisciplinarity within teaching collaborations

This section focusses on interdisciplinarity within teaching collaborations in the case study project. Interdisciplinary teaching collaboration differed from other interdisciplinary structures as it involved exchanges across disciplinary boundaries not only by project participants as teachers, but also by their students. While project participants report that teaching collaborations are useful as a way to get “expertise” (Focus group 1, line 69), they also stress that teaching collaborations allow both teachers and students to get to know disciplinary cultures and explore disciplinary similarities and boundaries. As a respondent noted during a focus group discussion among EMCRs, teaching collaborations aimed at unveiling and renegotiating disciplinary boundaries, as is shown by the following quote:

> "(…) letting the students from different disciplines clash with each other, rub up against each other and somehow negotiate the boundaries between their disciplines" (Focus group 1, pos. 82).

The scope of interdisciplinarity in teaching collaborations was observed as rather broad in data, ranging from merely getting inspiration from another discipline to transcending interdisciplinary practices and knowledge. Two representatives from different disciplines within the social sciences even referred to their teaching collaboration as transdisciplinary:

> "I would say our seminar is transdisciplinary. We have conceptualised something new based on the expertise each of us brought along. And something totally new has emerged; this has not existed this way before." (Focus group 1, pos. 236)

Overall, interviewees see interdisciplinarity in teaching collaborations as particularly work intensive, yet rewarding. Respondents reported being challenged and facing critical questions by their collaboration partners, but see these confrontations as positive. As respondents noted, despite all challenges, their collaborative "seminar has profited from us conceptualising it together" (Interview 6, PhD_soc, pos. 182).

7.5. Outputs and sustainability of interdisciplinary project structures

On the one hand, literature argues that collaboration practices and outcomes do not always align (Bégin-Caouette et al., 2022). On the other hand, it is argued that certain outputs, in particular joint publications, can serve as a proxy for studying social relationships and constitute a meaningful indicator of collaboration intensity (Katz & Martin, 1997). Literature also claims that many interdisciplinary initiatives are episodic instead of creating long lasting change (Sá, 2008) – a phenomenon possibly further intensified within the context of the project as an organisational form of the case study.

This section therefore focusses on outputs of collaboration as well as on perspectives regarding the sustainability of interdisciplinary structures within the context of academic projects.

7.5.1. Outputs of interdisciplinary collaboration

Literature shows that there is a wide range of scholarly outputs, including teaching, research, or knowledge transfer outputs of different kinds, which reflect the "multi-product nature of university activity" (Pastor et al., 2015, p. 1867). There also seem to be disciplinary differences with regard to outputs, in particular between disciplines from the natural sciences and the social sciences and humanities (Huang & Chang, 2008), related to the importance of collaborative work versus individual authorship, of conference presentations versus journal articles versus monographies and book chapters (Hicks, 2004; Whitley, 2000), as well as the recognition of practice-led or embodied scholarly outputs such as exhibitions or performances (Borgdorff, 2012).

Within the context of the case study project, the generation of the following outputs was observed: Publications, conference presentations, teaching materials, and technical infrastructure. Additionally, collaboration within the scope of interdisciplinary project structures resulted in further collaborations of project participants outside of the organisational framework of the project.

Joint publications included but were not limited to contributions to edited volumes published by the project participants with strong encouragement from project leaders and in order to fulfil promises made to funders in the project proposal (Document 1, p. 16). Data shows that joint publications heavily relied on collaborations within interdisciplinary project structures. They particularly emerged from collaboration within the thematic working groups, but also from collaboration within sub-groups of the EMCR group. Data confirms joint publications to be based on intensive collaboration – which did not always take place without conflict. There are multiple accounts of disciplinary differences and perceived hierarchies among disciplines

leading to conflict during writing and publication processes – a topic which will be addressed in more detail in the section on barriers to interdisciplinarity in Chapter 9. Joint conference presentations – both on external academic conferences as well as internal project meetings – were heavily based on collaboration within the working groups.

Teaching materials constituted an important output based on interdisciplinary collaboration within the case study project. They were mainly created in the context of thematic working groups, in particular the group focussing on research and teaching connected to video vignettes and producing them for the use in teaching settings, but also in the form of other materials used for the preparation or reflection of teaching in higher education, such as guides and tools related to the Universal Design of Learning – a method for inclusive teaching. Similarly to the case of publications, the creation of teaching materials as a project output had also been promised in the project proposal (Document 1, p. 16).

Additionally, technical infrastructure was created – and remains available beyond the case study duration – for the implementation and analysis of teaching formats in the context of both higher education and school education.

Finally, further collaborations were observed as an output of interdisciplinary collaboration within the case study project. Such collaborations took place on smaller (non-formalised) and bigger scales, even including applications for further third-party-funded projects in individual instances. Data points to the project in general and collaboration within interdisciplinary structures in particular playing an important role for the emergence of these further collaborations – in particular if they involved representatives from rather distant disciplines in the areas of the natural sciences and the humanities. They allowed project participants to build trust and test their ability to successfully collaborate in the lower risk environment of an already funded project.

7.5.2. Interdisciplinary co-publications: A social network analysis

Following the assumption that joint publications serve as an indicator of collaboration intensity (Katz & Martin, 1997), I draw on results of the social network analysis to corroborate qualitative research findings regarding collaboration within interdisciplinary structures and the outcomes thereof.

A modularity analysis applied to the network in order to identify community structures (Blondel et al., 2008; Lambiotte et al., 2014) has identified six modularity classes, or communities, within the co-publication network (see Figure 4). While ties exist between these communities, ties within them are stronger than ties to the outside. An analysis of interdisciplinary affiliations of actors in the network has revealed that most of the identified communities can be regarded as interdisciplinary; many of these even encompassing representatives of soft and hard sciences.

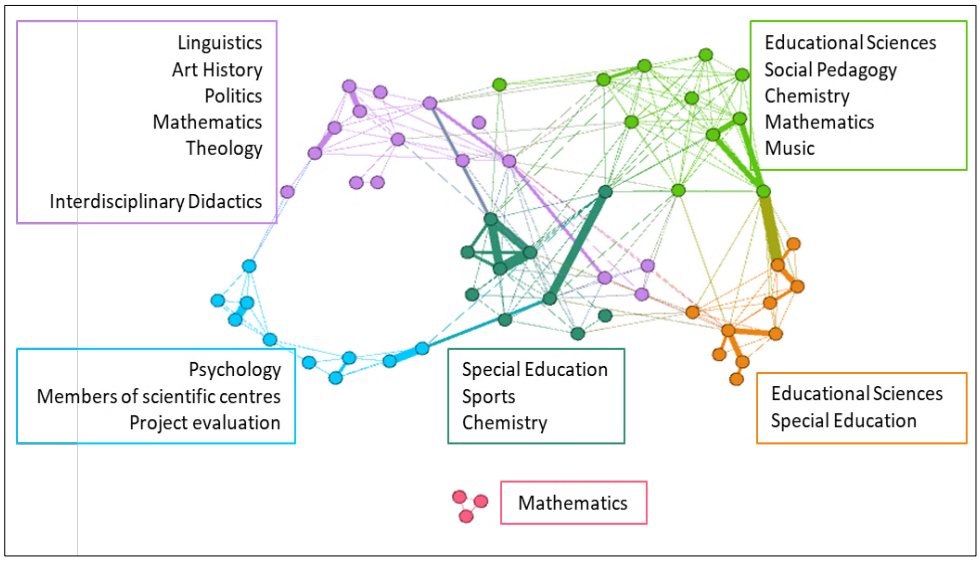

Figure 4: Co-publication network of project participants within the first project phase

The communities at the top of the figure are especially interdisciplinary. The community depicted at the top left corner of the graph (lilac) contains representatives from linguistics, art history, politics, theology and mathematics as well as – more distantly – interdisciplinary didactics. The community at the top right corner (light green) contains representatives from the educational sciences, social pedagogy, music, chemistry and

mathematics. The community at the bottom left of the graph contains representatives from psychology, as well as project participants that were involved in the project for evaluation and development purposes (light blue). The community in the middle (dark green) contains representatives from special education, sports, and chemistry. The remaining communities can be deemed less interdisciplinary: The community at the bottom right corner of the graph (orange) contains representatives of educational sciences and special education. It is, however, closely tied the top right (light green) community via co-publications of the same institute from the area of educational sciences. At last, the community at the bottom of the graph (pink) represents a disciplinary peninsula of representatives from mathematics, who did not engage in interdisciplinary co-authorship with colleagues from the case study project at the time of data collection.

While project participants are not fully integrated through co-authorship, the network analysis shows that the vast majority of communities within the network contains actors from different disciplines. Thus, the analysis confirms the emergence of interdisciplinarity within the case study project not only related to scholarly practices, i.e. participation in interdisciplinary structures, but also scholarly outputs, i.e. publications.

7.5.3. Perspective regarding the sustainability of interdisciplinary structures

Being based within a third-party funding line, the sustainability of interdisciplinarity structures in the case study was a delicate issue. Being aware of this, project leaders took several strategic measures to ensure the dissemination of project results and sustainability of structures not only during the transition between the two project phases, but also beyond the project's overall lifetime. For one, special positions for selected post-docs as coordinators of working fields were created at the beginning of the second project phase in order to ensure a sustainability beyond the end of the case study project. These post-docs were granted contracts with longer duration than other project participants to ensure a dissemination of results and,

possibly, continuance of structures outside the scope of the project. Further, there was a notable shift towards greater openness to involve university members who were not originally part of the project into the working groups in the second phase of the project. This adjustment aimed at enhancing networking opportunities and more effective dissemination of outcomes to university members beyond the project.

Despite these developments, the transitional phase between the two project phases was described as challenging by respondents. The departure of active individuals left a "void" (Interview 18, postdoc_hum, line 240), and there was a perceived "lack of flow" in the working groups at the beginning of the second project phase (Interview 20, postdoc_soc, pos. 110). This phase made it evident that the momentum of the project relied heavily on specific actors:

> "We realise now in the second project phase how much something like this depends on certain people, on people who push it and who are motivated." (Interview 20, postdoc_soc, pos. 109)

Similar developments were witnessed with regard to the EMCR group. In interviews, respondents reported a clash between new actors in the project, who were seeking orientation at the beginning of the second project phase, versus established ones, who want to implement previously developed ideas and create tangible outputs. As an interviewee put it, "if more than half of the participants just have to see what's going on, what's this here, what's this all about, right? You get slowed down a bit." (Interview 20, post-doc_soc, pos. 158). This even led to a short-term drop in attendance from 10-15 to around five regular participants in group meetings. Nevertheless, all interdisciplinary structures survived the transition between project phases. Data points that after initial difficulties, engagement of project participants in interdisciplinary structures – especially in working groups – grew even stronger.

However, respondents' accounts of sustainability of interdisciplinary structures beyond the project's lifetime are less optimistic. Respondents believe that pre-existing structures at the universities will continue to pose

challenges to interdisciplinary teaching collaborations. They attribute the success of teaching collaborations within the scope of the project to "negotiation abilities" of project participants, which immensely relied on credibility gained from participation in the case study project. As EMCRs formulated during a focus group discussion, they were "unsure whether this can be continued within the same scope once the project expires. Because there are very strong structures and it is very hard to combine" faculty-based structures for teaching and interdisciplinary teaching collaborations (Focus group 1, pos. 187). On the one hand, project leaders and one of the interviewed professors uttered hopes that a new, interdisciplinary socialisation of EMCRs might lead to a sustainability of interdisciplinary collaborations. On the other hand, data highlights that this socialisation is unlikely to result in lasting structural change at the university itself, as PhD students and post-docs usually seek employment in other institutions or even different sectors after their project contracts expire. This is also illustrated by the following quote:

> "No, nothing will come of it. Quite simply because those who are responsible for most of the project work, namely the early- and mid-career researchers, will be gone relatively quickly, right?" (Interview 8, prof_soc, line 135)

7.6. Chapter summary

Overall, three types of interdisciplinary structures emerged within the case study project. These included an early- and mid-career researchers' (EMCR) group, five thematic working groups, and multiple teaching collaborations. Due to the focus of the case study project on university teacher education, research and teaching were even more strongly intertwined than usual in a Humboldtian higher education system. This was also reflected in the work within the interdisciplinary structures, most of which were either directly concerned with teaching (in particular the teaching collaborations), or with research on the provision of university teaching.

Analysis shows that with regard to interdisciplinary structures in the case study project, a distinction of planned versus emergent structures is warranted. While the EMCR group was planned in the project proposal and, in particular at the beginning of the project, was characterised by a top-down implemented, pre-specified framework, teaching collaborations seem to have developed largely bottom-up, whereas the emergence of working groups was tied to a complex interplay between top-down and bottom-up developments. Further, there was variety across the working groups in terms of intensity of collaboration across disciplinary boundaries as well as their operational dynamics.

Planned

Emergent

Early- and mid-career researchers' group	
Emergence: Top-down, pre-specified, planned in project proposal; Shift towards autonomy of junior researchers.	**Participation**: Formally obligatory for PhD students and post-docs.
Operational dynamics: Regular (bi-weekly) meetings; Shift from focus on organisational matters to teaching and research.	**Interdisciplinary collaboration:** Descriptions ranging from pluri- to transdisciplinary; broader group exchanges and stronger, more focused collaboration in temporary sub-groups.
Thematic working groups (6)	
Emergence: Top-down and bottom-up dynamics; topical foci and desire for collaboration across disciplines grounded in bottom-up, and processes of formalization in top-down dynamics.	**Participation**: All project participants, extending beyond project in second project phase; led by designated professors, later supported by a post-doc as coordinator
Operational dynamics: Regular (usually monthly) meetings; Focus on both research and teaching (or research ON teaching), and – in case of living lab – collaboration with societal actors.	**Interdisciplinary collaboration:** Descriptions ranging from pluri- to transdisciplinary (latter in case of living lab only).
Teaching collaborations	
Emergence: Bottom-up, with encouragement by project leadership.	**Participation**: voluntary, non-formalised, across status groups; sometimes extending beyond project boundaries.
Operational dynamics: Range of operational modi (collaboration for specific seminar sessions or throughout courses), strongly dependent on individual preferences and initiative.	**Interdisciplinary collaboration:** Descriptions ranging from inter- to transdisciplinary; often entailing interdisciplinary collaboration for participating students.

Table 5: Interdisciplinary structures, their emergence, and participation, operational dynamics, and interdisciplinary collaboration within them

Table 5 summarises the observed interdisciplinary structures, outlining their emergence as well as participation, operational dynamics, and interdisciplinary collaboration with them. The EMCR group has emerged as pre-defined, top-down structure, which was increasingly been co-designed by its participants and over time transformed into a platform they perceive ownership of - their 'own product'. The thematic working groups emerged in complex dynamics of top-down and bottom-up developments. The general desire for collaboration across disciplinary boundaries and the topical foci of structures seem to have emerged bottom-up, the latter sometimes based in previous research interests of individual professors, while top-down developments were observed in efforts by project leadership to formalise the organisation of groups and introducing a formal obligation for participation in at least two groups for EMCRs.

However, there were differences in how working groups operated and the working group having emerged largely independently from top-down influences displayed stronger signs of collective responsibility and met more frequently. Interdisciplinary teaching collaborations were located at the other side of the spectrum, emerging largely bottom-up and based on individual project participants' preferences and initiative. Nevertheless, appreciation and encouragement by project leaders seem to have positively influenced their emergence.

The development towards more 'democracy' and stiving for autonomy in the EMCR group over the course of the project phases was also observed for the overall project in general. Yet, data also points to the importance of top-down developments, in particular in setting frameworks within interdisciplinary structures can emerge. According to multiple accounts of project participants in data, the EMCR group would not have emerged in the same way without the planned element and guidance at the beginning of the project. As such, the group serves as an example of difficulty in trying to reach balance between top-down and bottom-up: Participants demanded guidance, in particular at the

beginning of the first project phase, then counter-reacted on these expectations and demanded more autonomy.

The chapter has further focussed on the outputs and perspectives regarding the sustainability of interdisciplinary structures within the case study project. Findings show that outcomes of interdisciplinary collaboration within project structures go beyond traditional scholarly outputs, such as publications and conference presentations. They included teaching materials of various kinds, including, for example, video vignettes and preparatory materials for inclusive teaching, as well as technical infrastructure for the implementation and analysis of inclusive and inclusion-oriented teaching approaches. Additionally, further collaborations, sometimes less structured and sometimes highly formalised in the form of third-party-funded projects emerged based on collaborations within project structures.

Despite strategic measures taken to ensure a dissemination of project results and the continuation of formats beyond the duration of the case study project, data reveals little optimism regarding the sustainability of interdisciplinary structures. Data shows that learning towards interdisciplinary has been taking place and that new social networks have emerged based on which further interdisciplinary collaboration has become more likely to emerge. The sustainability of structures, however, seems to depend on their degree of formalisation. Structures depending on bottom-up initiatives of a smaller number of individual actors, specifically teaching collaborations, are believed to be more likely to continue, although definitely harder to achieve without the support of the case study project. In contrast, top-down implemented structures bringing together large numbers of participants from different scientific disciplines and faculties, in particular the EMCR group, are highly unlikely to continue outside an organisational framework such as the one of the case study project.

8. Actors, Motivation and Engagement in Interdisciplinary Structures

> "I think I have made my point [laughs]: It all depends on the people" (Interview 20, post-doc_soc, pos. 512)

This chapter focusses on actors and their motivation to contribute to the emergence and engage in interdisciplinary structures. The analysis has revealed that the degree of engagement of individual actors and their motivations to do so have had significant influence on interdisciplinary collaboration within project structures. Within the course of this chapter, I will describe different types of actors that have been found to be relevant for interdisciplinarity in the case study project. I will then turn to the question of how actors engage in interdisciplinary structures, exploring descriptions of collaboration within the structures and investigating the extent of interdisciplinarity within them. The chapter concludes with the preposition of a typology of interdisciplinary actors, based on the motivation and agency of participants of the case study project, and the corroboration of findings based on results of the social network analysis.

8.1 Actors

This section focusses on different types of actors within the project and the descriptions attached to them. Data points to differences in how actively project participants have contributed to the emergence of and engaged in interdisciplinary structures within status group. Nevertheless, actors will be introduced according to these groups within the first section of this chapter, while differences in engagement, motivation, and a proposal for a typology of actors will be presented at later points in this chapter. This section commences with a description of the group of early- and mid-career researchers (EMCRs) and the attributes attached to them, followed by a description of the group of professors, as well as of project leadership and administration. I will then turn to the question of how actors were recruited and thus gained legitimacy to participate in the case study project.

8.1.1 The role of early-and mid-career researchers in the case study project

Early- and mid-career researchers (EMCRs) played a central role in the case study project and particularly within interdisciplinary project structures. The exact number of EMCRs varied slightly by up to 34 members over the course of the two project phases. The group comprised academic staff on PhD level, who typically held their first academic positions, as well as postdoctoral researchers, who held doctoral degrees and had prior experience in teaching and research. They were hired at the discretion of professors participating in the project and directly responded to them. Data depicts EMCRs as the most critical actors within the case study project, not only conducting the majority of research (partly through their individual dissertation projects) but also in actively engaging in and sometimes initiating interdisciplinary collaborations. Upon being asked which role EMCRs played within interdisciplinary project structures, a post-doc emphasised: "The most important role, as they do the work" (Interview 20, postdoc_soc, pos. 210).

Data points to a high degree of agency and organisation of EMCRs in the case study project. Interviewees suggested that unlike in many other university structures, where researchers below the professorial level struggled to have their voices heard, they experienced a comparatively high level of agency in the case study project. Their strong organisation within a dedicated structure – the EMCR group – was a key factor in contributing to this empowerment. Collaboration within this structure enabled EMCRs to exchange across disciplinary boundaries and to actively shape project developments and decision-making processes. A PhD student from the humanities highlighted these dynamics with the following words:

> "Because first of all, there are so many young academics/ early- and mid-career researchers somehow organised within the project. So we are also MANY MORE than it would perhaps be usual within a single discipline. Um (.) and uh then/ yes, it's totally clear from the outset that [inhales audibly] we're the ones who mainly do the work" (Interview 22, PhD_hum, pos. 173)

However, despite the central role attributed to EMCRs in many of the interviews conducted, not all young researchers demonstrated the same level of engagement and initiative. This hesitancy was attributed to both a lack of experience in teaching and research and resulting caution, as well as insufficient support from professors who either showed little interest in or failed to recognise the benefits of interdisciplinary collaboration within the case study project. Data further suggests that the extent to which EMCRs perceived themselves as powerful within the case study project was also influenced by disciplinary cultures and traditions. In disciplines with relatively flat hierarchies, young researchers were more accustomed to speaking up and taking initiatives, whereas disciplines with steeper hierarchies often placed professors in dominant decision-making roles, leaving EMCRs with limited influence and motivation to engage.

Hierarchies were also (re)negotiated within the group of EMCRs. On the one hand, post-docs were perceived as important actors within interdisciplinary structures. While not all post-docs took on active roles, some played a crucial part in advancing the project due to their experience and high degree of (disciplinary) knowledge:

> "(…) but I also found again and again that the postdocs did a lot. Um, not all of them, but (.) some. (.) because they simply knew more about the topic" (Interview 24, PhD_soc, pos. 92)

On the other hand, their experience made it easier for them to speak up in larger settings, disadvantaging PhD students in larger group settings. This led to a revision of speaking roles in meetings: "first, PhD students, then post-docs may speak" (Protocol 26, p. 1), but due to general dissatisfaction with this rule it was soon abolished again.

Within the group of EMCRs, two more groups of actors can be distinguished: speakers of the EMCR group as well as post-docs entrusted with the coordination of working groups. Speakers were introduced within the first project phase in order to ensure better communication with project leadership

and representation within the project steering group. Speakers were elected by members of the EMCR group and within this group, often took on organisational tasks as well as the structuring of discussion and ensuring productive outcomes in meetings:

> "In larger groups, when we only have, let's say, two hours to discuss something, and in the end, everyone leaves dissatisfied, then it's important to say, okay, let's take a more focused look at a particular point. Having a more goal-oriented approach to push things forward is something I always find very important. And that's just— that's just— for me, it's always been relatively important to take the initiative in such situations." (Interview 16, PhD_nat, pos. 79)

In the second project phase, selected EMCRs took on additional responsibilities as working group coordinators. These actors were post-docs of the professors leading the respective working group and received special contracts exceeding those of their peers, aiming at a continuation of working groups beyond the official life-time of the project. The primary role of these working group coordinators involved organisational and administrative tasks. As a working group coordinator reported: "a lot of it is actually a bit of housekeeping, I would say" (Interview 22, PhD_hum, pos. 115). However, other actors within the project also saw a potential to exercise agency by supervising and shaping collaborative efforts within the working groups. As an interviewee put it: "They have the threads in their hands" (Interview 20, post-doc_soc, line 234).

Data shows that the project put a strategic focus on EMCRs in order to foster long-term change. This was also highlighted in communication with one of the project leaders who underlined that the decision to actively integrate and empower young researchers was based on the recognition that academics socialised and established within their disciplines were unlikely to change their approaches: "We won't change the old people any more" (Interview 7, PI_hum, pos. 5). Instead, the project sought to provide "interventions into

their processes of socialization" (Interview 7, PI_hum, pos. 34) to cultivate an interdisciplinary mind-set among the next generation of academics.

Overall, the case study project exemplifies the central role of EMCRs for interdisciplinary research. While data shows that PhD students and post-docs drove much of the work, their ability to do so and to exert agency depended on multiple factors, including organisational structures, disciplinary hierarchies, and encouragement and support by their superior professors. The deliberate emphasis on integrating and empowering young researchers, in particular also their organisation within a dedicated EMCR group, fostered their agency and enabled them to act not only as participants, but also as key agents of interdisciplinary collaboration within the case study project.

8.1.2 The role of professors in the case study project

The group of professors was slightly smaller than that of EMCRs and comprised between 19 and 24 professors in each of the two project phases. Data shows that interdisciplinary structures require active engagement across academic status group to be effectively established and maintained. From the perspective of EMCRs, the role of professors was highlighted in data in particular with regard to long-term sustainability of interdisciplinary structures which depended on the involvement and support of professors. During a focus group discussion, a PhD student from the natural science emphasised:

> "To truly establish interdisciplinary structures in a sustainable way, professors need to be brought on board, at least this is what I think. I think without/ obviously, us early- and mid-career researchers are often the ones who implement things and drive them forward. But without the backing and continued involvement of professors, these structures are unlikely to persist in the long run." (Focus group 2, pos. 66)

This underlines that even if a majority of interdisciplinary collaboration is carried out by EMCRs, professors still need to be included in order to gain their support for and enable sustainability of structures beyond the projects'

lifetime. The findings specifically underline that professors were key actors in supporting and encouraging interdisciplinary structures, in particular due to their role as supervisors of EMCRs. An interviewee noted “great differences in the extent to which professors allow their PhD students to experiment” (Interview 7, PI_hum, pos. 21), which, according to their point of view, significantly impacted the agency of young researchers in participating in and shaping the development of interdisciplinary structures.

A focus group participant further noted that the participation of professors in working groups affected their level of significance, resulting in a “different gravitas, or a different radiance” (Focus group 2, pos. 81) and thus increasing the institutional legitimisation and impact of working groups. Next to the role of professors in legitimising interdisciplinary structures and encouraging their PhD students and post-docs to engage in them, they were also involved in their content-wise development. As a PhD student from the humanities noted:

> “After all, professors bring the most experience into these discussions, having supervised multiple research projects and possessing a broader overview" (Focus group 2, pos. 81)

However, both the extent to which professors engaged with interdisciplinary structures and the extent to which they encouraged EMCRs to do so varied significantly. While there were professors that were amply active within the project itself and referred all project related work to their PhD students and post-docs, there were other professors that were highly active, in particular in working groups and sometimes in teaching collaborations.

Within the group of professors, two types of actors stand out: professors taking responsibility as working group leaders and professors holding additional strategic positions. The influence of working group leaders was seen as particularly strong within the project, as the establishment and development of working groups is often described as reflecting the priorities and interests of individual professors. As an interviewee described:

> "In the working groups, one can clearly see that they [annot: the professors] shape the structures and the further developments, and in a way, they are kind of the 'babies' of (.) those (.) involved in [the case study project]" (Interview 21, PhD_hum, pos. 201)

The second type is that of professors in strategic positions, e.g. deans of faculties within the university. These actors held the authority of carrying project knowledge beyond the project into their faculties and contributed to the legitimisation of (participation in) the project and its interdisciplinary structures vis-à-vis their faculties. This suggests that while interdisciplinary initiatives may emerge within specific projects, their integration into broader institutional frameworks requires support from actors in strategic positions, such as deans.

Overall, analysis shows that unlike EMCRs, who often engage in structured collaboration, professors tend to act less collectively and to interact less systematically in interdisciplinary structures. Nevertheless, professors were found to play a key role within the case study project, not only as supporters of interdisciplinarity (in their role as supervisors of PhD students and post-docs), but also as leaders and active participants in interdisciplinary working groups. While, during the course of the project, a lot of collaboration across disciplinary boundaries took place on the level of EMCRs, the long-term success of interdisciplinary structures depends on professorial engagement, both in terms of legitimisation and the contribution of knowledge. Respondents put a specific importance on the role of professors in ensuring the sustainability of structures beyond the scope of the case study project. While EMCRs had temporary contracts and were likely to leave the university again soon after the end of the project, professors held lifetime positions and thus had the power to influence the development of interdisciplinary structures in the long run.

8.1.3 The role of project leadership

Data shows that not only the presence of professors in meetings and discussion, but in particular also of project leaders contributed to the

credibility of interdisciplinarity and motivated participants to engage in shifts of perspective, thus making collaborations more binding and structured. The case study project was led by two individuals, both of whom were professors at the case study university. At the time of data collection, one of the leaders was a member of the university's rectorate, while the other held a central position in coordinating teacher training across faculties. The leadership team was characterised by diversity in terms of both gender and disciplinary background, representing the humanities and natural sciences, as well as disciplinary and subject-didactic orientations. Project leaders were supported by project administrators, who took on administrative duties and certain communication tasks.

Across a majority of interviews and focus group discussions, project leaders were described as pivotal figures in fostering interdisciplinarity in the case study project. They were recognised as highly committed actors in all data sources and characterised as actors striving for success of project initiatives beyond "formal sources of motivation" and based on their personal dedication to the project's topic. They were further perceived as key gatekeepers of the project's interests due to their influential positions within the university. Their authority and dedication were also considered instrumental in driving sustainable change across project boundaries, as reflected in one interviewee's statement:

> "Of course it makes a difference when (…) there are actors involved, who have the ambition and are entitled to make a change within the university." (Interview 1_postdoc_hum, line 67).

Data shows that the strategic roles of project leaders within the university, in particular the affiliation to the rectorate, allowed them to act as a "systemic guardian" (Interview 7, PI_2, pos. 27), monitoring the project from a meta-perspective and regarding it as a part of the wider university with aspirations for organisational change, rather than a self-standing unit.

Leadership played a crucial role in the case study project by inviting project participants, allocating resources, setting agendas, and ensuring alignment with project goals. This included creating opportunities for participants to meet and exchange ideas within interdisciplinary structures and creating frameworks for collaboration within these structures. This aspect will be discussed in more detail in the chapter on barriers and facilitators for the emergence of interdisciplinary structures (Chapter 9).

Diversity and goal ambiguity, brought along by the large number of project participant coupled with their varied disciplinary backgrounds, posed challenges for leadership within the project. These differences encompassed epistemological orientations and preferred approaches to interdisciplinary collaboration – ranging from open-discussion-based formats to more goal-oriented processes focused on the production of tangible outputs. Data suggests that in this regard, the heterogeneity of project leaders was beneficial as it enabled them to better address the different preferences and needs of project participants, e.g. through the provision of diverse interdisciplinary structures and formats, as corroborated by the following quote from a project participant:

> "I think the project benefits greatly from the fact that it is led by two very different people." (Interview 11, prof_hum, pos. 278)

Project leaders further took an influence through the invitation of participants to the case study project. The selection of project participants was described in data as a strategic process, aimed at a) ensuring a broad disciplinary representation within the project, b) involving individuals holding power positions within the university, e.g. deans, with the aim of reinforcing the legitimacy of the project and carrying its findings and outcomes into the various faculties, as well as c) building upon existing, successful interdisciplinary collaboration in order to ensure a basis of trust among participants. Interview data as well as observation notes corroborate that this strategy, starting with individuals that had a history of successful

collaboration and expanding to include actors in key positions and from different disciplines, has helped in building a foundation for interdisciplinary collaboration within the case study project.

Overall, actors contributing to the emergence of interdisciplinary structures were described as socially and communicatively skilled individuals who engaged in organising meetings, setting agendas, and maintaining a focus on collaborative goals within interdisciplinary structures. Data shows that actors contributing to the emergence of interdisciplinary structures occurred across the above-discussed status groups. Rather than referring to specific status groups, accounts in interviews and focus group discussions underline the role of particularly active, individual actors as crucial. This is underlined by the following quote:

> "It is tied to personalities, not to status groups (…). A project like this needs to address all status groups equally and give them space. If there are projects where (.) only the professors are important, then the others don't get a chance. But if a project tries to distribute this across all status groups, then it depends on personalities." (Interview 12, PI_nat, pos. 69)

While higher academic status goes hand in hand with power over resources (both financially and personnel), giving professors and project leaders more freedom to act within the project, this suggests that the above-mentioned categories of actors (EMCRs, professors, project leadership) cannot fully explain engagement in the emergence of interdisciplinary structures. The importance of actors for successful interdisciplinarity rather seems to depend on individual characteristics, motivation, and engagement within interdisciplinary structures. These issues will be explored in more depth in the following sections of this chapter.

8.2 Engagement in interdisciplinary structures

This section focusses on perceptions and characterizations of engagement in interdisciplinary structures within the case study project. Initially aiming at a categorization of the structures themselves, the analysis has quickly revealed

that the lived realities of participants vary, even when they participate in the same structure(s). As noted during a focus group discussion regarding collaborations in the context of working groups:

> "(…) and you can decide for yourself how in-depth you want to go into interdisciplinarity. How much use do I make of it? Do I just get something out of it for myself and my dissertation or do I want to broaden the discussion? Am I really interested in what other disciplines do?" (Focus group 1, pos. 31)

In the following, I will thus provide an overview of descriptions and meaning attached to collaboration by project participants. I will first provide an overview of notions and meanings attached to collaborations, and then structure them along the lines of existing typologies of collaboration across disciplinary boundaries, namely – ranging from the least to the highest degree of integration of knowledge – pluri-disciplinarity, cross-disciplinarity, interdisciplinarity, and transdisciplinarity.

8.2.1. Notions of interdisciplinary collaboration

Many descriptions of collaboration within project structures remain at a superficial level, including notions such as working together, getting together, collaborating, discussing, negotiating (managing differences between disciplines), and, most notably, exchanging. In a number of interviews as well as during focus group discussions, the term confrontation was brought up, whereas participants explained that they regarded such confrontation with the approaches and methods of other disciplines as productive and positively connoted. A number of participants, all from the social sciences but from different status groups, underlined that collaboration within project structures was strongly tied to leaving their own comfort zones and questioning themselves and their methods and approaches (reflexivity).

In descriptions of collaborations within interdisciplinary structures, positive connotations were predominant. Participants described the collaboration with colleagues from other disciplines as fruitful, beneficial (either described so

generally, or with references to an increase in scientific quality), stimulating, inspiring, and enriching. While less common in data, the analysis also revealed negative connotations – often in singular accounts –: irritating, frustrating, time-consuming, overwhelming, scary, threatening, excluding or invasive.

Findings show that perceptions of collaboration across disciplinary boundaries in the case study project were not mutually exclusive. Respondents often described encounters with other disciplines as negative with terms such as time consuming, while simultaneously pointing out their positive sides, using terms such as beneficial or fruitful.

8.2.2. Characterisations of (inter)disciplinary collaboration

There were several accounts in data, mainly in interviews and to a lesser extent in focus group data and a project evaluation report, pointing to collaboration in interdisciplinary structures as **pluri-disciplinary**. In such accounts, collaboration was described as additive and as "buying in" knowledge from other disciplines for specific purposes. They strongly underlined the importance of identifying differences and boundaries between disciplines, the importance of maintaining certain discipline-specific aspects, and underline that encounters with other disciplines often act as a confirmation for project participants' own (disciplinary) practices. At the same time, data suggests that working towards a common goal, namely the establishment of inclusive and inclusion oriented higher education, motivated project participants to keep their "individual research projects open at the margins" in order to ensure a certain degree of adaptability across disciplines within the wider context of the project (Focus group 2, pos. 139).

A considerably larger proportion of references in data dealt with making use of a diversity of perspectives in a **cross-disciplinary** sense. Here, project participants underlined that collaboration with representatives of other disciplines changed and broadened their perspectives, allowing them to identify blind spots in their own research and to continue their research with

new input. This entailed drawing upon the expertise of other disciplines and, in particular, also borrowing concepts and methods from other disciplines. Exposure to a diversity in approaches and experiences of other disciplines thus led to a broadened scope or rethinking of project participants' work here. References to cross-disciplinarity were often found in statements regarding collaboration on specific topics or methods in the context of working groups, suggesting that it might have been facilitated by certain disciplinary or epistemological similarities. This assumption is supported by an interviewee stating that they tend to be inspired by practices of people "who work on my topic or on similar topics" (Interview 6, PhD_soc, pos. 240).

Even slightly more references refer to understanding and adapting methodologies from other disciplines and exchanging ideas across disciplinary boundaries in order to address a common goal, and can thus be attributed to **interdisciplinarity**. In this context, project participants reported symbiotic relationships, of the integration of methods and approaches, of identifying synergies and common research topics, of co-constructing research problems, as well as of developing a meta-level perspective on a common problem – inclusive and inclusion-oriented higher education – and attempting to develop a common language in order to solve this.

At last, there was evidence of the creation of new formats and practices, pushing boundaries of conventional, disciplinary methods and approaches and thus pointing to **transdisciplinary** moments in the collaboration of project participants. Transdisciplinarity was only detected in nine places, among which the first focus group discussion as well as a handful of interviews, mainly from the social sciences and humanities and including one representative from the natural sciences.

While references to cross-disciplinarity were strong in discussions regarding collaboration within working groups (often referring to borrowing methods and concepts from other disciplines), transdisciplinary moments were described within the context of the early and mid-career researchers' group,

teaching collaborations, as well as general project dynamics that could not be attributed to specific structures. Statements referring to pluri- as well as to interdisciplinarity cover a wide range of interdisciplinary structures and formats and – despite assumptions by respondents that some disciplines might be more open to discussing and contesting their objects and methods of teaching and research (Interview 21, PhD_hum) – cannot be attributed to representatives of specific disciplines or status groups. It is noteworthy that there is a strong occurrence of the code interdisciplinarity in documents, such as the project proposal (Document 1) and project reports (Documents 2; 5), pointing to a high strategic relevance of the term. This corresponds with individual critical voices regarding the impact of exchange across disciplinary boundaries, window-dressing and "faking interdisciplinarity" in order to obtain funding for PhD students (observation 4_project conference, pos. 21).

Regardless of attributions to certain types of collaboration across disciplinary boundaries, data from both focus group discussions and interviews heavily underline the importance of learning from as well as about each other as a prerequisite for successful collaboration across disciplinary boundaries. This does not only include learning about methods, theories, and practices of other disciplines, but also learning about their cultures, norms, and specific language. Data shows that project participants perceived awareness of such differences, as well as negotiation and the development of understanding between disciplines as a prerequisite for successfully bridging gaps between disciplines.

The findings show that the perceptions and characterizations of collaborations as well as engagement in interdisciplinary structures has varied significantly among project participants. While some participants described the project in general as well as collaboration within project structures as inherently interdisciplinary, others stated that interdisciplinarity "played a rather minor role" for them as they largely continued to work and stayed "among ourselves" (Interview 10, pos. 59). Such differences might, among other, be

based on project participants' motivation for engagement in interdisciplinary structures, which will be discussed in more detail in the following section. Analysis has further revealed that a distinction between interdisciplinarity in teaching or research was hard to make. Due to the projects' focus on higher as well as school education, teaching and research remained strongly intertwined and many research projects were related to or their findings were later used for teaching, which is illustrated by the following quote:

> "The fact that many people also research their own teaching or that they process their own research results in their teaching means that it's all / well/ a bit interlinked." (Interview 22, PhD_hum, pos. 48)

To conclude, there was a wide range of types of collaboration (pluri-, cross-, inter- as well as transdisciplinarity) in case study project structures. While overall, inter- and cross-disciplinary interactions were most prevalent, it was not possible to tie collaboration types to certain structures, nor to individual actors. Actors reported of highly different (perceptions of) collaboration even within the context of the same structures. At the same time, actors may have had collaborations that can be classified as relatively low in terms of integration of knowledge (e.g. pluri-disciplinary) in one context, while doing true interdisciplinarity, or – in very few cases – even transdisciplinarity, in other contexts.

8.3 Motivation to engage in interdisciplinarity

Analysis has led to the identification of different categories of motivation for project participants to engage in and contribute to the emergence of interdisciplinary structures. Although respondents often invoked multiple and overlapping motivations, these can be categorised as follows: a) access to resources, b) legitimisation vis-à-vis different internal and external actors, c) scientific quality, d) responding to student needs, e) advocating for inclusive and inclusion-oriented higher education, and f) intrinsic motivation.

8.3.1 Access to resources

The theme of access to resources, in particular funding for human resources, was invoked in several interviews as well as a focus group discussion. While professorial positions within the German higher education system are covered via basic funding and do not rely on third-party funding, the case study project provided additional funding for the hiring of PhD students and post-docs as well as for student assistants. Perceptions of the role of resources for motivation to engage in the case study project and its interdisciplinary structures varied. Some interviewees attached strong meaning to resources, describing the project as a "motor to generate money" (Interview 8, prof_soc, pos. 221-225) in the first place and above all. Other interviewees provide more nuanced perspectives, explaining that this particular funding allowed them to hire new academic staff that could take on project tasks they would otherwise not have any capacities for:

> "The PROJECT is good for financing my employee and for doing precisely this kind of development work." (Interview 17, prof_eng, pos. 30)

Overall, there seems to be agreement across status groups that access to resources, in particular funding for academic staff, provides an important incentive to participate in interdisciplinary projects:

> "From an economic perspective, this is what is needed at the beginning – a goal. So it needs an incentive to explain why you're doing it – well, now the incentive is that there is money for a certain period of time and I can hire new people, so we're doing it now because there's money for it." (Focus group 2, pos. 178)

However, this motivation had more impact on participation in the project in general, whereas actual contribution to the emergence of and engagement within interdisciplinary structures probably remained limited. As discussed in the description of actors above (Chapter 8.1), engagement of project participants in these structures varied despite professors being granted similar access to resources within the project.

8.3.2 Legitimisation of interdisciplinary activities

Data further suggests that legitimisation vis-à-vis different internal and external actors constitutes an important motivation for actors to participate in interdisciplinary structures. This includes legitimisation towards funding agencies, legitimisation and recognition within the own institution, as well as disciplinary legitimisation.

Legitimisation vis-à-vis funding agencies

Legitimisation towards the funding agency of the project was referenced multiple times in data and across status groups. Interdisciplinary collaboration was part of the project proposal (Document 1), and project participants seemed to be aware that they had to fulfil certain expectations in order to increase chances for further funding:

> "Everyone, of course, has in the back of their minds / well (.) the [funding agency] naturally also wants to see something, and whether further funding is approved or not also depends on that. So, of course, you're not under pressure, but you know that an interim or final report is pending and that you have to explain what you've done. And you have to present it particularly well and beautifully and it also has to be somehow well-founded in order to somehow get more money." (Interview 14, prof_soc, pos. 95)

There are accounts in data proposing that legitimisation pressures towards funders in highly-competitive funding programmes can lead to certain degrees of window dressing. The following quote suggests that fulfilling funder expectations was the utmost aim of all project activities:

> "The more strongly you are embedded in such a competitive format, the more the project has to succeed [...] And everything that is done serves to prove that the funding agency's money has not been wasted." (Interview 8, prof_soc, pos. 221-225)

However, data also suggests that interdisciplinarity in the case study project thrived without pressures to perform in order to gain legitimisation via-à-vis the funding agency. During an interview conducted in the second project

phase, after which there were no more possible prolongations, an interviewee stated that they felt they "*no longer* [had] *to jump through the burning hoop (...) to get funded again*", but that this actually resulted in "*freedom and a certain degree of independence*" in pursuing their interdisciplinary collaborations within a working group (Interview 18, post-doc_hum, pos. 73-74).

Legitimisation and recognition within the institution

Secondly, motivation to engage in interdisciplinary structures was related to seeking legitimisation and recognition within the institutional community, particularly, but not restricted to, vis-à-vis other project participants. As interdisciplinarity was declared as an official strategic aim of the project, participants perceived strong expectations by project leaders and other project participants to engage in interdisciplinary structures. In some cases, respondents reported perceptions of a "pressure to participate" (Interview 2, PhD_soc, pos. 118) in interdisciplinary structures, particularly the working groups and the EMCR group. Such perceptions of pressure to participate were more strongly pronounced for EMCRs, but not limited to them. On professorial level, participation of professors in project structures also resulted in legitimisation pressures and an increase in participation of other professors. Respondents further reported expectations to participate in project publications – many of them were written by interdisciplinary teams – in order to uphold their legitimacy as project participants.

Disciplinary legitimisation

Finally, analysis also revealed an account of disciplinary legitimisation as a source of motivation to engage in interdisciplinary collaborations with specific disciplines. A professor reported of the early beginnings of a collaboration, which would later be merged with one of the thematic working groups, with the following words:

> "(…) then we somehow met and said that it would actually be worthwhile to look into this and thought that we needed a third discipline/ Which discipline should we

> add`? And somehow, I think we were looking for a link, because [disciplines] are secondary subjects at school and are always under a bit of pressure to legitimise themselves." (Interview 14, prof_soc, pos. 36)

This shows that project participants have purposefully entered collaborations with disciplines with higher reputation – either within scientific, or, in this case, also the school-context – in order to legitimise their work beyond disciplinary boundaries.

8.3.3 Scientific quality

The third motivation for collaboration within interdisciplinary project structures concerns scientific quality. Data shows that project participants regarded interdisciplinary collaborations as beneficial in better understanding phenomena related to the projects' topic, in being able to use, adapt or integrate methods and tools from other disciplines, and not having to start from scratch with research on inclusion and heterogeneity but being able to draw on the expertise of other disciplines more experienced in this area:

> "Uh (.) then, of course, you also totally benefit from / from experiences and / and somehow, um, yes, research or methodological results that other people have already produced." (Interview 22, PhD_hum, pos. 74)

Accounts of this motivation in interviews vary a bit regarding their scope: While some interviewees underlined the importance of learning and borrowing from other disciplines for progress with their individual research projects, other respondents emphasised the importance of interdisciplinarity in reaching broader project aims and goals.

Data also suggests that participants perceive interdisciplinary collaboration as beneficial for the quality of their work. For example, an interviewee described collaboration within a working group as an "internal quality circle" (Interview 15, prof_nat, pos. 57). While research and teaching were strongly intertwined in the case study project anyway, some respondents also specifically highlighted the benefits of interdisciplinary collaboration for the quality of

their teaching. With regard to a teaching collaboration, a PhD student from the social sciences explained:

> "So now, too, after this collaboration has ended, I naturally have this / erm, this knowledge and erm, the idea of how it is regarded from a [different discipline's] perspective and my students benefit from that enormously" (Interview 24, PhD_soc, pos. 26)

Overall, data shows that scientific quality, in particular reaching better and faster outcomes through collaboration within interdisciplinary project structures, constituted a motivation for participants to engage in interdisciplinary structures within the case study project.

8.3.4 Responding to student needs

Responding to the needs of students in teacher education was a central aim both of the funding line as well as of the case study project. As such, it was manifested in various documents (including the project proposal, criteria for a teaching award, protocols; e.g. Documents 1, 6). The link between responding to student needs and interdisciplinarity is supported by numerous references in interviews and focus group discussions. Student needs were particularly strongly articulated in the motivation for interdisciplinary teaching collaborations. Interdisciplinary team teaching was referred to as a "best practice example" (Focus group 1, pos. 67) for students in teacher training programmes, since these students will have to collaborate with colleagues teaching different subjects in schools later on in their professional lives. During a focus group discussion, a participant from the social sciences explained with regard to her interdisciplinary teaching collaboration:

> "We both saw a bit of a need in our student groups that they should ultimately /that we should train them to collaborate, but ultimately you can't learn that without actually practising it somehow" (Focus group 1, pos. 71-72)

Yet, the motive of responding to student needs was not limited to interdisciplinary teaching, but invoked for other kinds of interdisciplinary

collaborations as well, in particular the working groups. A focus group participant from the natural sciences explained that their involvement in the project and engagement in interdisciplinary project structures emerged as a response to "inquiries from students" who did not feel accurately prepared in the area of inclusion and heterogeneity for their practice-based training at schools (Focus group 1, pos. 67). The importance of student needs for the establishment of interdisciplinary structures – both related to teaching and research – is further underlined by the following quote from another focus group discussion among EMCRs:

> "So, on the one hand, the interdisciplinary structures that we are trying to establish aim at providing students with inclusion-oriented higher education but also, on the other hand, teaching them about inclusion and about the possibilities of inclusion-oriented teaching that they can use later, that they can pass on to the children or young people or adults they then teach later." (Focus group 2, Pos. 108)

8.3.5 Advocating for inclusion-oriented and inclusive higher education

Partly related to the quality of teaching, the fifth category of motivation of project participants to engage in interdisciplinary collaboration within the case study project is that of advocating for inclusion-oriented and inclusive higher education. Data shows that both the emergence as well as the engagement in interdisciplinary project structures were heavily tied to individuals being passionate about the case study projects' topic:

> "I think you have to be passionate about such a topic somehow. Right? Well (.) I personally think inclusion is very important. And I also think it makes sense to prepare for it properly at university. And (.) it's something that I think is still being done far too little." (Interview 16, PhD_nat, pos. 64-67)

Project participants with this motivation were deeply invested in research heterogeneity and inclusion, seeing a need for structural change and in particular for interdisciplinary collaboration in order to be able to implement

inclusive and inclusion-oriented higher education on a broader scale, beyond their own teaching. According to one of the interviewees, people driving the emergence of interdisciplinary structures were those not only interested in reaching outcomes for inclusion-oriented teaching, thus aiming at improving school education, but persons who had realised that the project was relevant "not only for school, but also for the university" (Interview 16, PhD_nat, pos. 221).

8.3.1 Intrinsic motivation for interdisciplinary collaboration

While boundaries to the categories of quality and advocating for inclusion-oriented and inclusive higher education are somewhat blurred, the final category emerging from analysis is intrinsic motivation. Respondents have stated that the development of interdisciplinary structures within the case study project as well as successful interdisciplinary collaboration in general depend on the willingness to invest time beyond official workload and make efforts beyond immediately visible benefits for their own research and careers:

> "And, um, (..) I also think that doing things beyond the point of added value for oneself is very important. For this type of collaboration in general, I think." (Interview 16, PhD_nat, Pos. 445-447)

Many respondents discussed the relevance of intrinsic motivation within the context of other structural conditions and motivators:

> "So institutional structures, encouragement, (.) I think so, but what is harder to bring about: Personal motivation. Interest. So that I intrinsically think: This is important. (laughs) And not just because the project wants that." (Interview 21, PhD_hum, pos. 309)

However, there were a handful of respondents –also considered as particularly active actors by their peers – who were displaying strong references to intrinsic motivation during interviews. These respondents describe interdisciplinarity – including its positive as well as negative

connotations – as an essential part of their (scientific) being, as illustrated by the following quote:

> "And for my work, I need this exchange. I don't understand how you can do science at all otherwise. In this respect, these connections are absolutely vital, because they enrich me, irritate me and bring me to new things. So I need that. I also need this, this state of feeling uncomfortable (...)" (Interview 11, prof_hum, pos. 214)

8.4 Towards a typology of interdisciplinary actors

As presented in the preceding sections of this chapter, strong differences were observed among actors in the degree of participation, as well as (motivation for the) engagement for and within interdisciplinary structures. As put by an interviewee, there were "those, who fully devoted themselves to the project and participated everywhere, and others who just aren't involved at all" (Interview 9, post-doc_hum, pos. 126). Based on the analysis, I was able to distinguish five different types of interdisciplinary actors: Non-participants, actors continuing previous collaborations and research lines, actors sticking to disciplinary scripts, actors in search of orientation, and actors strategically contributing to the development and engaging in interdisciplinary structures.

1. Non-participation/involvement: Actors who are formally members of the case study project but participate in it to very little extent. These actors are usually professors, stating that they do not have time to participate in interdisciplinary structures, have enough work to do already, and – upon being asked questions with regard to interdisciplinary collaboration in the project, invoke the role of their academic staff that is paid from project funds: 'I do not know, you would have to ask my PhD student / my post-doc'. These actors do not contribute to the emergence, nor the further development of interdisciplinary structures.
2. 'I continue what I have done before': Routine actors continuing previous collaborations and research within the context of the case study projects. These actors are usually professors. They participate in interdisciplinary

structures, usually a working group tied to their past practices and previous research interest, and might even have shaped the emergence of a working group based on their previous work. Collaboration within interdisciplinary structures does, however, impact their convictions and practices to only little or no degree.

3. Discipline-based actors participating in interdisciplinary structures, while largely sticking to disciplinary scripts. These actors are looking for people working with the same methods or concepts so they can receive feedback on their individual research projects. While they may be open to learn about the perspectives of others and learn how to better understand them, this tends to reinforce their own disciplinary perspectives rather than challenging them. These actors mostly engage in what has been characterised as pluri-disciplinary collaboration above. While participating in interdisciplinary structures, they do not tie any strategic ambitions to them.
4. Sense-making actors participating in interdisciplinary structures, resulting in a search for orientation for them. These actors try to make sense of the disciplinary diversity they are presented with, which becomes visible in their search for synergies between disciplines and their advocacy for concrete definitions within the project. These actors engage in collaborations with other disciplines for project-related ends, but do not strategically contribute to the emergence and further development of interdisciplinary structures.
5. Strategic actors, whereas I distinguish between 'the pure interdisciplinarian' and the 'pragmatic interdisciplinarian'. Both of these actors are highly active in engaging in and shaping interdisciplinary structures. They have a high intrinsic motivation and purposefully and strategically pursue interdisciplinarity, yet for different reasons. The 'pure interdisciplinarian' has a natural predisposition towards interdisciplinarity and presents themselves as a highly reflexive being that wants and needs to be challenged – in a positive sense – through

encounters with representatives of other disciplines. The 'pragmatic interdisciplinarian' recognises the importance of interdisciplinary structures for achieving the aim of inclusion-oriented teaching and strategically embedding it within the broader university across disciplinary and faculty boundaries. The first thus strategically pursues interdisciplinarity as an end in itself, whereas the latter strategically pursues interdisciplinarity to further inclusive and inclusion-oriented higher education.

8.5 A social network perspective on agency

In order to corroborate findings regarding the role of actors for interdisciplinarity, specifically to identify possible brokers, I turn to results of the social network analysis. *Eigenvector Centrality* was used to measure the social power of actors, whereas *Betweenness Centrality* – a measure often mentioned in the context of interdisciplinarity – was used to measure how actors connect (disciplinary) communities (Larrosa, 2019; Leydesdorff, 2007).

Eigenvector Centrality measures an author's influence based on the influence of their co-authors in a co-publication network. Within the scope of this study, it was used to identify authors who act as integrators of interdisciplinary knowledge. Eigenvector centrality values range between 0 and 1 and authors within the studied network displayed values between 0.0038 and 1. I interpreted the top ten percent of values, thus values between 0.9 and 1, as high. Five actors displayed values falling within this range, suggesting that they collaborate with many central authors across discipline, facilitate knowledge flows between disciplines, and are part of the core intellectual structure of the case study project. Three of these actors, all early- and mid-career researchers (EMCRs), were also identified as actors strategically contributing to the emergence of interdisciplinary structures based on interview data.

Betweenness Centrality was used to determine brokers, coordinators, or boundary spanners. Actors with a high betweenness centrality value act as structural bridges, connect multiple communities, and thus play central roles in interdisciplinary collaboration. Betweenness Centrality depends on the size, density, and structure of a network. Values can thus only be interpreted by relative comparisons, not absolute numbers. Actors displaying the top one percent of values are usually interpreted as top brokers. I further interpreted actors displaying at least twice of the mean Betweenness Centrality value as high-importance brokers. This resulted in the identification of one top- and four high-importance brokers. The top broker was a post-doc from the humanities, who was referred to as a strategic actor in multiple interviews and displayed traits of a pure interdisciplinarian. The high-importance brokers include the two project leaders from the natural sciences and humanities respectively, as well as two PhD students from the social sciences. The former fall into the category of strategic actors, while one of the latter was categorised as a sense-making actor based on data. No qualitative accounts were available to assess the role of the fourth broker.

Findings from this social network analysis thus partly confirm the qualitative findings of this study, in particular regarding the importance of strategic actors for interdisciplinarity. Yet, at least one project participant referred to as a strategic actor, specifically a pragmatic interdisciplinarian, in interview data displayed a betweenness centrality value of zero, thus suggesting they played no bridging role at all in the project. This may have been caused by the limited time-frame (only data from the first three years of the project were included in analysis) in conjunction with time-lags (Björk & Solomon, 2013) between writing and the actual publishing of articles, chapters and books (chapters). The results of this social network analysis therefore have to be treated with caution.

8.6 Chapter summary

This chapter has focused on the different categories of actors involved in the case study project as well as on their engagement in and contribution to the emergence of interdisciplinary project structures and their motivation to do so. It has identified and analysed the role of different groups of actors, specifically of project leadership and administration, of professors, and of early- and mid-career researchers (EMCRs). It has been observed in data that the design of the case study project positively impacted the agency of EMCRs. Due to the rather large size of the group and due to existence of interdisciplinary structures, early- and mid-career researchers in the project had a highly organised network and, according to their own accounts, felt more informed and powerful than their peers working in traditional, discipline-bound positions.

Overall, data does not point to links between agency for interdisciplinarity and project participants' status group. It cannot be denied that certain actors within the project had more power to influence the work of others (e.g. professors, who acted as superiors of PhD students and post-docs) and that project leadership held a central role in protecting and legitimising interdisciplinarity. Yet, we have found that the emergence of interdisciplinary structures in general and successful collaboration within them in particular was influenced by highly dedicated actors from different status groups.

The case study project brought together a large number of scientific disciplines and can thus be considered as a multidisciplinary setting per se. However, collaboration within project structures has often exceeded multidisciplinarity, with data pointing to the existence of cross- and interdisciplinary collaboration as the most prevalent form, of pluri-disciplinary collaborations characterised by a lower degree of disciplinary integration in certain instants, as well as of transdisciplinary collaboration in a few situations – most of which were tied to work within the living-lab type thematic working group.

Analysis shows that it is not possible to clearly define the degree of interdisciplinarity within structures. Instead, data points to the existence of 'multiple interdisciplinarities', where experiences of individual project participants regarding their collaboration practices may vary even within the very same structure. I was not able to establish patterns with regard to the type and scope of interdisciplinary collaboration and project participants' disciplinary background, and data neither points to systematic differences between representatives of *Fachdidaktik* versus *Fachwissenschaft*. However, a small number of respondents – all from the social sciences but from different status groups – underlined that their perceptions of interdisciplinary collaboration practices within the project was were strongly tied to leaving their comfort zones and questioning their positions as researchers as well as their (disciplinary) methods and approaches.

Collaboration within interdisciplinary structures was often attributed negative characteristics – such as irritating, frustrating, time-consuming, overwhelming, scary, threatening, excluding or invasive – and positive characteristics – such as fruitful, beneficial, stimulating, inspiring, or enriching – at the same time, which has led us to an exploration of actors' motivations to engage in interdisciplinary collaboration.

Data shows that these motivations are constituted by:

1. *Access to resources*, as participation within the case study project funded PhD, post-doc, and student assistant positions for professorships;
2. *Legitimisation*, in particular within the institutional community and vis-à-vis other project participants;
3. *Scientific quality*, related to the belief that exchange across disciplinary boundaries can contribute to individual research progress and help to address the societal problem of inclusion in (higher) education institutions;
4. *Responding to students' needs*, who – as future school teachers – need to be equipped with interdisciplinary collaboration skills;

5. *Advocating for the goal of inclusion-oriented and inclusive teacher training*, whereas interdisciplinarity is seen as a tool to create scientific knowledge as well as the structural foundation to reach this goal within the traditionally disciplinary dispersed teacher training structures at German universities; as well as, lastly,
6. *Intrinsic motives,* including personal motivation and interest as well as a general predisposition towards interdisciplinary work.

The analysis of actors, their perceptions of and engagement in interdisciplinary collaboration, and their motivation has resulted in a typology of five ideal types of interdisciplinary actors (see Table 6).

The *non-involved actor* does not participate or only to some degree and does not contribute to the emergence of interdisciplinary structures. Engagement is mono- or multidisciplinary and does not have consequences for individual academic practices. The *routine actor* participates and contributes to the emergence of interdisciplinary structures based on previous research interests and collaborations. Engagement ranges between pluri- and interdisciplinarity, but is strongly tied to already established practices.

The *discipline-based actor* participates in interdisciplinary structures for specific purposes, such as progressing individual research projects, and contributes little to their emergence. Engagement is usually of pluridisciplinary nature and results in a reinforcement of disciplinary perspectives. The *sense-making actor* participates in interdisciplinary structures beyond seeking benefits for their individual research project. They contribute to the further development of structures by filling them with life. Their denomination is derived from their continuous engagement in sense-making activities, including their search for disciplinary synergies and pursuit of common definitions within the project, for which they cross disciplinary boundaries.

Type of actor	Participation in and contribution to interdisciplinary structures	(Inter)disciplinary engagement and practices
Non-involved actor	No to little participation in interdisciplinary structures. No contribution to emergence of interdisciplinary structures.	Mono- or multidisciplinary engagement without consequences for individual academic practices
Routine actor	Participation in interdisciplinary structures is based on previous research interests and collaboration. Thematic shaping of interdisciplinary structures based on own research interests.	Pluri- to interdisciplinary engagement strongly tied to previous academic practices
Discipline-based actor	Participation in interdisciplinary structures for specific purposes, such as feedback on individual research projects. Little contribution to emergence of interdisciplinary structures.	Multi- to pluridisciplinary engagement resulting in reinforcement of disciplinary perspectives
Sense-making actor	Participation in interdisciplinary structures beyond seeking benefits for individual research projects. Contribution to further development of interdisciplinary structures by filling them with life; engagement in sense-making activities through search for disciplinary synergies and common definitions.	Cross- to interdisciplinary engagement resulting in the broadening or integration of disciplinary perspectives
Strategic actor *(I) The pure interdisciplinarian* *(II) The pragmatic interdisciplinarian*	Strategic contribution to emergence and development of interdisciplinary structures, based on high degrees of intrinsic motivation grounded in … … a natural predisposition towards interdisciplinarity. … the perceived importance of interdisciplinary collaboration for pursuing a goal, i.e. establishing inclusion-oriented and inclusive teacher education.	Inter- and transdisciplinary engagement, resulting in partial integration and transformation of disciplinary knowledge and practices

Table 6: Typology of interdisciplinary actors

The *strategic actor* strategically contributes to the emergence and development of interdisciplinary structures. Strategic actors display a high degree of intrinsic motivation, grounded in either a natural predisposition towards interdisciplinarity (*the pure interdisciplinarian*) or the perceived importance of interdisciplinary collaboration for addressing the societal

challenge of inclusion in (higher) education settings (*the pragmatic interdisciplinarian*).

Qualitative findings regarding the importance of strategic actors for the emergence of interdisciplinary structures are largely supported by results of a social network analysis of co-publications of project participants. Most of the actors identified as highly influential brokers between communities within the network or as holding high degrees of social power were also described as strategic contributors to the emergence and further development of interdisciplinary structures in interview and focus group data.

9. Factors Inhibiting and Promoting the Emergence of the Interdisciplinary Structures in Academic Project Settings

After having introduced the interdisciplinary structures that emerged within the case study project and having discussed the involvement and motivation of actors to engage in the emergence and participate in these structures, I will now turn to the third research question of this dissertation: Which factors inhibit or promote the emergence of interdisciplinary structures?

As outlined in Chapter 3 of this dissertation, literature highlighting potential barriers and challenges to interdisciplinarity is vast, while there is a lack of understanding of which factors contribute to the successful emergence of interdisciplinarity. Both of these aspects – factors inhibiting and promoting the emergence of interdisciplinarity – while be addressed in this chapter. The first section of this chapter focusses on barriers and challenges to interdisciplinarity. In the second section, I will turn to factors that have supported and promoted the emergence of interdisciplinary structures in the case study project. The chapter concludes with an interim discussion on factors inhibiting and promoting the emergence of interdisciplinary structures in academic project settings.

9.1 Barriers and challenges to interdisciplinarity

In the following, findings on factors inhibiting the emergence as well as the sustainability of interdisciplinary structures in the case study project will be discussed. This section is structured according to the following categories derived from data during analysis: 1) workload, time and resources, 2) different dimensions of conflict, including personal and disciplinary conflict, 3) language and understanding, 4) pre-existing organisational structures, 5) dynamics of leadership and autonomy, as well as 6) career structures.

9.1.1 Workload, time, and resources

Data shows that workload, time, and the availability of resources are crucial factors for the emergence of interdisciplinary structures or the inhibition of

these. This concerns both working groups and teaching collaboration and data even suggests that it holds true for all kinds of interdisciplinary collaborations. Respondents especially underlined a high organisational workload attached to the organisation of interdisciplinary teaching collaborations, stating that interdisciplinary teaching means more work than following disciplinary scripts and pre-existing organisational structures.

Especially among early- and mid-career researchers (EMCRs), interdisciplinary exchange was framed as work-intensive. Respondents reported that although enjoying working together across disciplinary boundaries in the various project structures, they often struggled with finding a balance between having enough time for meaningful exchange within them on the one hand, and not scheduling too many meetings in order to be able to complete other tasks on the other. This is illustrated by the following quote from a focus group discussion among EMCRs:

> "(...) when you develop structures like this, it's always difficult to find a balance between, well, it's important to work together in the different formats, to exchange ideas and so on, and on the other hand, of course, to have enough time to continue working on the individual projects. I always find that really difficult when you look at the next few weeks and see, well, you've already got something coming up in the next three weeks, I've got ten meetings with other early- and mid-career researchers, and then you somehow have to teach as well, and at some point it's so busy and you have the idea afterwards that you somehow haven't worked on your own project at all" (Focus group 1, pos. 209-210)

Further, PhD students reported difficulties in balancing interdisciplinary exchange within the project and having to work on their individual projects, i.e. their PhD dissertations, at the same time:

> "And that's where you notice it, so I think these phases of doing your PhD/ so (.) with me now you can already see the differences over the three years, right? At the beginning I had more of these ideas and innovations and

> did even more and here and there and again looked there and went to conference, did some network here again and got to know more people. And in the last year, as you know yourself, you realise: Okay, I really have to work on THIS project [annotation: PhD] every day now." (Interview 21, PhD_hum, line 227)

This quote underlines a phenomenon reported upon by various interviewees and observed by the researcher towards the end of the first project phase. As contracts were about to expire, PhD students were forced to complete and started prioritising their individual research projects and writing over collaboration within interdisciplinary structures and interdisciplinary teaching collaborations – because, as an interviewee from the social sciences phrased:

> "(…) nobody will care if I don't hand in my PhD thesis, but have done great seminars instead (…) which means that I am jeopardizing my own qualification process by this/ by investing in/ in these things" (Interview 24, PhD_soc, line 186-188)

9.1.2 (Disciplinary) differences and conflicts

As noted by an interviewee from the humanities, "it would be naive to believe that one could collaborate across all boundaries and work together productively" (Interview 3, prof_hum, line 126). In the following, I will thus focus on different dimensions of conflict with regard to the emergence and sustainability of interdisciplinary structures in the case study project. Data shows that interdisciplinary collaborations within the case study project were inhibited by conflicts on different levels, including personal conflicts, disciplinary conflicts, as well as conflicts related to considerations of disciplinary and interdisciplinary socialisation and career development. These dimensions will be explored in more depth in the following sections of this chapter.

Disciplinary conflicts and the Fachwissenschaft – Fachdidaktik divide

Analysis has revealed that collaborations within interdisciplinary structures in the case study project were sometimes fraught with conflicts stemming from different disciplinary cultures and traditions as well as power and hierarchy between disciplines. While these conflicts did not inhibit the emergence of the interdisciplinary structures presented in Chapter 7, they affected dynamics and possibly the sustainability of collaboration within these structures.

Data suggests that differences with regard to epistemic assumptions and the social structures of disciplines have affected project dynamics in manifold ways. For one, differences in social structures of disciplines led to imbalances in the contributions and recognition of EMCRs. Such imbalances became visible in strategic discussions of project leadership and the steering group, e.g. when discussing whether funding should be available for PhD students to travel to conferences. They were, however, also perceived among EMCRs, which reported that hierarchies within disciplines influenced the degree of participation and contributions of PhD students and post-docs and thus collaborative dynamics within the case study project in general:

> "There are disciplines which are extremely hierarchical and where it is not usual that a PhD student or Post-Doc speaks. (…) In disciplines like [my own], it is usual that early stage doctoral students present their work at conferences after half a year (...). This is absolutely normal and there are very collegial discussions. And I think, or I know that with them, this is not the case. In their conference, only professors speak, for example." [Interviewer]: "And does this affect dynamics in the project?" [Respondent]: "Yes, absolutely." (Interview 20, postdoc_soc, pos. 190-206)

While the great number of project participants and their broad disciplinary representation was often referenced as a chance for achieving change towards inclusive and inclusion-oriented teaching within the case study university, it also posed a challenge for collaboration within interdisciplinary project

structures. This is illustrated by the following quote from a focus group discussion among EMCRs, during which the group members vividly agreed that different disciplinary perspectives and epistemic assumptions of participants sometimes made it hard to agree on the aims and foci of working group meetings:

> [Speaker 1] "(...) and these are of course completely different perspectives on the topic. And then you first have to see what you can actually talk about without half of them saying: I'm not interested in that at all." [Speaker 2:] "Yes, where is the common denominator?" [Speaker 3:] "Yes, that's exactly what we already experienced in the first project phase!" (Focus group 2, lines 48-50)

With regard to epistemic differences, an emphasis on empirical research, strong output-orientation, and focus on concrete measures to safeguard results in a way that they can be used in practice – often in teaching – was prevalent among respondents from the natural sciences in the case study project. In contrast, representatives from other disciplines, mainly the humanities, found this approach counterproductive and favoured more dialogue-oriented formats. The analysis suggests that such differences created misunderstandings and conflicts during collaborative efforts and led to a diversification of interdisciplinary structures within the case study project.

> "I think there are disciplinary cultures and ways of thinking. I think I mostly find [representatives of own discipline] (.) very structured in their approach, which is perhaps also due to the subject. (...) They have clear goals and time perspectives. (...) and there are disciplinary cultures that refuse to do this and/ and things then emerge, how to say/ is it bottom-up?" (Interview 12, PI_nat, line 96)

Interestingly, the strongest divergence in goals and expectations was not observed between different disciplines in the case study project, but rather between disciplines (*Fachwissenschaften*) on the one hand and subject didactics (*Fachdidaktiken*) on the other. Interview data across academic ranks suggests a divide between the groups, showing that representatives from the

disciplines perceived their colleagues from subject didactics as overly controlling, sometimes even proselytizing:

> "And there is actually, I think, this separation between didactics and disciplines, that it, uh / Didactics is all about 'the subject matter', it's always about products and results. And (...) the disciplines and, um, where it's actually more about the / about the exchange itself, about, uh, language cultures, yes, that's 'blah blah blah' in the eyes of the others, who think, uh: 'You can get over it now, right, and devote yourself to the results'." (Interview 19, admin, pos. 485-493)

Vice versa, representatives from the subject didactics sometimes showed frustration with a lack of tangible output from their disciplinary colleagues. Representatives from both sides mentioned this divide between disciplines and subject didactics multiple times in interviews, while trying to avoid using the term 'conflict':

> "I would emphasise that there are - I wouldn't call it conflicts, but perhaps, certain reservations - yes - apparently that's the case." (Interview 17, prof_eng, pos. 55)

Data shows that a lack of appreciation for disciplinary structures and perceived imbalances regarding disciplinary power and hierarchies played a crucial role in shaping interactions within the case study project and have further exacerbated these conflicts. Conflict seemed to stem from the epistemic differences discussed above and accounts from multiple interviews reveal a rhetoric of 'otherness' that questions the legitimacy and value of different disciplines and research traditions. The strongest accounts came from a PhD student from the humanities, who expressed frustration over receiving non-appreciative feedback in working group meetings that questioned the validity of their entire topic and dismissed it as nonsense, failing to consider their disciplinary background.

> "And then I sometimes get feedback that is then (.) hm, well, not appreciative, that questions my entire topic, that

> dismisses it as nonsense, um (4) (exhales) sometimes doesn't take my disciplinary tradition into account. Which I somehow understand, um - by now I understand that not everyone can or wants to do this, but then they are also - yes even derogatory." (Interview 23, PhD_hum, line 92)

Such conflicts can lead to demotivating experiences for project participants. An example includes last-minute changes to publications and presentations where contributions from the same humanities PhD student quoted above were removed by a representative from the hard sciences, leading to feelings of uselessness and demoralization. "I'm useless in this project, nobody needs me here" (Interview 23, PhD_hum, line 335).

Data suggests that resistance towards the adoption of new methods and interdisciplinary approaches was more common among project participants who were more established in their fields, i.e. professors and sometimes post-docs, and who feared a loss of control through interference of other disciplines. Strategies to deal with such a loss of control commonly resulted in either retreat, or in efforts to dominate or coerce interdisciplinary collaboration into conforming to traditional disciplinary norms and practices

Conflicts with regard to socialisation and career development

While overall regarded as enriching and stimulating by the majority of participants, collaboration within interdisciplinary project structures was also related to possible conflict with regard to the socialisation and career development of PhD students and post-docs. Respondents highlighted the potential for overstimulation due to exposure to various fields of discourse, stating that the overwhelming amount of information and discourses within meetings of interdisciplinary structures made it difficult for them to focus and decide which new knowledge to integrate in their research effectively:

> "I think that you get a lot of stimuli and experience a lot of fields of discourse and I think that sometimes it's on the verge of overtaxing what you actually have to integrate into your own research." (Focus group 1, pos. 225)

A professor from the social sciences further raised concerns regarding impediments for career advancement of EMCRs when being socialised in interdisciplinary settings. They pointed out the challenge of developing specific expertise within their primary discipline while constantly engaging with others from different fields in interdisciplinary project structures:

> "And um/ and how should you develop this specific expertise if you have no or relatively little knowledge of the original/ the original subject area or if you have relatively few roots there because you're always doing something with others, yes?" (Interview 8, prof_soc, pos. 73)

Data shows that contrary to expectations, interdisciplinarity was not framed as a significant career risk in the data. However, while interdisciplinarity is often seen as valuable, it does not always align with the career priorities of EMCRs and – as discussed above - the primary focus remains on the completion of individual dissertation projects. This is reflected in the finding that they ultimately prioritise their own dissertation work over interdisciplinary engagements, viewing the latter as beneficial but secondary to their primary (academic) goals.

Personal conflict

Finally, data shows that personal dynamics are significant in the success or failure of interdisciplinary efforts. Personal relationship and conflict among individuals from different disciplines – either pre-existing or formed through interactions within the project – hindered interdisciplinary collaboration. The dimension of personal conflict could not always be detached from other levels of interest, including disciplinary conflict. For example, utterances in interviews regarding personal dislike and gender hierarchies seemed to relate to their perceptions of disciplinary hierarchies.

9.1.3. Language and understanding

Further hindering factors emerging from analysis are disciplinary languages and a resulting lack of understanding in interdisciplinary settings. Respondents reported that different disciplines often used unique

terminology, and had specific expectations and communication style, which sometimes led to difficulties in mutual understanding. This seemed to be the case especially when disciplines were more distant. This is underlined by the following quote from a professor from the humanities about collaborations with representatives from the natural sciences:

> "It was such an exhausting process and we SO often didn't understand each other. I thought: 'Surely this can't be possible'. I received manuscripts and notes from them that I didn't understand, where I thought: 'What on earth are they talking about?'" (Interview 3, prof_hum, pos. 135)

Another respondent shared experiences about the need to soften terminologies in interdisciplinary work, contrasting it with the rigid use of terminology preferred in their own field:

> "That's an example of what I've learned - I have learned that in contrast to what I'm used to in [my discipline], for some disciplines it is important not to clearly define terms, but to leave them very soft, so that (.) a lot of connotations are possible (...). I was socialised in the way that I try to define the terms ABSOLUTELY clearly, so that they CANNOT be misunderstood, but have a basis with which one can continue to think and build on." (Interview 12, PI_nat, pos. 113)

This quote underlines the fact that differences in language were not necessarily regarded as negative. However, whereas disciplinary differences were not framed as problematic per se by respondents – descriptions in the previous chapter of this dissertation underline the productiveness associated to being confronted with new knowledge -, dealing with differences in disciplinary languages was referred to as time consuming and exhausting:

> "It's exhausting having to argue about certain principles again and again." (Interview 3, prof_hum, pos. 130)

Overall, data suggests that language differences and challenges related to understanding were more pronounced between more distant disciplines. It was further observed that challenges grew when higher numbers of project

participants from different disciplines were involved. For example, differences in language led to a lack of project-wide understanding regarding core principles of the case study project, including a common definition of inclusion:

> "But still, too few things have been clarified. So the fact that we don't have a concept of inclusion (...) surprised me. (...) And that's not the best advertisement, (laughing) for interdisciplinary cooperation, when you hear how umm tough this process was and how long and how emotionally charged and what happened somehow and, in the end, umm (.) the result is, there is no result." (Interview 23, PhD_hum, pos. 436-438)

9.1.4. Pre-existing organisational structures

This empirical investigation confirms assumptions about pre-existing, organisational structures constituting a barrier to interdisciplinarity. Data has revealed three ways in which pre-existing organisational structures have hindered the emergence of interdisciplinary structures in the case study project. These include the strongly discipline-based organisation of universities, faculty-specific administrative frameworks and examination rules, as well as competition for resources between faculties.

As it is common for universities, organisational structures in which the case study project was embedded are strongly discipline-based. Teacher training is vested in individual faculties in the German case, unlike in other countries where it may be centralised in schools of education. On the one hand, this is seen as a strength of teacher training, as students obtain high quality and in-depth disciplinary education in both of the subjects that they study. On the other, the fragmentation of teacher training across faculties is also seen as a challenge, in particular with regard to interdisciplinary collaboration. As a professor from the social sciences stated:

> "So I do indeed believe that a major problem in German teacher training is (...) what was once considered a great achievement, namely the vestedness of teacher training in

> the individual disciplines. There is no, so to say, overarching structure for teacher training." (Interview 3, prof_soc, pos. 194)

Overall, pre-existing, organisational structures mainly seemed to constitute a barrier to interdisciplinary teaching collaborations. During a focus group discussion, members of the EMCR group reported that in relation to interdisciplinary teaching collaborations, they "strongly experienced (…) a division into these faculties" (Focus group 1, pos. 182). Faculty-specific examination rules and requirements as well as administrative frameworks challenged the emergence of interdisciplinary teaching collaborations. Rules differed across faculties; sometimes, persons from one faculty were not allowed to examine the work of students from another faculty, and requirements, e.g. for the use of digital teaching platforms, differed. Respondents reported that in addition to experiencing these barriers, they also perceived a lack of lack of support in overcoming them:

> "But again, when it comes to teaching collaborations, I have the feeling that it is always said that it is welcomed, that it is even desired and that the project wants to be characterised by such formats. But actually organising this and, above all, overcoming certain barriers at your own faculty - that was more a matter of personal commitment on our part and there was no specific assistance. So there isn't a catalogue of support measures: I would now like to teach across faculties, who can tell me what steps are necessary? Because there are different examination results, different requirements for the teaching platform, and even organisational structural barriers. But they [annotation: teaching collaboration] are actually only indicated as desired, and the actual implementation is left up to oneself." (Focus group 1, pos. 128-130)

Yet, there have also been accounts of faculty-specific administrative frameworks challenging interdisciplinary collaboration in research. For example, the hiring of a student assistant to be paid from money allocated to two different faculties was described by an interviewee as an "indescribable administrative effort" (Interview 11, prof_hum, pos. 123).

Data further points to competition between faculties, especially regarding the distribution of resources, constituting a barrier to interdisciplinarity. This ranged from conflict regarding a distribution of teaching loads, to the number of students per faculty being offered seminar places, or the availability of – or willingness of faculties to provide - rooms large enough to host collaborative seminar sessions. These conflicts all resolved around the area of teaching. A respondent explained with regard to the distribution of teaching loads as a barrier to interdisciplinary teaching collaborations:

> "(…) ultimately, every faculty is concerned with its own funding and its own interests and they are all under pressure to fulfil their teaching load and offer courses to students, and to some extent this is probably also connected to the fact that obstacles are placed in the way of such collaborations." (Interview 9, postdoc_hum, pos. 171)

According to the respondents, resolving these issues required high amounts of "persuasion work" and the success of a teaching collaboration ultimately depended on support by individuals: "it's persuasion work that you have to do and sometimes you're lucky and you get someone who supports it, but sometimes you don't and then it's more difficult" (Focus group 1, pos. 182).

9.1.5. Dynamics of leadership and autonomy

While leadership is posited by literature as a potential mitigator of barriers to interdisciplinarity (e.g. Jacob, 2015; Kroll & Schubert, 2023; Sá, 2008 Yang Yang et al., 2021), certain dynamics of leadership were observed to inhibit the emergence and sustainability of interdisciplinary collaboration within the case study project. These dynamics included a lack of transparency and communication, lack of appreciation, and, finally, a lack of leverage of project leadership over the activities of project participants based on the high degrees of professorial autonomy prevalent in the German higher education system.

In interviews, PhD students and post-docs pointed out that especially at the beginning of the first project phase, they experienced uncertainty regarding

expectations by leaders and professors on the work and output of working groups, and especially the EMCR group. A lack of communication and transparency, resulting in 'covert expectations' was perceived by some PhD students and post-docs as demotivating for their work within the EMCR group. Data further suggests that unclear roles and expectations for participants, particularly those in associative or peripheral roles, can hinder engagement and sustained participation in interdisciplinary project structures.

On both professorial and early- and mid-career level, there was a perceived lack of transparency and resulting insecurity regarding the prolongation of contracts for PhD, post-doc, and student assistant positions. This insecurity led to frustrations and, in a few cases, the retreat from participation in interdisciplinary structures. Finally, an interviewee from the humanities raised concerns that especially for new project members joining the project within the course of the first project phase, there was a lack of transparency regarding affiliation processes to working groups or other interdisciplinary endeavours.

This corresponds with findings retrieved from documents. A protocol of an EMCR group meeting states that due to "uncertainty" regarding the working groups, there was a wish for "more transparency regarding a) the existence of working groups and b) the selection/ invitation procedures" (Protocol 42, p.1). The respondent suggested more transparency and streamlined entry points into such activities for future projects aiming at fostering interdisciplinary exchange among its members. Overall, the nature of communication and (in)transparency within the case study project seem to have led to complicated dynamics of inclusion, forced participation, and exclusion from engagement in interdisciplinary structures within the project:

> "So/ how are you supposed to figure this out? It's not transparent at all. So (...) I don't know if we HAVE to figure it out at all, but it's kind of strange that it's (..) perhaps deliberately not disclosed transparently." (Interview 23, PhD_hum, pos. 210)

Data points to instances of a lack of appreciation of interdisciplinarity on all levels – the leadership level, the professorial level, as well as level of EMCRs. Some project participants seemed to not value interdisciplinarity in general, some did not value specific efforts of interdisciplinary collaboration, whereas others did not value and acknowledge different disciplines' traditions (as already outlined in the section on disciplinary differences and conflict above). It seems that lack of appreciation by professors, in particular those supervising PhD students and post-docs within the context of the case study project, had particularly detrimental effects on participation in interdisciplinary structures. As a PhD student from the humanities reported:

> "Or if a professor has a certain attitude towards the early- and mid-career researchers' group and then communicates this in a way that says: 'Yes, you can go there. (.) But it has no added value. You don't have to.' and so on. Um, I think if that had been the case with me from the start, I probably wouldn't have gone." (Interview 23, PhD_hum, line 283)

Leadership for interdisciplinarity was further limited by (professorial) autonomy as well as bottom-up efforts to assert independence. The reach of leadership authority was particularly challenged at the professorial level. Across academic ranks, interviewees and focus group participants agreed that project leaders could articulate expectations regarding the emergence of interdisciplinary structures, but that, ultimately, the real power – especially concerning the question to what extent EMCRs would engage in interdisciplinary structures – rested with professors. This eventually led to interviewees interpreting the obligation to attend EMCR group meetings as well as working group meetings as non-binding, as underlined by the following quote: "But this kind of (.) obligation is just a friendly request" (Interview 13, postdoc_soc, pos. 112). Interviewees further highlighted the constitutional right to freedom of teaching and research in Germany, emphasizing that the development of interdisciplinarity relied primarily on

the motivation of individual academics, rather than on decisions imposed from above.

9.1.6. Career structures

Finally, the analysis shows that career structures within the German higher education system can constitute a barrier to lasting change towards interdisciplinarity. EMCRs in the German higher education system usually have temporary contracts with little job security. Sectoral mobility (employment outside of highr education) and mobility to other higher education institutions are common after the completion of the doctoral as well as postdoc phase (Hüther & Krücken, 2018).

In various interviews as well as during the second focus group discussion, study participants reported that over the project life-time and especially in-between the two project phases, key actors have been dropping out due to the above-mentioned career structures. In the case of interdisciplinary teaching, this usually led to the end of collaboration. In the case of the thematic working group and the EMCR group, a "void" (Interview 18, postdoc_hum, pos. 240) and "lack of flow" (Interview 20, postdoc_soc, pos. 110) were reported by project participants when strategic and sense-making actors left the project due to their contracts ending after the first project phase.

The high turnover of personnel, which is common in academic settings where many positions are temporary, thus poses a significant barrier to the continuity and stability of interdisciplinary structures.

9.2 Facilitators for the emergence of interdisciplinary structures

The following section deals with facilitators for the emergence of interdisciplinary structures. Analysis reveals that in the case study project, there were facilitators on different levels. At first, a number of individual and disciplinary factors have been identified, including personal sympathy, trust, disciplinary similarity, previous ties and a predisposition for interdisciplinarity. The emergence of interdisciplinarity was further

facilitated by what I refer to here as relational factors, including shared aims and goals, appreciation, and encouragement of interdisciplinary collaboration. At last, a set of organisational factors was identified. These include dynamics of leadership and autonomy and circumstances created by the project as an organisational framework.

9.2.1. Sympathy, trust, and disciplinary similarity

Data shows that the emergence of interdisciplinary structures in the case study project partly depended on sympathy, trust, as well as – closely related to the previous – disciplinary similarity. Whereas personal dislike was identified as a barrier (see section on barriers above), several respondents highlighted the importance of personal sympathy for interdisciplinary collaboration. This is underscored by the following quote in which a respondent reported that despite other facilitators, such as the project as an organisational framework and encouragement of interdisciplinary collaboration, sympathy still played a central role:

> "I think I keep saying that, right? But I think a big point is something like sympathy. You get on well and you have the framework. Well, I think it's a combination of the two. There is this framework, there is the project and it is somehow desired. That's what is said again and again: One should work together somehow. Yes, I think the combination of the framework and then you like each other and think: 'Yes, why not?'." (Interview 20, postdoc_soc, pos. 294-300)

Further, a handful of respondents referred to trust as an important facilitator for interdisciplinary collaborations to thrive. Trust was approached in a twofold sense by respondents. On the one hand, it was framed as a precondition for successful and lasting interdisciplinary collaboration. At the same time, it was presented as a consequence of interdisciplinary encounters in working groups and in the early- and mid-career researchers' (EMCR) group. Open communication and exchange in project structures, in particular the EMCR group fostered trust among project participants, which was seen

as an important foundation for further collaboration and the longevity of interdisciplinary structures.

Data also shows that distance and closeness between disciplines within the case study project had an impact on interdisciplinary collaborations. There were multiple accounts of disciplinary similarity being described as a facilitator for interdisciplinarity in the data. For example, a professor from an applied discipline within the social sciences reported to have actively sought out project participants from similar research fields for interdisciplinary exchanges:

> "I actually found the self-selected, perhaps also personal exchange with people who have similar questions and come from similar research fields with the same research methods/ I actually found that the most beneficial." (Interview 14, prof_soc, pos. 223)

This approach seemed to be common within the case study project and was practised both during the above-mentioned personal exchange as well as within the scope of interdisciplinary structures in the project. As a respondent phrased:

> "Because we experience that it can be (.) very normal or very/ very gratifying to exchange ideas with other disciplines that we have a certain closeness to. Of course, I would exchange ideas with [a discipline from natural sciences], but you also notice that at conferences, there comes a point/ well during lunch there is enough to talk about, but then it suddenly gets (.) um, thin. So then you really have to invest in order to/ to continue doing something together" (Interview 18, postdoc_hum, pos. 221)

Similarities with regard to methodologies, goals, or research paradigms seemed to provide a safe basis for exchange across disciplinary boundaries, as also confirmed by the following quote:

> "Um, it depends on the level. Hm (.) when I talk to my colleague [from a close discipline within the humanities], for example, I can of course um, because we're also quite

> similar in the area of research (...) we can of course talk more about the content and also how we do research, um, basic research. (.) Um (.) I take a lot from that, for example, because it's close to what I do." (Interview 21, PhD_hum, pos. 304)

Yet, data also underlines quite clearly that while disciplinary similarity eases interdisciplinary exchange, it is not a crucial precondition for successful interdisciplinarity. The above-cited PhD student immediately added that she also benefited a lot from exchange with very distant disciplines within the case study project: "But I also take a lot from disciplines that are very distant." (Interview 21, PhD_hum, pos. 304).

Again, differences and similarities were not only perceived along disciplinary lines, but also invoked differentiations between *Fachdidaktik* and *Fachwissenschaft*. Analysis suggests that an affiliation to *Fachdidaktik* automatically led to assumptions about similarity in questions asked and methods used. This is underscored by this quote by a PhD student from the humanities, who reports the value of being provided with feedback within the scope of one of the thematic working groups and describes their members as very similar, even though they represent different *Fachdidaktiken*:

> "When you present your project there, you get feedback from people who are in a similar terrain. And that's always helpful. Even if it's from people who don't come from the same *Fachdidaktik*." (Interview 22, PhD_hum, pos. 197)

9.2.2. Previous ties and a predisposition for interdisciplinarity

Across the interviews, there were accounts of a predisposition for interdisciplinarity, whether due to previous ties to project participants, due to prior experience with interdisciplinary work, or a personal openness to new ideas.

Previous ties between project participants seem to have acted as a facilitator for further interdisciplinary collaboration. Several respondents reflected on the role of previous ties, either from their own experience or observations within the case study project. Previous ties, often from former project

collaborations, brought foundations of trust as well as of working- and communication styles, thus reducing many of the barriers presented in the previous section. Previous ties sometimes played a role for the selection of participants into the project, and many of them had been collaborating within the scope of other projects before, as illustrated by the following quote from a respondent reporting how he came to the case study project:

> "Exactly, so, from this circle. So actually, if you want to categorise it, through previous projects with - with - a similar group of participants." (Interview 17, prof_eng, pos. 14)

In only one interview, previous ties were mentioned as the foundation of an interdisciplinary teaching collaboration. Instead, previous ties played out most significantly in the context of larger project structures, e.g. with regard to the emergence of the thematic working groups at the beginning of the first project phase:

> "But especially in the first year I had the strong feeling that there were structures that - let's say [prof_hum] and [prof_nat]. They had this project and it just became, well, it's a good project, it's great, everything and so on, but that's how it was and that's how it [a thematic working group] started." (Focus group 1, pos. 122-123)

These previous ties had, partly, been of interdisciplinary nature and in general, prior experience with interdisciplinarity was outlined as a facilitating factor for participation in and contribution to the emergence of interdisciplinary project structures. Interdisciplinary experience, also with actors not involved in the case study project, was described as a factor predisposing participants to collaborate effectively within the scope of the project. This is, for example, shown by the following quotes by one of the project leaders who described himself as a regular crosser of disciplinary and institutional boundaries and explained that his previous interdisciplinary experience had taught him to acknowledge the existence of different disciplinary perspectives and had encouraged him to try and understand them:

> “I've always worked a lot with other people in interdisciplinary or, if it was not interdisciplinary, then in inter-institutional settings. I don't really know it any other way.” (Interview 12, PI_nat, pos. 93)

The analysis has further identified a personal predisposition, symptomatic in enthusiasm and attachment of high value to interdisciplinary exchange and openness to learning and new ideas. Respondents with such traits underlined the benefits of learning from fields not only close, but also distant to their own, showed a high willingness to engage in discussions across disciplines even without immediate benefit for themselves, described themselves as curious, and were thus naturally inclined towards interdisciplinary collaboration. These respondents were a clear minority and represented EMCRs from the social sciences.

Data thus suggests that those who either had previously engaged in interdisciplinary work as well as those with a personal motivation to do so found it easier to engage in and contribute to the interdisciplinary structures within the case study project.

9.2.3. Shared aims and understanding

The analysis has shown that within the case study project, shared aims and mutual understanding have significantly contributed to the successful emergence of interdisciplinary structures. According to participants of a focus group discussion among EMCRs, everyone in the project " (…) does more or less the same thing or pursues the same goal: to provide good teacher training." (Focus group 1, pos. 37). Data shows an overlap of topics and interests as well as a shared objective of implementing inclusion-oriented and inclusive teacher training. A respondent phrased that while the project brought together participants “who do very different things from different disciplines”, they remained connected via a common “topical and methodological core” (Interview 3, prof_soc, pos. 125). As the following quote shows, the perception of shared aims within the project provided a

starting point for collaborations and motivated respondents to look beyond disciplinary differences:

> "Above all because we also - I'll put it this way, act under the umbrella of inclusion, diversity, and heterogeneity management. We all have a common ground, where we say: First of all, we share the same objective and even if we are not familiar with the different disciplinary perspectives, we can start at a level of commonly agreed on norms." (Focus group 2, pos. 88)

Project participants did not always share the same aims. Data shows that aims and interests were sometimes only shared by sub-groups of project participants, who then engaged in respective collaborations. Examples of this have been witnessed with temporary sub-groups within the EMCR group (see description of interdisciplinary structures in Chapter 7 for more detail) or teaching collaborations. As previously discussed (see section on actors on motivation in Chapter 8), teaching collaborations were often driven by the aim of preparing students for interdisciplinary collaborations in their work as teachers at schools.

Yet, overall, data confirms the importance of creating a collective identity – or "we-culture" (Interview 25, PI_hum) – within the project in order to solidify interdisciplinary efforts. Such collective identity supports a mutual understanding across disciplinary boundaries. Data also shows that regular meetings and interactions in group with a somewhat stable membership, i.e. the working groups and the EMCR group – are a central facilitator for the exchange of knowledge and for building shared aims and understanding within the project.

9.2.4. Appreciation and encouragement

A handful of interviews, including those conducted with project leaders and administrators, as well as a focus group discussion also included references to appreciation and encouragement as factors contributing to interdisciplinary collaboration within project structures. EMCRs reported that overall, they felt that interaction within project structures was generally appreciated and that

this appreciation facilitated the exchange of ideas beyond disciplinary boundaries. However, an interviewee also stated that, while respect and appreciation constituted the foundation of interdisciplinary exchange, disciplinary hierarchies sometimes persisted:

> "Basically, the way we interact with each other is characterised by respect and appreciation and also by meeting at eye level. So that's the foundation but, in some places, you realise that some people from certain disciplines somehow think they are better than others." (Interview 9, postdoc_hum, pos. 101)

The role of appreciation of interdisciplinary collaboration by professors was particularly highlighted, yet contrarily perceived. While in a focus group discussion, a participant highlighted the "genuine appreciation" for exchange within interdisciplinary structures and the "regular participation" within them by professors (Focus group 2, pos. 82), two interviews with participants from different groups give evidence that a perceived lack of appreciation from the professorial level also hampered EMCRs' motivation to engage in interdisciplinarity. As a post-doc reported from their experience in their position as a speaker of the EMCR group:

> "(…) it's also about improving the level of appreciation. I keep getting desperate phone calls from people who have been beaten up by someone who is really not that active in [the case study project] and (…) shows up once to make a stink. These are things that can really be changed." (Interview 9, postdoc_hum, pos. 101)

Overall, and probably not surprisingly, appreciation and encouragement seem more relevant to researchers in formative stages of their careers, and less to professors.

9.2.5. Dynamics of leadership and autonomy

Despite the fact that certain dynamics of leadership and autonomy have been identified as inhibitors, leadership also constituted an important facilitator for the emergence of interdisciplinary structures in the case study project. For one, dynamics of demanding and contesting leadership – either in the form of

obligations to attend or of top-down provisions for project work – have been identified as central factors for the emergence of interdisciplinary structures. On the other hand, leadership was identified as a source of legitimisation for interdisciplinarity, providing protection from the traditionally discipline-based, pre-existing structures of the university discussed in the section on barriers to interdisciplinarity (Chapter 9.1).

Creation of meeting spaces: Voluntariness versus obligation to attend

Creating spaces for interdisciplinary collaboration often hinged on the balance between voluntariness and a perceived necessity of participation. Discussions around this topic in both interviews and the focus group discussions revealed different views on how environments for meaningful interaction across disciplines can be fostered. On the one hand, the top-down structuring of meeting spaces, including project meetings and conferences, but also the EMCR group were described as an important starting point for interdisciplinarity in the case study project. A postdoctoral researcher from the humanities reflected that these structured spaces helped them establish contacts and collaborations across disciplinary border, which otherwise might have felt too anonymous In their quote, meeting spaces and project expectations are described as factors pushing them to engage with other disciplines, even when this was perceived as challenging due to differences in disciplinary culture:

> "So, I don't think I would have gone into maths or statistics and would have asked, can we / - without these contacts or the first points of contact, um - I don't think so. The other discipline would have been too anonymous in terms of people and the threshold would simply have been too great or it would have been far too easy to use the excuse of saying: 'That's just not our disciplinary culture'." (Interview 18, postdoc_hum, pos. 178)

This perspective shows how structured meeting spaces or points of contacts within the case study project influenced individual participants' trajectories, making it easier for them to leave their disciplinary comfort zones. For other

participants, however, interdisciplinary structures themselves – particularly the working groups and EMCR group, were seen as vital and regular attendance was regarded as a factor contributing to the functioning and productivity of them. A participant of the second focus group discussion emphasised the importance of consistent attendance of interdisciplinary structures in fostering common understanding across disciplines and a certain continuity in discussions over time:

> "Um, of course it's always the case that if you want to build up structures like this, it only works if people come regularly. (…) so that you can find a common language and discuss the same things together and don't have to start from scratch every time, it makes sense for people to be there." (Focus group 2, pos. 41)

Compulsory attendance of project structures was seen by some respondents as unnecessary, as they thought that successful interdisciplinary collaboration had to be based on voluntariness and could not be forced. However, a great number of project participants also appreciated it and saw it as a facilitator, as it forced project participants to interact and therefore provided a basis to recognise possible intersections between disciplines, as illustrated by the following quote:

> "(…) it was indeed a good opportunity to, well I would say, get to know the colleagues from other disciplines. In fact being forced to get to know [them]. " (Interview 14, prof_soc, pos. 132)

Nevertheless, the notion of voluntariness retained a strong appeal in data. A professor from the social sciences reported that voluntary participation fostered motivation and productivity in interdisciplinary structures, as individuals who had chosen to attend voluntarily often did so with a clear purpose:

> "Apart from that, the following supports dynamics in the working group: the fact that only those join who really want to do so. So, it's voluntary. And those who join have certain aspirations and can use these things [annotation:

> working group results] for themselves accordingly." (Interview 3, prof_soc, pos. 41)

In addition, the terms room and space in this context and in the German language do not only reflect a metaphorical idea of collaboration, but also address a more practical issue in universities: Rooms are often scarce, and those that exist are often tied to specific departments or faculties, a fact that creates another challenge for establishing spaces for interdisciplinary work.

Overall, data reveals the complicated balance needed to design spaces for interdisciplinarity. While voluntariness can foster motivation and enthusiasm, a certain degree of structure – perhaps even of obligation – is regarded as an important starting ground for connections and collaborations across disciplinary boundaries.

Top-down provision of frameworks versus freedom and autonomy

Similar dynamics were observed with regard to the balance between a top-down provision of frameworks for collaboration on the one hand, and freedom and autonomy on the other hand. Data shows that top-down frameworks that were perceived within the project stemmed from two sources: project leaders as well as professors – in particular those leading the thematic working groups.

Project leaders were observed to give guidance and, sometimes, even make decisions affecting the focus of collaborative work, especially within the context of the EMCR group. This was perceived by participants in different ways. On the one hand, interview and focus group data suggests that for some project participants, such actions were useful, as they set frameworks for further interdisciplinary collaboration: "Yes, you definitely need such - yes, light pressure" (Interview 1, post-doc_soc, pos. 122). On the other hand, participants always advocated for more freedom and autonomy in their decisions on how to shape their interdisciplinary collaborations, which, according to participants of a focus group discussion among EMCRs led to continuous dynamics of demanding and contesting leadership:

> "And I also always had the feeling that project leadership would then take countermeasures. So okay – now the working groups have to be mandatory, now we definitely need presentation days to ensure regular exchange. It was a mixture between: "Now we are steering but then also somehow leaving space", so I have the feeling that there were always dynamics of action and reaction." (Focus group 1, pos. 149)

This view was confirmed in interviews with project leaders, who underlined that throughout the project they attempted to provide what they deemed necessary top-down frameworks while leaving enough space for developments induced by the project basis, i.e. its participants:

> "Um, we then/ so we tried to think both top-down and bottom-up, all the time, and to link the two. And, um, the early-and-mid-career researchers' group shows that (.) um, what kind of difficulties can arise (.) and what kind of fruits it can bear." (Interview 12, PI_nat, pos. 35)

Top-down provisions were most strongly perceived in early project stages by EMCRs. They felt that interdisciplinary collaboration within project structures was steered by decisions made by a group of highly active professors, who were also linked to the initiation of the project:

> "Well, I can say something that I feel may be unpopular, but we are here among ourselves now. At the beginning I had the feeling that there were some professors who had co-operations, who might like each other, and then they had some ideas: this and that should be the result of structures and we had to somehow see how we fit in. In the beginning it was quite extreme, but it's changed a bit now that we're a bit freer, we can do what we want a bit more and somehow it still fits in here." (Focus group 1, pos. 122-123)

Yet, as shown by this quote as well as multiple other statements in both interviews and focus group discussions, interdisciplinary structures – in particular the thematic working groups and EMCR group – were subject to changing leadership dynamics, moving towards more freedom and autonomy of project participants over the case study project's lifetime. Data further

suggests that throughout all these developments, project administrators were important actors in ensuring coordination and communication, thus linking the needs and expectations uttered by different groups within the project.

Throughout these dynamics of requesting and demanding leadership, project participants underlined the importance of freedom and autonomy for meaningful and sustainable collaborations, for example in the following quote:

> "(…) if you give people space, something can come of it, also in terms of participation. So, I think we have learned/a lot has been learned, including how to give people space that can be used effectively." (Interview 13, post-doc_soc, pos. 141)

As already discussed above within the context of the question to what extend obligation and voluntary participation affect interdisciplinary collaboration, this quote shows that the interviewed post-doc values freedom and space due to its positive influences on the participation of project participants in interdisciplinary structures. Moreover, freedom and space to create are also framed as a precondition for effective collaboration. In addition, the quote shows that the granting of this freedom and autonomy was a process, something that needed to be learned within the project. In the end, with the exception of a few examples of top-down provisions having been interpreted as too constricting, the balance of leadership and autonomy was evaluated positively by most of the respondents:

> "For people who want to make a difference, the project offers enough freedom for them to get involved, contribute or do something else. It doesn't mean that every idea that anyone has will be implemented, but of course here you have different formats for trying out your ideas and introducing them into the discussion." (Interview 1, postdoc_hum, pos. 205)

However, data underlines that the amount of freedom and autonomy experienced by EMCRs did not only depend on developments within the case study project, but also heavily on the leadership styles and priorities of their

respective professors. In an interview with a project leader, they underlined that interdisciplinary collaboration within the project could sometimes not live up to its full extent due to "major differences in the amount of freedom professors allow their doctoral students to experiment." (Interview 7, PI_hum, pos. 22).

Protection and legitimisation

Leadership finally facilitated the emergence of interdisciplinary structures within the case study project through legitimisation and protection from other powers and demands within the university. The data highlights multiple instances where interdisciplinarity was legitimised, and interdisciplinary collaboration was actively supported by project leaders or administrators, often in response to challenges posed by faculty leadership or administration. This support was especially crucial for EMCRs involved in the case study project, who frequently faced conflicts over resource allocation between faculties. These struggles affected both their time dedicated to interdisciplinary project structures, including both working group and EMCR group attendance and interdisciplinary teaching collaborations.

The legitimisation and protection of interdisciplinary collaboration seems to have partly been anchored already in the project proposal (Document 1), which specifically mentioned the EMCR group as a forum facilitating collaboration across disciplinary boundaries. Interview data confirms this perception. For example, a post-doc regularly participating in the EMCR group referred to it as a "protected" space (interview 21, postdoc_soc, pos. 266), facilitating interdisciplinary exchange among young researchers that would otherwise not have been as easy.

This study further underlines the central role of leadership not only in protecting and legitimising the project, but also in contributing to institutionalization. The power vested in project leaders through their other positions (see Chapter 8.1 on actors for more detail), enabled them to carry project outcomes and incentives into the wider university. An example of this

is a teaching award for inclusion-oriented teaching which, among other aspects, incentivised interdisciplinary approaches and interdisciplinary teaching collaborations. This award was first created for the project only, but was then institutionalised to be awarded to all members of the case study university and beyond the projects' lifetime.

The protection and legitimisation of interdisciplinarity through project leadership is tightly related to conditions provided by the case study project as an organisational framework, which will be discussed in more detail at a later point in this chapter.

9.2.6. The project as an organisational framework

The emergence of interdisciplinary structures further benefited from the organisational framework conditions of the case study project itself. Data from interviews and focus group discussions highlight different dimensions of this, including a prioritization of project work over other tasks, reduced barriers to interdisciplinary collaboration, and exemption from faculty-based teaching loads.

Data shows that the project provided participants with a justification and freedom to dedicate time and resources to interdisciplinary work. A participant from the humanities reflected on this dynamic with the following words:

> "Yes, yes, that was a luxury situation, of course. So, I notice that, in contrast to people or my colleagues who work at the institute, that that was already/ so I always had the justification to go there, because of course [the project] financed me, um and therefore also the freedom and I always said: No, now [the project] comes first." (Interview 21, PhD_hum, pos. 245)

This demonstrates that the project's financial support enabled focus participation on the one hand, and on the other hand legitimised the prioritisation of project-related activities over other obligations and demands

posed by other organisational units, such as the institutes or faculties in which participants were based.

Another significant aspect of the project's organisational framework conditions was its impact on teaching responsibilities. While the project offered an exemption from official teaching loads to be fulfilled within faculties, it nevertheless promoted engagement in teaching, thus allowing participants greater flexibility in choosing what and where to teach. Evidence from an early-career researchers' group meeting shows that the framework conditions of the project allowed teaching collaborations and that this was also expressively communicated: "It is expressly pointed out that these courses can also be taken in pairs, i.e. in tandems, in which case the number of hours per week during the semester is not halved." (Protocol 32_EMCR group, p. 1). In a focus group discussion, participants highlighted the legitimisation that the project provided for teaching collaborations, while at the same time raising doubts as to whether interdisciplinary teaching collaborations can survive beyond the scope of the project:

> "And I do think that it helps that we can say that this is a recognised format in [the case study project]. I am unsure whether this can be continued to the same extent when the project comes to an end, so to speak, because the structures are very strong and difficult to overcome." (Focus group 1, pos. 187)

Yet, and despite the exemption from official, faculty-calculated teaching loads, pressures on EMCRs to engage in tasks not related to the project sometimes persisted – as already discussed in the section on barriers to the emergence of interdisciplinary structures above.

Finally, participants considered the organisational framework of the case study project as a facilitator for interdisciplinarity, as it lowered barriers to engage with colleagues across disciplines, fostering interactions that would not have naturally emerged within traditional institutional structures. A professor from the social sciences observed:

> "Yes, well, of course you shouldn't neglect, I think, that everything takes place within the structure of a grant or project. Ehm (.) I think without the project we would never have come up with the idea of collaborating with [another discipline, nat] maybe even more so with [other discipline, soc], because [ibid.] is in our faculty (.) but to be honest I wouldn't have come up with the idea of [other discipline, nat] ehm / I don't think the working group would have developed without the project either (.) at least not to the same extent." (Interview 14, prof_soc, pos. 95)

Data thus suggests that while interdisciplinary can happen without the organisational framework provided by projects, they would not have developed with such a broad disciplinary scope without the case study project.

9.3. Chapter summary

This chapter has revolved around the question of which factors influence the emergence of interdisciplinary structures in academic project settings. Barriers and challenges to the emergence of interdisciplinary structures included workload, a lack of time and resources, personal as well as disciplinary differences and conflict, a lack of common language and understanding, pre-existing organisational structures, certain aspects and dynamics of leadership and autonomy, as well as – particularly with regard to sustainability of interdisciplinarity –, career structures and temporal employment in academia. Facilitators for the emergence of interdisciplinary structures included sympathy and trust, previous ties and interdisciplinary experiences, shared aims and understanding, appreciation and encouragement, certain supportive dynamics of leadership and autonomy, and, at last, contextual factors associated with the project as an organisational framework.

These factors can be placed into three categories, specifically those occurring on an individual level, on an organisational level, and on a supra-organisational or the scientific system level (see Table 7 below), whereas it needs to be acknowledged that these levels exist in co-relationship and continuously influence each other.

Barriers	Facilitators
Individual level	
Workload, time, and resources	Previous ties & interdisciplinary experiences
Individual conflict	Sympathy and trust
Organisational level	
Pre-existing organisational structures	The project as an organisational framework
Leadership and autonomy dynamics	
	Appreciation and encouragement
Supra–organisational level	
Disciplinary differences and conflict	Disciplinary similarity
Disciplinary languages	Shared aims and understanding
Academic career structures	

Table 7: Barriers to and facilitators for interdisciplinarity on the individual, organisational, and supra-organisational level

Workload and time have emerged as the most common theme in analysis, and are strongly tied to perceptions of interdisciplinarity as a particularly work-intensive and challenging task that is often performed in addition to regular, usually discipline-based requirements. Respondents feel that there is not enough time to overcome other barriers stemming from a supra-organisational, particularly discipline-related level. The strongly discipline-based organisation of science constitutes a challenge to interdisciplinarity in different regards on both the organisational and supra-organisational level: They manifest in differences in epistemic cultures and practices, disciplinary languages and resulting coordination efforts, and strongly discipline-based, dispersed faculties.

In addition to conflict based on disciplinary differences, data also points to epistemic conflicts between disciplines (*Fachwissenschaften*) and the corresponding subject didactics (*Fachdidaktiken*) in the case study, mostly stemming from differing preferences regarding scientific communications and outputs. With regard to academic career structures, the particular fixed-term contracts of EMCRs and resulting discontinuance of interdisciplinary ties within the organisation were identified as a barrier. Organisational and

administrative barriers were often identified in connection to teaching, rather than to research.

Many of the identified facilitators directly correspond to the identified barriers. This particularly applies to the building of trust (which largely depended on regular meetings and clear communication processes), and the development of shared aims and a common understanding. Findings further underline the importance of appreciation and encouragement of interdisciplinarity within the institution and suggest that projects as large as in the study at hand can benefit from offering a range of formats of interdisciplinary collaboration that acknowledges the different needs and preferences of project participants. Data also points to the fact that the case study is an academic project as a facilitator for interdisciplinarity: By providing a framework existing on top of the traditional organisational structure, legitimacy and flexibility for interdisciplinary endeavours has increased.

Dynamics of leadership and autonomy emerged as the most complex concept during analysis – acting as both a challenge to and a facilitator for interdisciplinarity. Leaders could provide legitimisation and protection from the power of faculties, and contributed to the emergence of interdisciplinary structures by providing meeting spaces, defining frameworks for structures, and encouraging participation. At the same time, however, leadership was constantly challenged by project participants pushing for more autonomy in their work, resulting in the question of how much leadership is enough or too much in the context of interdisciplinarity in academic project settings.

10. Discussion

The previous chapters of this dissertation have addressed the empirical findings of a case study on the emergence of interdisciplinary structures within an academic project setting. In the following, key findings will be critically interpreted against the background of existing literature as well as theoretical perspectives grounded in the bridging of structure and agency for organisational change. For this purpose, this chapter will first address notions and experiences of collaboration within interdisciplinary project structures. It will then turn to a critical reflection on barriers and facilitating factors for interdisciplinarity, before discussing the role of motivation and agency in the context of interdisciplinary structures. Finally, the last section of the chapter will focus on a theoretical reflection upon links between structure and agency, as well as top-down and bottom-up developments in the emergence of interdisciplinary structures.

10.1 Multi-, pluri-, inter-, trans? Reflecting on collaboration practices within interdisciplinary project structures

Collaboration within the case study projects' structures has often exceeded multidisciplinarity. Cross- and interdisciplinary collaboration were most prevalent within project structures. To some degree, pluri-disciplinary collaboration, which is characterised by a lower degree of integration between disciplines and occurred mainly in attempts of negotiating and setting boundaries between disciplines, was detected. Data contained only a few accounts of transdisciplinary collaboration. This included both transdisciplinarity following definitions applying to collaboration within academia, which transcend disciplinary knowledge and values and lead to the creation of something new (Klein, 2010), as well as transdisciplinarity as a way of including external partners, in particular societal actors, in processes of knowledge construction (Bernstein, 2015; Darbellay, 2015). While transdisciplinary endeavours in the first sense took place across different project structures, including teaching collaborations, transdisciplinarity in the latter sense occurred in particular with regard to activities of the working

group on cultural participation, which collaborated with a project for young migrants and refugees in the sense of a living lab (Steen & van Bueren, 2017).

10.1.1 Revisiting collaboration practices in the light of existing typologies of interdisciplinarity

Previous literature has established a categorization of interdisciplinary work as challenging, and an absolute division between categories is not possible (Huutoniemi et al., 2010). Klein (1996) even refers to the existence of multiple interdisciplinarities, which reflect a "variety of different ways of bridging and confronting the prevailing disciplinary approaches" (Huutoniemi et al., 2010, p. 80). This study confirms the existence of multiple interdisciplinarities not only across and within interdisciplinary structures, but also in the collaborative practise of individual actors. The findings show that collaborative processes, even within the same interdisciplinary structure, can have various different dynamics. I was thus not able to characterise the type of interdisciplinarity of a structure itself but can only draw on the lived experiences and perceptions of individual actors within them.

Drawing on Heckhausen's (1972) work, whose typology of interdisciplinarity is still widely cited in current research, discipline-spanning collaboration in the case study project most frequently occurs in the areas of auxiliary, composite, and supplementary interdisciplinarity. Auxiliary interdisciplinarity refers to the cross-disciplinary use of methods, which was often overserved in the context of interdisciplinary working groups. Composite interdisciplinarity occurs when disciplines temporarily work together and apply different techniques to solve a common problem or conduct a specific task, which was inherent to the case study projects' set-up. Heckhausen (1972) refers to this type of interdisciplinarity as a "strange assembly of disciplines" engaging in a rather instrumental pursuit of goals, but argues that it nevertheless possesses the power to change a person-environment system (p. 88). The highest degree of interdisciplinary maturation found within the context of this study is supplementary interdisciplinarity, in which disciplines develop a "partial overlapping in a

supplementary relationship", searching for similarities and integrating theories and methods in certain areas, whereas their collaboration "never extends across the whole area of the related disciplinary subject matter" (Heckhausen, 1972, pp. 88–89). Collaboration within the case study project has thus not led to the total integration of participating disciplines.

10.1.2 Interdisciplinary boundary crossing as a troublesome process?

Collaboration within interdisciplinary structures was often attributed both negative and positive characteristics at the same time. Negative notions included irritating, frustrating, time-consuming, overwhelming, threatening, or uncomfortable. Positive notions of interdisciplinarity, which prevailed in data, included fruitful, beneficial, stimulating, inspiring, and enriching. These notions were often used in combination, underlining that the crossing of disciplinary boundaries is a troublesome process, but can lead to better outcomes. This corresponds to the findings of Leahey et al. (2017), who have shown that interdisciplinarity leads to short term penalties but long term benefits in publishing and citation.

Project participants' descriptions of processes of interdisciplinarity as troublesome and its outcomes as positive also correspond to emotional patterns known from the concept of liminal spaces (J. H. F. Meyer & Land, 2005), referring to a "cultural and social state of 'betweenness'" (Miller, 2016, p. 35), which, when successfully navigated, can lead to new understandings and even changes in worldviews. Liminality has been tied to interdisciplinarity in some scholarly readings, e.g. as a process connected to "crossing tribal boundaries" (Land, 2012, p. 175), and has, in a few instances, been used to learning in the context of interdisciplinary higher education (e.g. Land, 2012; Zou et al., 2025). Based on the findings of this study, I advocate for the application of the concept of liminality to interdisciplinary team work in general, in particular focussing on the question of how a (re)negotiation of personal and disciplinary roles and norms can be guided in order for sustainable interdisciplinary structures to emerge.

10.2 Discussion of barriers to and facilitators for interdisciplinary

10.2.1 Barriers and challenges to interdisciplinarity

Barriers and challenges to the emergence of interdisciplinary structures include workload, a lack of time and resources, personal as well as disciplinary differences and conflict, a lack of common language and understanding, pre-existing organisational structures, certain aspects and dynamics of leadership and autonomy, as well as – particularly with regard to sustainability of interdisciplinarity -, career structures and temporal employment in academia. This aligns with existing literature identifying different psychological, ideological, and organisational (Weingart & Stehr, 2000), or, in the same sense, cognitive, philosophical, and institutional barriers (MacLeod, 2018) and underlines that in comparison to disciplinary work, interdisciplinarity is associated with "higher costs of coordination and relationship development" (Cummings & Kiesler, 2005, p. 704).

The epistemic divide between Fachwissenschaft and Fachdidaktik

With regard to disciplinary conflict, data reveals a strong rhetoric of otherness, which is not surprising when considering the degree to which academic identities and socialization processes of academics are tied to academic disciplines (Becher & Trowler, 2001). The findings do, however, point to another dimension of conflict based on epistemic differences not directly tied to disciplines, which has not yet been properly addressed by literature so far. This concerns a divide between disciplines (*Fachwissenschaften*) and the corresponding subject didactics (*Fachdidaktiken*).

Epistemology as the theory of knowledge and theory of justification of knowledge construction (Audi, 2002) guides with which assumptions, methods, and with which value and meaning attached to findings (Brister, 2017) research is being conducted. The case study reveals differences between *Fachwissenschaften* and *Fachdidaktiken* in particular concerning the value and meaning attached to research findings and the question of how they

should be put into use, with the latter showing preferences for the creation of tangible outputs that directly affect practices of teacher training. Literature shows that epistemological disagreement is a common obstacle to interdisciplinary research, whereas epistemological frameworks are usually better integrated within disciplines (Brister, 2017).

Despite a certain degree of epistemological integration between the different *Fachdidaktiken* in this case study, I follow Vollmer's (2014) argument that *Fachdidaktiken* are highly school-subject and discipline specific and should therefore not be considered as a unitary field; there rather is a "common core" of "individual subject didactics" (idem., p. 27). Previous literature touches upon the existence of a divide between *Fachwissenschaften* and *Fachdidaktiken*, stating a lack of collaboration between the two (Winkler & Schmidt, 2016) and arguing that in contrast to *Fachwissenschaften*, *Fachdidaktiken* are more likely to collaborate across disciplinary boundaries and are to be considered "inherently interdisciplinary" (Lindauer et al., p. 227). By revealing epistemic conflicts concerning the value and meaning of research findings and resulting differences in preferences for interdisciplinary collaboration, this study makes an important addition to literature.

Academic socialisation and career development in the context of interdisciplinary structures

Surprisingly, socialisation and career development did not emerge as strongly as barriers to interdisciplinarity in the case study project as suggested by literature. Previous research has outlined that collaboration, and interdisciplinary collaboration in particular is regarded as not easily recognised in single-discipline oriented reward systems and thus detrimental for career advancement (Hernandez-Aguilera et al., 2021). Müller (2012) has found life sciences postdocs to be restrictive in collaborating because they fear detrimental effects on their career advancement, which depends on individual and in particular first authored publications. Leahey et al. (2017) show that interdisciplinarity reduces the productiveness of researchers, while

at the same time leading to more prominent and highly cited papers. However, such effects only become visible after some time and may thus not be beneficial to the career advancement of early career researchers. While data shows that PhD students sometimes retreated from interdisciplinary structures to a certain degree to find the time to complete their dissertation projects, none of the participants uttered concerns regarding detrimental effects of interdisciplinarity on their career development. This might be related to the focus of the case study project on teacher training, where career goals might include returning to teaching in schools.

Organisational and administrative challenges

Organisational and administrative barriers were often identified in connection to teaching, rather than to research. This corresponds with Nickel's (2012) argument on the functional logics of organisational spheres in German universities, where teaching is described as having both a higher degree of formalisation and a more structured logic of organisation (control via internal and external mechanisms and regulations).

10.2.2 Facilitating factors for interdisciplinarity

While at first sight, the facilitators for the emergence of interdisciplinary structures identified in this case study do not seem too surprising and largely constitute opposites of the barriers discussed before, the findings give interesting insights into how facilitating conditions for interdisciplinarity can be established. Regular meetings, institutional recognition, and clear communication processes were key to overcoming barriers and fostering interdisciplinary collaboration in the case study project.

On the initiation, establishment, and maintenance of interdisciplinary relationships

The creation of meeting spaces outside thematic working groups further ensured the emergence of informal communication, which has been established as one of the most important starting points of academic collaboration by previous research (Bozeman & Corley, 2004). The degree to which project participants engaged in truly inter- or transdisciplinary

exchange, exceeding the multidisciplinary character of project structures, also seems to have depended on trust.

As Balliet and van Lange (2013) state, "trust is essential to initiate, establish, and maintain social relationships" (p. 1090), and is most commonly regarded as the expectation, predictability and confidence of other actors or the "expectation of other's benevolent motives" (idem.), or trust in the good intentions of others (Ellemers, 2021). Balliet and van Lange (2013) have shown in their work that "trust matters most in situations that contain greater amounts of conflicting interests" (p. 1102), which can be assumed to be the case in interdisciplinary settings, particularly when more distant disciplines collaborate and individuals are no longer able to draw on their own disciplinary scripts in order to predict the behaviour of others.

While the word trust itself was used scarcely in interviews and focus group discussions, the importance of processes of getting to know and being able to understand each other across disciplinary boundaries was a recurrent theme in data. Analysis suggests that regular meetings and prolonged social interactions within the framework of interdisciplinary project structures provided participants with the opportunity to observe each other, get to know each other, and consequently enabled them to make predictions about their intentions and behaviour leading to trust (or the lack hereof).

Ensuring the legitimacy of interdisciplinarity in research versus teaching

This study points to the importance of recognition and acknowledgement of interdisciplinary work by various actors, particularly professors and project leadership, for the emergence and sustainability of interdisciplinary structures. In general, there is often a lack of institutional recognition and support for interdisciplinary collaboration. Academic rewards and recognition are typically more aligned with individual research outputs rather than with collaborative or interdisciplinary efforts (van Rijnsoever & Hessels, 2011). Further, research increasingly tends to be valued over teaching (Leišytė et al., 2009). By formulating interdisciplinarity – not only in

research, but specifically also in teaching – as a strategic priority and communicating this to participants as well as to the wider university, the project managed to legitimise interdisciplinarity.

Following Nickel's (2012) assumption that teaching is more formalised and can more easily be controlled and managed through traditional, discipline-based structures and bodies than research, it is not unsurprising that the power of legitimisation of interdisciplinarity through the project was less successful for teaching: Interdisciplinary teaching collaborations remained to be perceived as challenging and potentially less sustainable by project participants.

"One size does not fit all", or: How diversity can contribute to interdisciplinarity

Findings further underline the importance of the provision of different formats for interdisciplinary collaboration, which acknowledge differences in the needs and preferences of different project participants – as Townsend et al. (2015, p. 674) formulated: "one size does not fit all". This seems to be especially relevant in larger settings bringing together a high number of participants from different disciplines, whose aims, understanding of key concepts, and preferences for collaboration formats will not always fully align. Such differences do, however, not necessarily constitute a problem for interdisciplinarity. On the contrary, the case study project demonstrated how to successfully capitalise upon differences by providing different formats (mix of ad-hoc and short-term as well as more structured formats with different thematic foci).

The findings further suggest that leadership characteristics, particularly diversity in the leadership team, might have helped to meet the different needs and preferences of project participants and might thus have contributed to the successful emergence of interdisciplinary structures in the case study project. As phrased by an interviewee: "*the project benefits greatly from the fact that it is led by two very different people*" (Interview 11, prof_hum, pos. 278).

Further thoughts on leadership

Project leadership further took a central role in fostering interdisciplinarity through legitimisation and protection from the power of faculties. Hereby, the legitimisation of interdisciplinarity seems to play a greater role for PhD students and post-docs than for established researchers, i.e. professors, who enjoy high degrees of autonomy and power within their faculties in the German context.

Overall, the findings on leadership resonate with the writings of Kroll and Schubert (2023), who propose that university leaders should engage in the legitimisation of interdisciplinary scripts and in convening scientists (coordination) in order to promote interdisciplinarity. However, there is evidence of constant dynamics of demanding and contesting leadership in data, leading to the question of how much leadership is enough and by whom leadership should be exercised – e.g. based on Fam et al., 2020) distinction of formal, intermediate, and informal leadership, the latter of which takes into account that actors might take a lead in furthering interdisciplinary collaboration without finding themselves in designated leadership positions.

The project as an organisational framework: Benefits and challenges for interdisciplinary initiatives

Finally, the project's organisational framework played a critical role concerning the facilitation of interdisciplinarity through decoupling from traditional organisational structures, in particular by prioritising project-related work, and by enabling flexible teaching arrangements. Such decoupling has traditionally been achieved by establishing interdisciplinary research centres, which operate outside of or on top of traditional university structures (Bozeman & Boardman, 2003; Sá, 2008).

This study shows that as an alternative, projects as organisational forms can result in a certain degree of decoupling that allows participants to engage in interdisciplinarity more easily, while still remaining based in their faculties and thus connected to traditional university structures. This finding thus underscores the value of project frameworks in overcoming constraints posed

by formal structures within universities (Barbier et al., 2005; Rose et al., 2020), even though sustainability beyond the project's duration remains uncertain.

10.3 Motivation and agency in the context of interdisciplinarity

The contribution to as well as engagement in interdisciplinary structures seems to be closely tied to the (collective) agency and motivations of project participants. In the following, findings regarding the motivation and agency of project participants as well as the proposed typology of interdisciplinary actors are discussed against the background of existing literature.

10.3.1 A discussion of findings regarding motivation to engage in interdisciplinarity

Based on study findings, motivations to engage in interdisciplinarity were categorised into access to resources, legitimisation both vis-à-vis funders as well as other scientific disciplines, an increase in scientific quality, responding to student needs, advocating for inclusion-oriented and inclusive higher education, and other forms of intrinsic motivation. Reflecting on these categories, motivation for engagement in interdisciplinary structures can be explained well with the motivational trichotomy of financial reward, reputational reward, and intrinsic motivation (gold, ribbon, and puzzle) (Lam, 2011). Gold corresponds to access to resources, ribbon to legitimisation, and puzzle – corresponding to the remaining categories – seems to be most strongly represented in the context of this study.

Lam (2011) has pointed to the existence of this motivational trichotomy with regard to research commercialisation. While research commercialisation and interdisciplinarity seem different at first glance, they both include boundary crossing and are associated with higher risks and, oftentimes, additional workload. With regard to university-industry collaborations, van Rijnsoever and Hessels (2021) found scientific excellence and a resulting increase of reputation within the academic community to be the main drivers behind collaboration choices. The authors conclude that gold is the easiest incentive

for academics to start engaging in interaction, whereas puzzle is most strongly linked to intrinsic motivation, and ribbon is the factor most easily influenced by pressures from within the academic system.

This corresponds to findings of this study: Financial incentives, i.e. access to resources, have constituted an important starting point for interdisciplinary structures, as they motivated participants to engage in the multidisciplinary setting of a research and teaching innovation project in the first place. Based on interactions within this setting and on participants' intrinsic motivations, in particular the pursuit of scientific advances (puzzle), further collaborations, constituting various types of inter- as well as transdisciplinarity, were able to emerge.

Overall, data suggests that the self-interest of project participants – evident in their pursuit of funding (access to resources) and legitimisation vis-à-vis other disciplines – constitutes both a potential facilitator and a barrier to the emergence of interdisciplinary structures. This seems contradictory at first, particular in the light of previous literature that has identified self-interest as a possible barrier to organisational learning (Schön & Agyris, 1996). However, a study conducted by Grills et al. (2012) in the health care sector – an example of a sector with a similar degree of professionalisation as higher education -, shows that networking between actors can be positively influenced by self-interest when individuals seek funds, visibility, and credibility. In a similar vein, this study shows how self-interest can both positively influence and restrict interdisciplinarity within the context of higher education institutions: On the one hand, resource competition and quests for legitimacy can lead to instrumental and superficial participation (= the non-involved actor) and generate conflict between disciplines and faculties. On the other hand, these same motivations can serve as important entry points for interaction, fostering connections that may later evolve into genuine interdisciplinary collaboration.

10.3.2 Theoretical reflections on the typology of interdisciplinary actors

Based on their engagement and motivation, this study has resulted in a typology of interdisciplinary actors. In Chapter 8.4 of this dissertation, I distinguish between

- non-participants
- routine actors continuing previous collaborations and research lines
- actors participating in interdisciplinary structures but sticking to disciplinary scripts
- actors contributing to the further development of interdisciplinary structures through their search of definition and orientation, and
- actors strategically contributing to the development and engaging in interdisciplinary structures.

As previous literature has outlined, change from established routines and institutional frameworks can only occur when agents depart from past practice. This can happen either with (DiMaggio & Powell, 1983) or without strategic intent (Giddens, 1984). Having applied these thoughts to the context of interdisciplinarity, Kroll and Schubert (2023, p. 353) propose a distinction between strategic agency, "motivated by the active intent to change existing organisations and institutions" on the one hand, and agency resulting as a response to changing frameworks but without strategic objectives in mind on the other. With regard to the latter, the authors distinguish routine agency, which is based on the repetition of previous actions, and sense-making agency, resulting from attempts to seek orientation in frameworks where clear disciplinary referents are lacking.

The findings of this study closely align with the theoretical framework proposed by Kroll and Schubert (2023), which has been published after data collection and largely also analysis for this research project had been conducted. Routine agency is reflected in the second type of actors, who continue past collaborations within the framework of the case study project.

Different forms of sense-making agency can be found among the third and fourth type of actors, who are searching for orientation within interdisciplinary structures with varied outcomes, namely a) either a reinforcement of disciplinary perspectives and collaboration which mostly remains on pluri-disciplinary level, or b) engagement in collaborations of cross- and interdisciplinary nature. Strategic-change agency is prevalent among the fifth type of actors identified within the scope of this study. The 'pure interdisciplinarian' and the 'pragmatic interdisciplinarian' are highly intrinsically motivated actors who pursue interdisciplinarity with concrete ambitions – the first for the sake of interdisciplinarity per-se, while the latter sees interdisciplinarity as a means to achieve the aim of inclusive and inclusion-oriented higher education.

The identification of two kinds of strategic actors in this study – namely pure and pragmatic interdisciplinarians – corresponds to Darbellay's (2015) argumentation that there are two major discourses on interdisciplinarity: an epistemological and theoretical orientation transcending disciplinary boundaries on the one hand, a pragmatic and participative orientation with the aim of problem solving on the other hand. Hereby, the interdisciplinary academic is characterised by their interdisciplinary orientation and eagerness to reflect on and cross disciplinary boundaries per se (the "synoptic thinker capable of spanning the breadth of knowledge", as argued by Klein, 2021, p. 40, in reference to Leonardo da Vinci). The actor of conviction takes a pragmatic approach and promotes and engages in interdisciplinarity following their pragmatic orientation towards problem solving.

Strategic actors and, to some degree, routine actors contributed to the emergence and further development of interdisciplinary structures within the case study project in the sense of what Kroll and Schubert (2023, p. 358) refer to as "interdisciplinary self-organisation". The remaining types of actors – with the exception of non-participants – contributed to the emergence of interdisciplinary structures less intentionally, but through filling the

organisational shell with life. While the interdisciplinary academics as a type of strategic actor showed particularly high degrees of disciplinary reflexivity (see Wilkinson, 1988, for detail on how reflexivity relates to different academic paradigms and norms), other types of actors experienced lower levels of disciplinary reflexivity and integration.

As psychological studies on interdisciplinarity have shown, reflecting on one's own disciplinary perspectives constitutes part of a set of interdisciplinary competences, and – in interplay with taking initiative for exchange across disciplinary boundaries, target group-specific communication, and knowledge integration – can contribute to satisfaction and effectiveness of interdisciplinary teams (Claus, 2019; Claus & Wiese, 2021). It seems that reflexivity is also important in achieving structural change towards interdisciplinarity. As Giddens (1984, p. 3) argues, "it is the specifically reflexive form of the knowledgeability of human agents that is most deeply involved in the recursive ordering of social practices". Similarly, Lawrence and Philipps (2019, p. 24) state that "people need first to have some conscious understanding of the workings of the social systems in which they live", before being able to strategically engage in their maintenance of change.

10.3.3 On collective agency and the role of brokers

Despite the proposed distinction into types of interdisciplinary actors, findings underline the importance of shared or collective agency. The interplay between various actors was an important precondition for the emergence and further development of interdisciplinary structures. Strategic agency along would not have mattered if other actors had not followed and engaged in interdisciplinary structures. This aligns with arguments made by Lawrence and Phillips (2019, p. 25), who argue that in order to understand organisational life, agency can no longer be regarded as "individualistic and unitary", but rather "relational and heterogeneous". It was further observed that the design of the case study project positively impacted the agency of

early- and mid-career researchers. Due to the rather large size of the group and their organisation within an interdisciplinary structure of their own, the group felt highly represented and displayed strong collective agency, which, according to McAlpine and Amundsen (2009) constitutes an important element of a positive academic experience for young researchers.

Collective agency and collaboration, particularly in complex setting such as large interdisciplinary projects, can be facilitated by brokers (Klein, 2021) or intermediaries (Ellemers, 2021). Painting collaboration across disciplinary boundaries as brokering work, Klein (2021) argues that brokers can facilitate transactions and flows of information and can resolve conflict between actors. She proposes social network analysis techniques as a possible tool in identifying brokers and communication flows (Klein, 2021). This study has linked qualitative approaches, in particular interviews and focus group discussions, with a social network analysis based on co-publications of participants in the case study project. Findings of qualitative data and the social network analysis largely align, with a strategic actor – specifically a pure interdisciplinarian – also scoring highest in network metrics suitable for identifying brokers. Network metrics further suggest project leadership to constitute high-importance brokers, which aligns with literature on the role of university leaders as enablers of change towards interdisciplinarity (Kroll & Schubert, 2023) – despite the persisting high degrees of academic autonomy in many higher education systems.

10.4 Reflecting on structure, agency, and the directionality of change towards interdisciplinarity

The findings of this study illustrate that the emergence of interdisciplinary structures cannot be understood solely through top-down or bottom-up initiatives. Instead, interdisciplinary structures emerged through a dynamic and recursive interplay of both in a way which resonates with Kezar's (2013) conceptualization of sense-giving and sense-making. Data shows how project participants, in particular the discipline-based and sense-making actors, engaged in interpreting and negotiation the meaning of collaboration within

interdisciplinary structures (sense-making), while strategic actors, in particular the project leaders, contributed by legitimising the project and communicating broader purposes and aims of interdisciplinary collaboration (sense-giving).

Recursive processes of sense-giving and sense-making were particularly evident in planned interdisciplinary structures, which were predominantly established through top-down processes, such as the early- and mid-career researchers' group. While the initial structural form was provided, the actual dynamics of operation and interdisciplinary collaboration within the structure emerged through ongoing, situated practices of sense-making among participants. Through top-down processes, new organisational arrangements were created as a 'shell' that then required the collective agency of participants to become operational for interdisciplinary collaboration. This finding underlines that structural ambitions become actionable only when they are rendered meaningful to those expected to enact them (i.e. the project participants).

On the one hand, there seem to be strong limitations for the top-down imposition of interdisciplinarity. Interdisciplinarity is not only a social practice, but also a cognitive practice, and thus cannot be forced. Data shows that while academics can be incentivised to participate in interdisciplinary structures, the ways in which they actually collaborate within them can vary largely, ranging from non-engagement and the reinforcement of disciplinary perspectives to true inter- and even transdisciplinary moments. Nevertheless, top-down initiatives within the case study project provided an important impetus for interdisciplinary collaboration, exactly through the above-mentioned provision of organisational shells within the context of which participants had the opportunity to develop collective agency.

Interview- and focus group data further suggests that over the project's duration, interdisciplinary exchange has intensified as participants increasingly incorporated perspectives and methods from other disciplines to

address shared questions. This process also entailed a form of interdisciplinary socialization for early- and mid-career researchers, strongly based on their organisation within their own group. Participants reported developing broader theoretical and methodological competencies, learning to 'think outside the box' and applying approaches beyond their disciplinary repertoires. In an interplay of planned and emergent processes, the project thus developed into framework allowing a young generation of academics to cultivated dispositions aligned with interdisciplinary inquiry.

Interpreting these findings through the lens of structuration theory (Giddens, 1984) and inhabited institutionalism (Hallett & Ventresca, 2006) highlights the recursive relationship between emerging structures and the practices through which actors inhabit and reshape them. From a structuration perspective, the interdisciplinary arrangements observed here can be seen as both medium and outcome of social practices. Actors exercised agency not by merely following routines, but by interpreting (making sense of) new social conditions and enacting or refusing new practices. On this note, strategic agency seems to be closely tied to a knowledgeability of social conditions and alternative practices, which relate to findings regarding high degrees of reflexivity of interdisciplinary actors – as already discussed in more detail in the theoretical reflection on the typology of interdisciplinary actors (see Chapter 10.3.2).

Processes of time-space distanciation as proposed by Giddens (1984) were not as evident in data, although data shows that interdisciplinary practices within the case study project were both influenced by organisational routines (in particular regarding existing organisational structures as a barrier to teaching collaborations) as well as influenced organisational routines by integrating non-project participants into interdisciplinary collaborations and through further interdisciplinary collaborations emerging from within the project.

There are, finally, a number of findings relating to Giddens' (1984) concepts of symbolic tokens and expert systems. Symbolic tokens, such as formal titles, roles, and resources, can structure opportunities and expectations for interdisciplinary work. In the case study project, the provision of resources for the hiring of PhD students and post-docs to participating professors functioned as an important incentive. Roles and resources were also employed in the context of the nomination of post-docs as working group coordinators to ensure sustainability of interdisciplinary structures beyond the case study projects' duration. Overall, symbolic tokens and initiatives for legitimacy of interdisciplinary collaboration strongly depended on the project as an organisational framework, which enabled decoupling from the larger organisational structures of the university (see Chapter 10.2.2 with discussion of facilitating factors for more detail). Data shows that expert systems sometimes acted as barriers for the emergence and development of interdisciplinary structures. Epistemic differences in particular, tied to methodological standards and the varying value attached to an output-orientation, acted as barriers and reinforced perceived hierarchies between disciplines. These findings underscore how structures and mechanisms can shape possibilities and constraints for interdisciplinarity in dynamic ways.

However, the findings also demonstrate why structuration theory (Giddens, 1984) alone is insufficient to fully account for the emergence of interdisciplinary structures. While it is an important sensitizing concept for observing how actors reproduce or transform structures, it does not adequately explain why actors are motivated to change established routines, how they negotiate and contest developments, or how such processes unfold through social interaction. Here, inhabited institutionalism (Hallett & Ventresca, 2006) offers an important addition. It foregrounds that institutions are enacted through situated interactions and shared interpretations: "it is not simply what people 'do' that matters, but how they do so 'together'" (Hallett & Ventresca, 2006, p. 216) – and, based on the findings of the study, also: why they do so.

The relational dimension was visible both in the qualitative data generated within the scope of this study, as well as in the social network analysis: even though the network overall showed high degrees of clustering, most of these clusters contained actors from various disciplines, thus suggesting high degrees of interrelatedness across disciplinary boundaries.

11. Conclusion

In the light of increasing political, societal and institutional demands for interdisciplinary knowledge production and teaching, this study has focused on the how and why of interdisciplinarity within academic project settings at universities. Specifically, it aimed at contributing to an understanding transcending barriers to interdisciplinarity by showing how and why interdisciplinary structures can successfully emerge within the context of academic projects in universities – hereby making an important theoretical contribution and providing valuable insights for policy-makers, university leaders, as well as academics interested in making structured interdisciplinary collaborations work. For this purpose, a longitudinal, ethnographic, revelatory single-case study of a project for inclusion-oriented and inclusive teacher training at a German university was conducted. The research questions were addressed by employing various methods of data collection and analysis, including participatory observation, two focus group discussions, 24 interviews, document- and website analysis, as well as a social network analysis based on co-publications.

The purpose of this chapter is to draw together the key findings of the study and highlight their significance. Having examined how interdisciplinary structures emerge in an academic project setting at a German university, the following sections reflect on how key insights that have emerged from the analysis and address the contributions of the study. The chapter also considers the contribution to and implications of these findings for higher education research, policy and practice, acknowledges the study's limitations, and proposes directions for future research.

11.1 Answers to the research questions

This study has addressed the following research question:

How do new structures across traditional disciplinary boundaries emerge within project settings at German universities?

In order to answer this question, the research project was guided by a set of sub-questions focussing on the kind of structures that emerge, on participation of actors in these structures, on the initiation of the emergence of these structures, as well as on factors inhibiting or promoting the emergence of interdisciplinary structures.

In the following, key findings will be summarised in order to answer each of these sub-questions and, ultimately, the main research question.

11.1.1 Sub-question 1: What kind of interdisciplinary structures emerge within academic project settings and which actors participate in them?

Within the context of this study, the emergence of three main types of interdisciplinary structures has been observed. These include an early- and mid-career researchers' group, thematic working groups with different theoretical or methodological foci, as well as teaching collaborations. These interdisciplinary structures were found to vary regarding their processes of emergence and dynamics of participation, operation, and collaboration. Findings show that a distinction of planned – sometimes even prescribed through the project proposal – versus emergent structures – depending on the initiative of individual actors – is warranted, whereas in practice, the processes of the establishment and further development of interdisciplinary structures were based on a complex interplay of top-down and bottom-up processes.

All of the observed interdisciplinary structures had a strong focus on the core areas of academic work, i.e. teaching and/or research. Even structures initially intended to focus on exchange regarding organisational matters, in particular the early- and mid-career researchers' group, evolved a focus on teaching and research. Collaboration within the structures led to the creation of several outcomes, which included traditional scholarly outputs such as publications and conference publications, but also extended to teaching materials, the creation of technical infrastructure for teaching and research purposes, as well as further collaborations outside of the case study projects' authority.

Despite initial attempts, it was not possible to clearly define the degree of interdisciplinarity of the different interdisciplinary structures. Instead, data points to the existence of 'multiple interdisciplinarities' within them, showing that experiences of individual project participants regarding their collaboration practices may vary even within the very same structure. The case study project brought together a large number of scientific disciplines and could thus be considered as a multidisciplinary setting per se. However, collaboration within project structures has often exceeded multidisciplinarity, with data pointing to the existence of cross- and interdisciplinary collaboration as the most prevalent form, of pluri-disciplinary collaborations characterised by a lower degree of disciplinary integration in certain instants, as well as of transdisciplinary collaboration (most of which tied to work within the living-lab type working group) in a few situations.

11.1.2 Sub-question 2: How do these actors contribute to the emergence of interdisciplinary structures and what motivates them to do so?

Within the scope of this study, different types and categories of actors were identified. From a formal perspective, based on their official roles and titles, actors included early- and mid-career researchers (PhD students and post-docs), professors, project leaders, as well as project administrators. From an agentic perspective, taking into consideration actors' engagement in and motivation for collaboration across disciplinary boundaries, as well as their contribution to the emergence of interdisciplinary structures, a much more nuanced and complex picture emerged, resulting in a typology distinguishing non-involved, discipline-based, sense-making, and strategic actors, whereas strategic actors are further differentiated into pure interdisciplinarians and pragmatic interdisciplinarians.

The *non-involved actor* does not participate or participates to a very small degree and does not contribute to the emergence of interdisciplinary structures. Engagement is mono- or multidisciplinary and does not have consequences for individual academic practices. The *routine actor*

participates and contributes to the emergence of interdisciplinary structures based on previous research interests and collaborations. Engagement varies between pluri- and interdisciplinarity, but is strongly tied to already established practices.

The *discipline-based actor* participates in interdisciplinary structures for specific purposes, such as progressing their individual research project, and contributes little to their emergence. Engagement is usually of pluridisciplinary nature and results in a reinforcement of disciplinary perspectives. The *sense-making actor* participates in interdisciplinary structures beyond seeking benefits for their individual research project. They contribute to the further development of structures by filling them with life. Their denomination is derived from their continuous engagement in sense-making activities, including their search for disciplinary synergies and pursuit of common definitions within the project, for which they cross disciplinary boundaries.

The *strategic actor* strategically contributes to the emergence and development of interdisciplinary structures. They display a high degree of intrinsic motivation, grounded in either a natural predisposition towards interdisciplinarity (*the pure interdisciplinarian*) or the perceived importance of interdisciplinary collaboration for addressing the societal challenge of inclusion in (higher) education settings (*the pragmatic interdisciplinarian*).

Overall, data did not point to links between agency for interdisciplinarity and project participants' status group. It cannot be denied that certain actors within the project had more power to influence the work of others (e.g. professors, who acted as superiors of PhD students and post-docs) and that project leadership held a central role in protecting and legitimising interdisciplinarity. Yet, we found that the emergence of and, in particular, successful collaboration within interdisciplinary structures was influenced by highly dedicated actors from different status groups. Data does not reveal clear relationships between disciplinary affiliation and interdisciplinary

agency, although transdisciplinary collaborations seemed more prevalent among project participants from the social sciences and humanities. Finally, both representatives of *Fachwissenschaften* (disciplines) as well as of *Fachdidaktiken* (sciences of teaching and learning of subject matters of specific disciplines) were represented across categories of the typology. There are, however, indications for differences regarding collaboration preferences between the groups, in particular regarding participation in dialogue-oriented versus output-oriented formats.

11.1.3 Sub-question 3: Which factors inhibit or promote the emergence of interdisciplinary structures in academic project settings?

Barriers and challenges to, as well as facilitators for the emergence of interdisciplinary structures were identified on different levels, namely the individual level, the organisational level, as well as the supra-organisational level. It is important to acknowledge that these levels exist in co-relationship and continuously influence each other, especially against the background of assumptions based on structuration theory (Giddens, 1984). On the individual level, challenges included workload, a lack of time and resources, as well as individual conflict. Facilitators on this level, on the other hand, included previous ties and interdisciplinary experiences as well as sympathy and trust among participants.

On the organisational level, pre-existing organisational structures of the larger university were identified as the central challenge, whereas freedom and legitimacy created through the project as an organisational framework, as well as appreciation and encouragement acted as facilitators. Dynamics of leadership emerged as both challenging and facilitating factors. On the one hand, project leaders provided legitimisation and protection from the power of faculties, and contributed to the emergence of interdisciplinary structures by providing meeting spaces, defining frameworks for structures, and encouraging participation. On the other hand, leadership was criticised for a lack of transparency and was constantly challenged by project participants

pushing for more autonomy in their work, resulting in the question of how much leadership is enough or too much in the context of interdisciplinarity in academic project settings.

Factors on the supra-organisational level largely concerned the organisation of academic careers and academic disciplines. Disciplinary differences and conflict (as well as epistemic conflicts between disciplines, *Fachwissenschaften*, and subject didactics, *Fachdidaktiken*), disciplinary languages and a resulting lack of understanding constituted challenges to the emergence of interdisciplinarity. In contrast, disciplinary similarity and the development of shared aims and understanding across disciplinary boundaries constituted facilitators. At last, academic career structures were identified as a barrier to the sustainability of interdisciplinary structures, as early- and mid-career researchers who were particularly numerous and active and enjoyed a strong interdisciplinary socialisation (also identified as a facilitator in the context of interdisciplinary experiences) had fixed-term contracts and were likely to leave the case study university soon after the end of the project.

This study further shows that large interdisciplinary initiatives bringing together a high number of academics from different disciplines with different aims, understanding of key concepts, and preferences for collaboration formats can successfully capitalise upon such differences by providing different interdisciplinary formats, i.e. a mix of ad-hoc and short term versus more structured formats as well as formats with different thematic foci). It also shows that the diverse needs and preferences of participants in large interdisciplinary initiatives are best addressed by a diverse leadership team, for example in terms of disciplinary background and gender.

11.1.4 Overall conclusion: How do structures emerge across disciplinary boundaries in academic project settings?

The emergence of interdisciplinary structures in academic project settings constitutes a dynamic social process shaped by both structural conditions and collective agency. Interdisciplinary structures within the context of this study did not fully emerge from formal, top-down intervention, nor were they fully dependent on individual, bottom-up initiative. Rather, they were produced in a continual interplay of institutional arrangements, incentives, social interactions, and actors' shared efforts to make sense of, and give meaning to collaboration across disciplinary boundaries.

For this, the agency of different types of actors is required. Within the context of the case study project, routine actors (continuing previous research interests and collaborations, embedding them into new contexts), sense-making actors (engagement in sense-making activities through search for disciplinary synergies and common definitions) and strategic actors (strategically contributing to interdisciplinarity based on high degrees of intrinsic motivation) were identified as important for the emergence and further development of interdisciplinary structures. This study shows that financial incentives, i.e. access to resources, have constituted an important starting point for interdisciplinary structures, as they motivated participants to engage in the multidisciplinary setting of a research and teaching innovation project in the first place. Collaboration with higher degrees of disciplinary integration, however, and strategic agency specifically, depended on other motives, in particular the pursuit of scientific advances (puzzle) and intrinsic motivation.

The emergence of interdisciplinary structures was influenced by several challenges and facilitators on the individual, the organisational, and the supra-organisational level. Most of the identified challenges were grounded in differences in epistemic cultures and practices and the strongly discipline-based organisation of university structures, and resulting coordination efforts.

While many of the identified facilitators seem unsurprising and directly corresponded to these barriers, the findings of this study bear some interesting insights for the support of interdisciplinarity in academic project settings: For one, appreciation and encouragement at a project as well as on institutional level appeared as highly relevant factors. Secondly, large interdisciplinary projects can benefit from addressing the diverse needs and preferences of participants through the provision of a variety of interdisciplinary formats and structures. At last, protection – in particular vis-à-vis traditional university structures –, legitimacy, and flexibility were identified as crucial factors for the success of interdisciplinary endeavours. Within the context of the case study, this was largely achieved through the project as an organisational framework, which facilitated deviation from formal structures.

11.2 Contributions and implications of the study

This study has several theoretical and empirical contributions as well as practical implications, which will be discussed in the following paragraphs of this section.

11.2.1 Theoretical and empirical contributions

This study advances the understanding of the emergence interdisciplinary structures in multiple ways:

Firstly, it contributes to the theoretical discussion by framing interdisciplinarity not as a purely planned structural arrangement, but highlighting its emergent properties within the context of academic project settings. The findings illustrate that interdisciplinary structures are shaped as much by micro-level sensemaking as by institutional frameworks. They show that meaningful interdisciplinary collaboration and sustainable interdisciplinary structures depend on the recursive interactions between top-down and bottom-up processes, and that interdisciplinary structures need to be conceptualised as flexible and evolving social constructs rather than fixed organisational units.

Secondly, it extends the body of existing literature on interdisciplinarity by not only confirming findings regarding barriers to interdisciplinarity (which largely align with existing literature), but by providing rare empirical evidence of facilitating factors for interdisciplinarity.

Thirdly, it proposes a typology of change-agents for the specific context of interdisciplinarity, which advances understanding of how and why different types of actors engage in and contribute to interdisciplinarity.

The study further informs organisational theory in higher education by demonstrating how micro-interactional dynamics interact with meso-level structures, and by showing that organisational change towards the emergence of interdisciplinary structure does not only depend on situated interaction and shared interpretation, but heavily relies on the motivation of actors as well. This multi-level perspective on change processes reinforces the view that universities continue to function as loosely coupled systems, in which formal structures only partially determine academic practices. Moreover, findings from this study show how projects as a form of temporary organisation can facilitate deviation from formal structures and establish a bounded but flexible organisational framework in which disciplinary boundaries become more permeable.

Additionally, the study makes an empirical contribution by confirming assumptions of a theoretical framework proposed by Kroll & Schubert in 2023. Although data collection and, to a large extent, also analysis for this research project had already been conducted when the authors published their framework, findings of this study largely confirm their assumptions regarding new and temporary scripts being articulated by leadership, the role of leadership in legitimising interdisciplinarity and convening researchers, as well as the importance of collective agency in facilitating change towards interdisciplinarity.

Finally, the findings of this study, in particular with regard to facilitators and barriers, are likely not unique to the context of interdisciplinary structures, but may help to understand other contexts in which practices are integrated or coordinated across different domains.

11.2.2 Implications for policy and practice

The study bears several implications for design and facilitation of interdisciplinary initiatives. Findings underscore the importance of a careful design of interdisciplinary initiatives, ensuring the provision of enough guidance for academics to come together, but leaving enough freedom for meaningful collaboration to emerge. Data shows that mere participation in interdisciplinary structures can be steered by responding to actors' extrinsic motivation, including access to resources and legitimacy vis-à-vis other actors within the university. However, intrinsic motivation seems indispensable for collaborations with a higher level of disciplinary integration, as well as strategic agency for interdisciplinarity.

Based on findings regarding disciplinary differences and languages, academic leaders should invest in times and spaces in which academics can meet and develop the trust and shared understanding needed for interdisciplinary collaboration. Further – and particularly in larger interdisciplinary initiatives – they should recognise the diversity of involved academics and employ a 'one-size-does-not-fit-all' approach, providing a variety of interdisciplinary formats and structures to meet their varying needs and preferences.

Regarding policy and practices on the institutional level, the findings of this study call for a re-evaluation of assessment strategies, especially regarding teaching loads, so that collaborative processes such as team teaching can be recognised more easily. Further, administrative and funding mechanisms should allow for a more dynamic distribution to facilitate engagement across faculty boundaries.

Finally, given findings regarding the complexity of interdisciplinary initiatives, I propose funding policies that allow for a longer duration of

interdisciplinary projects to enable the complex dynamics associated with disciplinary boundary crossing to fully evolve.

11.3 Limitations

This study is based on a longitudinal, ethnographic, single-case design. Based on this design, it was able to create "concrete, context-dependent knowledge" (Ridder, 2017, p. 298) with regard to a phenomenon not yet properly understood so far: the emergence of interdisciplinary structures within universities. While such a design can contribute to theory-making (Yin, 2009), the design does not allow for generalisation in a statistical sense.

Besides this design choice, the study has a number of further limitations. For one, respondents from the natural sciences and from engineering were comparatively underrepresented in the sample of interview partners, which may have led to an over-representation of perspectives of respondents from the social sciences and humanities. The strong intertwining of teaching and research due to third-party funding line as well as the subject of the case study project (inclusion within the context of teacher training) may distort findings regarding the focus and of outputs of interdisciplinary structures.

The context of teacher training has two additional implications for the interpretation of findings. For one, it added an additional layer of epistemic complexity through the representation of both representatives of disciplines (*Fachdidaktiken*) and of subject-didactics (*Fachwissenschaften*), which may have distorted findings regarding disciplinary differences. Moreover, career-paths in the context of teacher training may not necessarily correspond to traditional academic career paths. Early career researchers are not unlikely to leave academia for a tenured civil servant status in school teaching, which is common in most German federal states. This may explain why in contrast arguments made in existing literature, the lack of recognition of interdisciplinarity for traditional academic career paths was not reported as a challenge in this study.

A critical reflection on the research process further reveals strengths and weaknesses of the combination of a social network analysis with qualitative data. On the one hand, this approach allowed for triangulation of data. On the other hand, the limited time-frame of data collection for the social network analysis constitutes a weakness and is expected to mirror only part of the underlying social processes, in particular focussing on a highly formalised scholarly output such as publications. Further research could be employed to extent the time-frame of the network analysis and account for time lags between collaborative processes and collaborative outcomes.

Finally, the case study was based within the context of German higher education. While the German higher education system mirrors a number of broader changes that are observed across higher education systems world-wide, it has a number of unique features – including a particularly strongly discipline-based structure of higher education institutions and high levels of academic autonomy –, which may hamper generalization into other contexts.

11.4 Further research

Based on the findings of this study and the above-presented limitations, several avenues for future research are proposed. Outcomes of interdisciplinary collaboration have emerged as an important topic during analysis, despite not having been at the focus of the study. Outcomes of interdisciplinary collaboration have, so far, been mainly regarded in the form of traditional scholarly output, such as publications, and interdisciplinary publications have mainly been studied from a quantitative perspective, including large scientometric studies (Leahey et al., 2017), in the past. Therefore, qualitative studies studying different types of outcomes of interdisciplinary collaboration as social artefacts are warranted. I particularly call for studies which focus in-depth on which knowledge is perceived as legitimate, which voices are recognised, and how different disciplines translate ideas across boundaries – all while paying specific attention to perceived disciplinary hierarchies.

The focus of this dissertation has been on the study of social structures and (collective) agency. However, interdisciplinary collaboration is much more complex. Future research could expand the findings of this study by not only focussing on social integration, but showing how cognitive integration takes place in the context of interdisciplinary collaboration and how it contributes to the emergence of sustainable, interdisciplinary structures. Moreover, further research is needed in order to understand how academics engage in 'boundary work' (Klein, 2021) within the context of interdisciplinary structures, how they link knowledge and methods from different disciplines and produce new knowledge (and what kind of knowledge) relevant across them.

A possible conceptual framework for such undertakings could be constituted by social symbolic work as proposed by Lawrence and Phillips (2019). The authors address structural and symbolic changes, focussing on discursive and counter-discursive work, on the identity work of researchers, on translation work, as well as on legitimacy work within the context of change. Within the context of interdisciplinarity, a focus on translation work – how is interdisciplinary interpreted and lived in local context? – and identity work – how does the navigation of competing epistemological frameworks and disciplinary cultures affect academic identity? (Leišytė & Rose, 2024) – seems particularly pertinent.

12. References

Albert, M., Paradis, E., & Kuper, A. (2015). Interdisciplinary promises versus practices in medicine: The decoupled experiences of social sciences and humanities scholars. *Social Science & Medicine*, *126*, 17–25.

Alvargonzález, D. (2011). Multidisciplinarity, Interdisciplinarity, Transdisciplinarity, and the Sciences. *International Studies in the Philosophy of Science*, *25*(4), 387–403. https://doi.org/10.1080/02698595.2011.623366

Alvesson, M. (2003). Methodology for close up studies – struggling with closeness and closure. *Higher Education*, *46*(2), 167–193. https://doi.org/10.1023/A:1024716513774

Alvesson, M., Hardy, C., & Harley, B. (2008). Reflecting on reflexivity: Reflexive textual practices in organization and management theory. *Journal of Management Studies*, *45*(3), 480–501. https://doi.org/10.1111/j.1467-6486.2007.00765.x

Audi, R. (2002). Introduction: A narrative survey of classical and contemporary positions in epistemology. In M. Huemer (Ed.), *Epistemology: Contemporary readings* (pp. 1–24). Routledge.

Aula, H.-M., & Tienari, J. (2011). Becoming "world-class"? Reputation-building in a university merger. *Critical Perspectives on International Business*, *7*(1), 7–29. https://doi.org/10.1108/17422041111103813

Ávila-Robinson, A., Mejia, C., & Sengoku, S. (2021). Are bibliometric measures consistent with scientists' perceptions? The case of interdisciplinarity in research. *Scientometrics*, *126*(9), 7477–7502. https://doi.org/10.1007/s11192-021-04048-0

Bahrdt, H. P. (1975). Erzählte Lebensgeschichten von Arbeitern. In M. Osterland (Ed.), *Arbeitssituation, Lebenslage und Konfliktpotential* (pp. 9–37). Suhrkamp.

Bailey, F. G. (1977). *Morality and expediency: The folklore of American politics*. Blackwell.

Baldridge, J. V. (Ed.). (1983). *The dynamics of organizational change in education*. McCutchan.

Balliet, D., & van Lange, P. A. M. (2013). Trust, conflict, and cooperation: A meta-analysis. *Psychological Bulletin*, *139*(5), 1090–1112.

Bamkin, M., Maynard, S., & Goulding, A. (2016). Grounded theory and ethnography combined. *Journal of Documentation*, *72*(2), 214–231. https://doi.org/10.1108/JD-01-2015-0007

Barbier, M., Cerf, M., & Barrier, J. (2005). *Projects as learning agency at organization borders: A resource for organizational learning?* Communication to the Sixt International Conference on

Organizational Learning and Knowledge, University of Trento, 9-11 June 2005.
Barley, S. R., & Tolbert, P. S. (1997). Institutionalization and Structuration: Studying the Links between Action and Institution. *Organization Studies*, *18*(1), 93–117.
Barringer, S. N., Leahey, E., & Salazar, K. (2020). What catalyzes research universities to commit to interdisciplinary research? *Research in Higher Education*, *61*(6), 679–705. https://doi.org/10.1007/s11162-020-09603-x
Bastian, M., Heymann, S., & Jacomy, M. (2009). Gephi: An open source software for exploring and manipulating networks. *Proceedings of the International AAAI Conference on Web and Social Media*, *3*(1), 361–362. https://doi.org/10.1609/icwsm.v3i1.13937
Bates, T. (2000). *Managing technological change: Strategies for college and university leaders*. Jossey-Bass.
Becher, T. (1994). The significance of disciplinary differences. *Studies in Higher Education*, *19*(2), 151–161. https://doi.org/10.1080/03075079412331382007
Becher, T. (2006). Towards a definition of disciplinary cultures. *Studies in Higher Education*, *6*(2), 109–122. https://doi.org/10.1080/03075078112331379362
Becher, T., & Kogan, M [M.]. (1980). *Process and Structure in Higher Education*. Heinemann Educational Books.
Becher, T., & Trowler, P. R. (2001). *Academic Tribes and Territories: Intellectural enquiry and the culture of disciplines*. The Society for Research into Higher Education & Open University Press.
Benson, T. L. (1982). Five arguments against interdisciplinary studies. *Issues in Integrative Studies*, *1*, 38–48. https://www.oakland.edu/assets/upload/docs/ais/issues-in-interdisciplinary-studies/1982-volume-01/02_vol_1_pp_38-48_five_arguments_against_interdisciplinary_studies_(thomas_c._benson).pdf
Berman, E. P. (2011). *Creating the market university: How academic science became an economic engine*. Princeton University Press.
Bernstein, J. H. (2015). Transdisciplinarity: A review of its origins, development, and current issues. *Journal of Reseach Practice*, *11*(1), Article R1.
Bess, J. L., & Dee, J. R. (2008). *Understanding college and university organization: Dynamics of the system*. Stylus Publishing.
Bhaskar, R., Danermark, B., & Price, L. (2018). *Interdisciplinarity and wellbeing: A critical realist general theory of interdisciplinarity*. Routledge.

Biagioli, M. (1998). The Instability of Authorship: Credit and responsibility in contemporary biomedicine. *The FASEB Journal*, *12*(!), 3–16.

Björk, B.-C., & Solomon, D. (2013). The publishing delay in scholarly peer-reviewed journals. *Journal of Informetrics*, *7*(4), 914–923. https://doi.org/10.1016/j.joi.2013.09.001

Bleiklie, I., Enders, J., & Lepori, B. (2015). Organizations as penetrated hierarchies: Environmental pressures and control in professional organizations. *Organization Studies*, *36*(7), 873–896. https://doi.org/10.1177/0170840615571960

Bleiklie, I., Enders, J., Lepori, B., & Musselin, C. (2016). New public management, network governance and the university as a changing professional organization. In T. Christensen & P. Lægreid (Eds.), *The Ashgate research companion to new public management* (pp. 161–176). Routledge.

Blömeke, S. (2000). Zentren für Lehrerbildung: Element universitärer Organisationsentwicklung. *Das Hochschulwesen*, *48*(2), 124–130.

Blondel, V. D., Guillaume, J.-L., Lambiotte, R., & Lefebvre, E. (2008). Fast unfolding of communities in large networks. *Journal of Statistical Mechanics: Theory and Experiment*, *2008*(10), P10008. https://doi.org/10.1088/1742-5468/2008/10/P10008

Boer, H. de, Enders, J., & Schimank, U. (2007). On the way towards new public management? The governance of university systems in England, the Netherlands, Austria, and Germany. In D. Jansen (Ed.), *New forms of governance in research organizations: Disciplinary Approaches, Interfaces and Integration* (pp. 137–152). Springer.

Boix-Mansilla, V., & Duraising, E. D. (2007). Targeted assessment of students' interdisciplinary work: An empirically grounded framework proposed. *The Journal of Higher Education*, *78*(2), 215–237.

Boix-Mansilla, V., & Gardner, H. (2003). *Assessing Interdisciplinary Work at the Frontier: An Empirical Exploration of "Symptoms of Quality"*. https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=http://www.interdisciplinarystudiespz.org/pdf/VBM-Gardner_AssessingSymptoms_2003.pdf&ved=2ahUKEwi6iLT58eWUAxXB0AIHHaC-MhEQFnoECBcQAQ&usg=AOvVaw268QVUMFdc1VsB_vMOdBHl

Borgdorff, H. (2012). *The conflict of the faculties: Perspectives on artistic research and academia*. Leiden University Press.

Börner, K., Contractor, N., Falk-Krzesinski, H. J., Fiore, S. M., Hall, K. L., Keyton, J., Spring, B., Stokols, D., Trochim, W., & Uzzi, B. (2010). A multi-level systems perspective for the science of team science.

Science Translational Medicine, *2*(49), 49cm24. https://doi.org/10.1126/scitranslmed.3001399

Bozeman, B., & Boardman, P. C. (2003). *Managing the new multipurpose, multidiscipline university research centers: Institutional innovation in the academic community*. IBM Center for The Business of Government.

Bozeman, B., & Corley, E. (2004). Scientists' collaboration strategies: Implications for scientific and technical human capital. *Research Policy*, *33*(4), 599–616.

Brewer, G. D. (1999). The challenges of interdisciplinarity. *Policy Sciences*, *32*, 327–337.

Brint, S. (2005). Creating the future:'New directions' in American research universities. *Minerva*, *43*(1), 23–50.

Brint, S., Turk-Bicakci, L., Proctor, K., & Murphy, S. P. (2009). Expanding the social frame of knowledge: Interdisciplinary, degree-granting fields in American colleges and universities, 1975-2000. *The Review of Higher Education*, *32*(2), 155–183. https://doi.org/10.1353/rhe.0.0042

Brister, E. (2017). *Epistemological obstacles to interdisciplinary research*. Blog entry. https://i2insights.org/2017/10/31/epistemology-and-interdisciplinarity/

Bromham, L., Dinnage, R., & Hua, X. (2016). Interdisciplinary research has consistently lower funding success. *Nature*, *534*(7609), 684–687. https://doi.org/10.1038/nature18315

Broucker, B., Leišytė, L., De Wit, K., & Verhoeven, J. C. (2019). Understanding higher education system reform: Practices, patterns and pathways. In B. Broucker, K. De Wit, J. C. Verhoeven, & L. Leišytė (Eds.), *Higher Education System Reform: An International Comparison after Twenty Years of Bologna* (pp. 221–238). Brill.

Brown-Saracino, J., Thurk, J., & Fine, G. A. (2011). Beyond groups: Seven pillars of peopled ethnography in organizations and communities. In P. Atkinson & S. Delamont (Eds.), *Sage Qualitative Research Methods* (pp. 91–112). Sage.

Bryant, A., & Charmaz, K. (2007). *The Sage handbook of grounded theory*. Sage.

Burt, R. S. (2008). *Brokerage and closure: An introduction to social capital*. Oxford University Press.

Butler, S. (1996). Child protection or professional self-preservation by the baby nurses? Public health nurses and child protection in Ireland. *Social Science & Medicine*, *43*, 303–314.

Capano, G., & Regini, M. (2014). Governance reforms and organizational dilemmas in European universities. *Comparative Education Review*, *58*(1), 73–103.

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. Sage.

Clark, B. R. (1983). *The higher education system: Academic organization in cross-national perspective*. University of California Press.

Clarke, A. E. (2003). Situational analyses: Grounded theory mapping after the postmodern turn. *Symbolic Interaction*, *26*(4), 553–576.

Claus, A. M. (2019). *Interdisziplinarität im Arbeits- und Studienkontext: Eine psychologische Perspektive* [PhD dissertation]. RWTH Aachen University. https://doi.org/10.18154/RWTH-2020-01843

Claus, A. M., & Wiese, B. S. (2021). Interdisziplinäre Kompetenzen: Modellentwicklung und diagnostische Zugänge. *Gruppe. Interaktion. Organisation: Zeitschrift Für Angewandte Organisationspsychologie*, *52*(2), 279–288. https://doi.org/10.1007/s11612-021-00578-6

Cohen, M. D., March, J. G., & Olsen, J. P. (1972). A garbage can model of organizational choice. *Administrative Science Quarterly*, 1–25.

Corbin, J. M., & Strauss, A. (1990). Grounded theory research: Procedures, canons, and evaluative criteria. *Qualitative Sociology*, *13*(1), 3–21.

Cummings, J. N., & Kiesler, S. *Who works with whom? Collaborative tie strength in distributed interdisciplinary projects.* Third International e-Social Science Conference.

Cummings, J. N., & Kiesler, S. (2005). Collaborative research across disciplinary and organizational boundaries. *Social Studies of Science*, *35*(5), 703–722.

Cummings, J. N., & Kiesler, S. (2008). Collaborative Research across Disciplinary and Organizational Boundaries. In G. M. Olson, A. Zimmerman, & N. Bos (Eds.), *Acting with technology. Scientific collaboration on the Internet* (pp. 99–118). MIT Press. https://doi.org/10.7551/mitpress/7482.003.0010

Darbellay, F. (2015). Rethinking inter- and transdisciplinarity: Undisciplined knowledge and the emergence of a new thought style. *Futures*, *65*, 163–174. https://doi.org/10.1016/j.futures.2014.10.009

Dee, J. R., & Leišytė, L. (2017). Knowledge sharing and organizational change in higher education. *The Learning Organization*, *24*(5), 355–365. https://doi.org/10.1108/TLO-04-2017-0034

Dee, J. R., Leišytė, L., & van der Meulen, B. J. R. (2023). Conceptualizing higher education transformation: Introduction to the Research Handbook on the Transformation of Higher Education. In L. Leišytė, J. R. Dee, & B. J. R. van der Meulen (Eds.), *Elgar handbooks in education. Research handbook on the transformation of higher education* (2–22). Edward Elgar Publishing. https://doi.org/10.4337/9781800378216.00006

Defila, R., & Di Guilio, A. (1999). Interdisziplinarität als Herausforderung an die Lehre. In W. Umstätter & K.-F. Wessel (Eds.), *Interdisziplinarität: Herausforderung an die Wissenschaftlerinnen und Wissenschaftler* (pp. 108–118). Kleine.

DFG. (2017). *DFG Classification of Scientific Disciplines, Research Areas, Review Boards and Subject Areas (2016-2019)*. https://www.dfg.de/resource/blob/172318/59d71d69539b6e393aee68ffb976b0c5/fachsystematik-2016-2019-en-grafik-data.pdf

Dill, D. D. (1982). The management of academic culture: Notes on the management of meaning and social integration. *Higher Education*, *11*(3), 303–320.

DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, *48*(2), 147. https://doi.org/10.2307/2095101

Dobbins, M., & Knill, C. (2015). Reformen der Hochschulsteuerung in Deutschland: Vom Humboldtismus zum „gezähmten Markt"? In J. Schrader, J. Schmid, K. Amos, & A. Thiel (Eds.), *Governance von Bildung im Wandel: Interdisziplinäre Zugänge* (pp. 175–201). Springer. https://doi.org/10.1007/978-3-658-07270-4_8

Donina, D., Seeber, M., & Paleari, S. (2017). Inconsistencies in the governance of interdisciplinarity: The case of the Italian higher education system. *Science and Public Policy*, *44*(6), 865–875. https://doi.org/10.1093/scipol/scx019

Doyle, T., & Brady, M. (2018). Reframing the university as an emergent organisation: Implications for strategic management and leadership in higher education. *Journal of Higher Education Policy and Management*, *40*(4), 305–320. https://doi.org/10.1080/1360080X.2018.1478608

Dresing, T., Pehl, T., & Schmieder, C. (2015). *Manual (on) Transcription: Transcription Conventions, Software Guides and Practical Hints for Qualitative Researchers*. http://www.audiotranskription.de/english/

Dunne, C. (2011). The place of the literature review in grounded theory research. *International Journal of Social Research Methodology*, *14*(2), 111–124.

Duysburgh, P., Naessens, K., Konings, W., & an Jacobs (2012). Collaboration in a multidisciplinary, distributed research organization: A case study. *Higher Education Policy*, *25*(3), 267–288. https://doi.org/10.1057/hep.2012.13

Eckel, P. D. (2006). *The shifting frontiers of academic decision making: Responding to new priorities, following new pathways*. ACE/Praeger.

Eckel, P. D., & Kezar, A. (2003). *Taking the Reins: Institutional Transformation in Higher Education*. Praeger Publishers/American Council on Education.

Ellemers, N. (2021). Science as collaborative knowledge generation. *British Journal of Social Psychology*, *60*(1), 1–28. https://doi.org/10.1111/bjso.12430

Engwall, L. (2018). Structural Conditions for Interdisciplinarity. *European Review*, *26*(S2), 30-40.

Fam, D., Clarke, E., Freeth, R., Derwort, P., Klaniecki, K., Kater-Wettstädt, L., Juarez-Bourke, S., Hilser, S., Peukert, D., Meyer, E., & Horcea-Milcu, A.-I. (2020). Interdisciplinary and transdisciplinary research and practice: Balancing expectations of the 'old' academy with the future model of universities as 'problem solvers'. *Higher Education Quarterly*, *74*(1), 19–34. https://doi.org/10.1111/hequ.12225

Fielding, N. G. (2012). Triangulation and mixed methods designs: Data integration with new research technologies. *Journal of Mixed Methods Research*, *6*(2), 124–136.

Freeman, T. (2006). 'Best practice'in focus group research: making sense of different views. *Journal of Advanced Nursing*, *56*(5), 491–497.

Funtowicz, S. O., & Ravetz, J. R. (1993). The emergence of post-normal science. In R. von Schomberg (Ed.), *Science, politics and morality: Scientific uncertainty and decision making* (pp. 85–123). Springer.

Georghiou, L. (1998). Global cooperation in research. *Research Policy*, *27*(6), 611–626. https://doi.org/10.1016/S0048-7333(98)00054-7

German Federal Statistical Office. (2025). *Institutions of higher education*. https://www.destatis.de/EN/Themes/Society-Environment/Education-Research-Culture/Institutions-Higher-Education

Gerring, J. (2011). *Social science methodology: A unified framework*. Cambridge University Press.

Geschwind, L. (2019). Legitimizing change in higher education: Exploring the rationales behind major organizational restructuring. *Higher Education Policy*, *32*(3), 381–395. https://doi.org/10.1057/s41307-018-0088-6

Gibbons, M., Limoges, C., Nowotny, H., Schwartzmann, S., Scott, P., & Trow, M. (1994). *The new production of knowledge: The dynamics of science and research in contemporary societies*. Sage.

Giddens, A. (1979). *Central problems in social theory*. *Contemporary Social Theory*. Red Globe Press. https://doi.org/10.1007/978-1-349-16161-4?locatt=label:secondary_bloomsburyCollections

Giddens, A. (1984). *The constitution of society: Outline of the theory of structuration*. University of California Press.

Gioia, D. A., & Pitre, E. (1990). Multiparadigm perspectives on theory building. *Academy of Management Review*, *15*(4), 584–602.
Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory*. Aldine.
Gordon, M. D. (1980). A critical reassessment of inferred relations between multiple authorship, scientific collaboration, the production of papers and their acceptance for publication. *Scientometrics*, *2*(3), 193–201. https://doi.org/10.1007/bf02016697
Gornitzka, Å., & Maassen, P. (2000). Analyzing organizational change in higher education. In R. Kalleberg (Ed.), *Comparative perspectives on universities* (pp. 83–99). Jai Press. https://doi.org/10.1016/S0195-6310(00)80021-6
Granovetter, M. (1973). The strength of weak ties. *American Journal of Sociology*, *78*(6), 1360–1380.
Grills, N. J., Robinson, P., & Phillip, M. (2012). Networking between community health programs: A case study outlining the effectiveness, barriers and enablers. *BMC Health Services Research*, *12*(1), 206. https://doi.org/10.1186/1472-6963-12-206
Hackett, E. J. (2005). Introduction to the special guest-edited issue on scientific collaboration. *Social Studies of Science*, *35*(5), 667–671. https://doi.org/10.1177/0306312705057569
Hage, J. T. (1999). Organizational innovation and organizational change. *Annual Review of Sociology*, *25*(1), 597–622.
Hallett, T., & Ventresca, M. J. (2006). Inhabited Institutions: Social Interactions and Organizational Forms in Gouldner's Patterns of Industrial Bureaucracy. *Theory and Society*, *35*(2), 213–236. https://doi.org/10.1007/s11186-006-9003-z
Hammersley, M. (1992). *What is wrong with ethnography?* Routledge.
Hansson, F., & Mønsted, M. (2012). Changing the peer review or changing the peers: Recent development in assessment of large research collaborations. *Higher Education Policy*, *25*(3), 361–379. https://doi.org/10.1057/hep.2012.17
Hardy, C., Langley, A., Mintzberg, H., & Rose, J. (1983). Strategy formation in the university setting. *The Review of Higher Education*, *6*(4), 407–433.
Harman, K. M. (1989). Culture and conflict in academic organisation: Symbolic aspects of university worlds. *Journal of Educational Administration*.
Heckhausen, H. (1972). Discipline and interdisciplinarity. In L. Apostel, G. Berger, A. Briggs, & G. Michaud (Eds.), *Interdisciplinarity: Problems of teaching and research in universities* (pp. 83–90). OECD.
Hedstrom, P., & Swedberg, R. (1998). *Social mechanisms*. Cambridge University Press.

Henkel, M. (2007). Shifting boundaries and the academic profession. In M. Kogan & U. Teichler (Eds.), *Key Challenges to the Academic Profession* (pp. 192–220). Jenior.

Hericks, U., & Meister, N. (2020). Das Fach im Lehramtsstudium: Theoretische und konzeptionelle Perspektiven. In N. Meister, U. Hericks, R. Kreyer, & R. Laging (Eds.), *Zur Sache. Die Rolle des Faches in der universitären Lehrerbildung: Das Fach im Diskurs zwischen Fachwissenschaft, Fachdidaktik und Bildungswissenschaft* (pp. 3–17). Springer VS. https://doi.org/10.1007/978-3-658-29194-5_1

Hernández, J. M., & Dorta-González, P. (2020). Interdisciplinarity Metric Based on the Co-Citation Network. *Mathematics*, *8*(4), 544. https://doi.org/10.3390/math8040544

Hernandez-Aguilera, J. N., Anderson, W., Bridges, A. L., Fernandez, M. P., Hansen, W. D., Maurer, M. L., Ilboudo Nébié, E. K., & Stock, A. (2021). Supporting interdisciplinary careers for sustainability. *Nature Sustainability*, *4*(5), 374–375. https://doi.org/10.1038/s41893-020-00679-y

Hesburgh, T. M. (1971). The nature of the challenge: Traditional organizations and attitudes of the universities towards contemporary realities. In S. D. Kertesz (Ed.), *The task of universities in a changing world* (pp. 3–11). University of Notre Dame Press.

Hicks, D. (2004). The four literatures of social science. In H. F. Moed, W. Glänzel, & U. Schmoch (Eds.), *Handbook of quantitative science and technology research: The use of publication and patent statistics in studies of S&T systems* (pp. 473–496). Kluwer Academic Publishers. https://doi.org/10.1007/1-4020-2755-9_22

Höhle, E. (2015). Hierarchie in Lehrstuhl und Department: Ein empirischer Vergleich in Europa. In U. Banscherus, O. Engel, A. Mindt, A. Spexard, & A. Wolter (Eds.), *Differenzierung im Hochschulsystem: Nationale und internationale Entwicklungen und Herausforderungen* (pp. 199–220). Waxmann.

Holley, K. A. (2009). Interdisciplinary strategies as transformative change in Higher Education. *Innovative Higher Education*, *34*(5), 331–344. https://doi.org/10.1007/s10755-009-9121-4

Hond, F. den, Boersma, F. K., Heres, L., Kroes, E. H., & van Oirschot, E. (2012). Giddens à la Carte? Appraising empirical applications of Structuration Theory in management and organization studies. *Journal of Political Power*, *5*(2), 239–264. https://doi.org/10.1080/2158379X.2012.698901

Huang, M., & Chang, Y. (2008). Characteristics of research output in social sciences and humanities: From a research evaluation perspective.

Journal of the American Society for Information Science and Technology, *59*(11), 1819–1828. https://doi.org/10.1002/asi.20885
Huber, M. (2005). Reform in Deutschland: Organisationssoziologische Anmerkungen zur Universitätsreform. *Soziologie*, *34*(4), 391–403.
Hüther, O. (2009). Hochschulräte als Steuerungsakteure. *Beiträge Zur Hochschulforschung*, *31*(2), 50–73.
Hüther, O. (2010). *Von der Kollegialität zur Hierarchie?* VS Verlag für Sozialwissenschaften.
Hüther, O., & Krücken, G. (2018). *Higher education in Germany: Recent developments in an international perspective*. Springer. https://doi.org/10.1007/978-3-319-61479-3
Huutoniemi, K. (2016). Interdisciplinarity as academic accountability: Prospects for quality control across disciplinary boundaries. *Social Epistemology*, *30*(2), 163–185. https://doi.org/10.1080/02691728.2015.1015061
Huutoniemi, K., Klein, J. T., Bruun, H., & Hukkinen, J. (2010). Analyzing interdisciplinarity: Typology and indicators. *Research Policy*, *39*(1), 79–88. https://doi.org/10.1016/j.respol.2009.09.011
Jacob, W. J. (2015). Interdisciplinary trends in higher education. *Palgrave Communications*, *1*(1), 1–5. https://doi.org/10.1057/palcomms.2015.1
Jacobs, J. A. (2014). *In defense of disciplines: Interdisciplinarity and specialization in the research university*. University of Chicago Press.
Jacobs, J. A., & Frickel, S. (2009). Interdisciplinarity: A critical assessment. *Annual Review of Sociology*, *35*, 43–65.
Jacomy, M., Venturini, T., Heymann, S., & Bastian, M. (2014). Forceatlas2, a continuous graph layout algorithm for handy network visualization designed for the Gephi software. *PLOS ONE*, *9*(6), e98679. https://doi.org/10.1371/journal.pone.0098679
Jæger, K. (2021). New-style higher education: Disciplinarity, Interdisciplinarity and Transdisciplinarity in the EHEA qualifications framework. *Higher Education Policy*, *34*(1), 155–174. https://doi.org/10.1057/s41307-018-00126-w
Jankvist, U. T. (2011). The construct of anchoring: An idea for 'measuring' interdisciplinarity in teaching. In F. Seroglou, V. Koulountzos, & A. Siatras (Eds.), *Science and culture: Promise, challenge and demand* (pp. 366–370). Epikentro Publications.
Jepperson, R., & Meyer, J. W. (2011). Multiple Levels of Analysis and the Limitations of Methodological Individualisms. *Sociological Theory*, *29*(1), 54–73. https://doi.org/10.1111/j.1467-9558.2010.01387.x
Joas, H. (1987). Giddens' Theory of Structuration. *International Sociology*, *2*(1), 13–26. https://doi.org/10.1177/026858098700200102

Johnson, J. C., Avenarius, C., & Weatherford, J. (2006). The active participant-observer: Applying social role analysis to participant observation. *Field Methods*, *18*(2), 111–134.
Kallenberg, T. (2007). Strategic innovation in HE: The roles of academic middle managers. *Tertiary Education and Management*, *13*(1), 19–33.
Katz, J., & Martin, B. R. (1997). What is research collaboration? *Research Policy*, *26*(1), 1–18. https://doi.org/10.1016/s0048-7333(96)00917-1
Keller, G. (1983). *Academic strategy: The management revolution in American higher education*. The Johns Hopkins University Press.
Kezar, A. (2001). *Understanding and facilitating organizational change in the 21st century: Recent research and conceptualizations*. Jossey-Bass.
Kezar, A. (2013). Understanding sensemaking/sensegiving in transformational change processes from the bottom up. *Higher Education*, *65*(6), 761–780. https://doi.org/10.1007/s10734-012-9575-7
Kiser, E., & Hechter, M. (1991). The role of general theory in comparative-historical sociology. *American Journal of Sociology*, *97*(1), 1–30.
Kleimann, B. (2019). German universities as multiple hybrid organizations. *Higher Education*, *77*(6), 1085–1102.
Klein, J. T. (1996). *Crossing boundaries: Knowledge, disciplinarities, and interdisciplinarities*. University of Virginia Press.
Klein, J. T. (2000). A conceptual vocabulary of interdisciplinary science. In P. Weingart & N. Stehr (Eds.), *Practising interdisciplinarity* (pp. 3–24). University of Toronto Press.
Klein, J. T. (2010). A taxonomy of interdisciplinarity. In R. Frodeman, J. T. Klein, & C. Mitcham (Eds.), *The Oxford Handbook of Interdisciplinarity* (pp. 15–30). Oxford University Press.
Klein, J. T. (2021). *Beyond interdisciplinarity*. Oxford University PressNew York. https://doi.org/10.1093/oso/9780197571149.001.0001
Knorr-Cetina, K. D. (1981). Social and Scientific Method or What Do We Make of the Distinction Between the Natural and the Social Sciences? *Philosophy of the Social Sciences*, *11*(3), 335–359. https://doi.org/10.1177/004839318101100304
Kogan, M [Maurice], & Teichler, U. (Eds.). (2007). *Key Challenges to the Academic Profession*. Jenior.
Kosmützky, A. (2012). Between mission and market position: Empirical findings on mission statements of German higher education institutions. *Tertiary Education and Management*, *18*(1), 57–77. https://doi.org/10.1080/13583883.2011.617466
Kosmützky, A., & Krücken, G. (2024). Governing research: New forms of competition and cooperation in academia. In K. Sahlin-Andersson &

U. Eriksson-Zetterquist (Eds.), *University collegiality and the erosion of faculty authority* (pp. 31–57). Emerald Publishing. https://doi.org/10.1108/s0733-558x20230000086002

Kosmützky, A., & Meier, F [Frank] (2025). Competing: an analytical framework and application in higher education. *Studies in Higher Education*, 1–21. https://doi.org/10.1080/03075079.2025.2455425

Kraut, R., Egido, C., & Galegher, J. (1988). Patterns of contact and communication in scientific research collaboration. In I. Greif (Ed.), *ACM Conferences, Proceedings of the 1988 ACM conference on Computer-supported cooperative work* (pp. 1–12). ACM. https://doi.org/10.1145/62266.62267

Kroll, H., & Schubert, T. (2023). Can university leaders effectively promote research on complex societal challenges? A change-agency perspective. *Higher Education Policy*, *37*, 348–365. https://doi.org/10.1057/s41307-023-00307-2

Krücken, G. (2017). Die Transformation von Universitäten in Wettbewerbsakteure. *Beiträge Zur Hochschulforschung*, *3-4*, 10–29.

Krücken, G., & Meier, F [F.]. (2006). Turning the university into an organizational actor. In G. Drori, J. W. Meyer, & H. Hokyu (Eds.), *Globalization and organization: World society and organizational change* (pp. 240–257). Oxford University Press.

Lam, A. (2011). What motivates academic scientists to engage in research commercialization: 'Gold', 'ribbon' or 'puzzle'? *Research Policy*, *40*(10), 1354–1368. https://doi.org/10.1016/j.respol.2011.09.002

Lambiotte, R., Delvenne, J.-C., & Barahona, M. (2014). Random walks, Markov processes and the multiscale modular organization of complex networks. *IEEE Transactions on Network Science and Engineering*, *1*(2), 76–90. https://doi.org/10.1109/TNSE.2015.2391998

Lamnek, S. (2005). *Qualitative Sozialforschung*. Beltz.

Land, R. (2012). Crossing tribal boundaries: Interdisciplinarity as a threshold concept. In P. R. Trowler, M. Saunders, & V. Bamber (Eds.), *Tribes and Territories in the 21st Century* (pp. 175–185). Routledge.

Lange, S. (2010). Hochschulräte. In D. Simon, A. Knie, & S. Hornborstel (Eds.), *Handbuch Wissenschaftspolitik* (pp. 347–360). VS Verlag für Sozialwissenschaften.

Larrosa, J. M. (2019). Co-authorship networks of Argentine economists. *Journal of Economics, Finance and Administrative Science*, *24*(47), 82–96. https://doi.org/10.1108/JEFAS-06-2018-0062

Lattuca, L. R. (2002). Learning Interdisciplinarity. *The Journal of Higher Education*, *73*(6), 711–739. https://doi.org/10.1080/00221546.2002.11777178

Laudel, G. (2001). Collaboration, creativity and rewards: Why and how scientists collaborate. *International Journal of Technology Management*, *22*(7/8), Article 2990, 762. https://doi.org/10.1504/ijtm.2001.002990

Laudel, G. (2002). What do we measure by co-authorships? *Research Evaluation*, *11*(1), 3–15.

Laudel, G., & Gläser, J. (1998). *What are institutional boundaries and how can they be overcome? Germany's collaborative research centres as boundary-spanning networks.* WZB Discussion Paper.

Lauer, S. (2019). *Transformational governance of academic teaching*. Phd dissertation. Technische Universität Dortmund. https://doi.org/10.17877/DE290R-20126

Lawrence, T. B., & Phillips, N. (2019). *Constructing Organizational Life*. Oxford University Press. https://doi.org/10.1093/oso/9780198840022.001.0001

Leahey, E., Beckman, C. M., & Stanko, T. L. (2017). Prominent but Less Productive. *Administrative Science Quarterly*, *62*(1), 105–139. https://doi.org/10.1177/0001839216665364

Leišytė, L. (2007). *University governance and academic research: Case studies of research units in Dutch and English universities* [PhD dissertation, University of Twente, Enschede]. research.utwente.nl. https://research.utwente.nl/en/publications/university-governance-and-academic-research-case-studies-of-resea

Leišytė, L. (2015). Changing academic identities in the context of a managerial university: Bridging the duality between professions and organizations. In W. K. Cummings & U. Teichler (Eds.), *The relevance of academic work in comparative perspective* (pp. 59–73). Springer.

Leišytė, L. (2023). Passive and active resistance to performance pressures among academics in UK universities. In L. Leišytė, J. R. Dee, & B. J. R. van der Meulen (Eds.), *Elgar handbooks in education. Research handbook on the transformation of higher education* (pp. 351–365). Edward Elgar Publishing. https://doi.org/10.4337/9781800378216.00033

Leišytė, L., Dee, J. R., & Rose, A.-L. (2026). *Institutional logics and the strategies and practices of interdisciplinary research centres: Competition or convergence*. Unpublished manuscript.

Leišytė, L., Enders, J., & Boer, H. de (2009). The balance between teaching and research in Dutch and English universities in the context of university governance reforms. *Higher Education*, *58*, 619–635.

Leišytė, L., & Hosch-Dayican, B. (2016). Boundary crossing and maintenance among UK and Duch bioscientists: Towards hybrid identities of academic entrepreneurs. In L. Leišytė & U. Wilkesmann

(Eds.), *Organizing Academic Work in Higher Education: Teaching, learning, and identities* (pp. 223–242). Routledge.

Leišytė, L., & Rose, A.-L. (2024). Academic identities. In F. Darbellay (Ed.), *Elgar Encyclopedias in the Social Sciences. Elgar encyclopedia of interdisciplinarity and transdisciplinarity* (pp. 1–4). Edward Elgar Publishing. https://doi.org/10.4337/9781035317967.ch01

Leišytė, L., Rose, A.-L., & Boer, H. de (in press). The Governance of German Private Higher Education. *Studies in Higher Education*.

Leišytė, L., Rose, A.-L., & Sterk-Zeeman, N. (2022). Higher education policies and interdisciplinarity in Germany. *Tertiary Education and Management*, *28*(4), 353–370. https://doi.org/10.1007/s11233-022-09110-x

Leišytė, L., & Wilkesmann, U. (Eds.). (2016). *Organizing Academic Work in Higher Education: Teaching, learning, and identities*. Routledge.

LERU. (2016). *Interdisciplinarity and the 21st century research-indentisve university*. https://www.ub.edu/portal/documents/34829/1291819/LERU+Interdisciplinarity+21st+century/104379a8-50ca-49b9-ada4-8852057ec634

Lewis, M. W., & Kelemen, M. L. (2002). Multiparadigm inquiry: Exploring organizational pluralism and paradox. *Human Relations*, *55*(2), 251–275.

Leydesdorff, L. (2007). Betweenness centrality as an indicator of the interdisciplinarity of scientific journals. *Journal of the American Society for Information Science and Technology*, *58*(9), 1303–1319. https://doi.org/10.1002/asi.20614

Leydesdorff, L., & Ivanova, I. (2021). The measurement of "interdisciplinarity" and "synergy" in scientific and extra-scientific collaborations. *Journal of the Association for Information Science and Technology*, *72*(4), 387–402. https://doi.org/10.1002/asi.24416

Lincoln, Y. S., & Guba, E. G. (1986). But is it rigorous? Trustworthiness and authenticity in naturalistic evaluation. *New Directions for Program Evaluation*, *1986*(30), 73–84.

Lindauer, T., Schmellentin, C., & Beerenwinkel, A. Sprachbewusster Naturwissenschafts-Unterricht: Werkstattbericht zu einem transdisziplinären Entwicklungsprojekt. In I. Winkler & F. Schmidt (Eds.), *Interdisziplinäre Forschung in der Deutschdidaktik: „Fremde Schwestern" im Dialog* (pp. 225–246). Peter Lang.

Littig, B., & Wallace, C. (1997). Möglichkeiten und Grenzen von Fokus-Gruppendiskussionen für die sozialwissenschaftliche Forschung.

Lounsbury, M., & Ventresca, M. J. (Eds.). (2002). *Research in the sociology of organizations: v. 19*. *Social structure and organizations revisited*. Emerald. http://www.emeraldinsight.com/0733-558X/19

Louvel, S. (2016). Going interdisciplinary in French and US universities: Organizational change and university policies. In E. Popp-Berman & C. Paradeise (Eds.), *Research in the sociology of organizations: Vol. 36. The University Under Pressure* (pp. 329–359). Emerald.

Luhmann, N. (1992). Die Universität als organisierte Institution. In N. Luhmann & A. Kieserling (Eds.), *Universität als Milieu* (pp. 74–79). Haux.

Maassen, P., & Stensaker, B. (2019). From organised anarchy to de-coupled bureaucracy: The transformation of university organisation. *Higher Education Quarterly*, *73*(4), 456–468. https://doi.org/10.1111/hequ.12229

MacLeod, M. (2018). What makes interdisciplinarity difficult? Some consequences of domain specificity in interdisciplinary practice. *Synthese*, *195*(2), 697–720.

Mahoney, J., & Thelen, K. (2009). *Explaining institutional change: Ambiguity, agency, and power*. Cambridge University Press.

Mäkinen, E. I., Evans, E. D., & McFarland, D. A. (2025). Interdisciplinary Research, Tenure Review, and Guardians of the Disciplinary Order. *The Journal of Higher Education*, *96*(1), 54–81. https://doi.org/10.1080/00221546.2024.2301912

Makrinus, L. (2013). Vermittlungsversuche in der Organisation der Lehrerbildung. In L. Makrinus (Ed.), *Der Wunsch nach mehr Praxis: Zur Bedeutung von Praxisphasen im Lehramtsstudium* (pp. 71–96). Springer Fachmedien Wiesbaden GmbH. https://doi.org/10.1007/978-3-658-00395-1_5

Manning, K. (2017). *Organizational theory in higher education*. Routledge. https://www.taylorfrancis.com/books/mono/10.4324/9781315618357/organizational-theory-higher-education-kathleen-manning https://doi.org/10.4324/9781315618357

Martin, B. R. (2003). The changing social contract for science and the evolution of the university. In A. Geuna, A. J. Salter, & W. E. Steinmueller (Eds.), *Science and innovation: Rethinking the rationales for funding and governance* (pp. 7–29). Edward Elgar.

Mays, N., & Pope, C. (2000). Assessing quality in qualitative research. *Bmj*, *320*(7226), 50–52.

McAlpine, L., & Amundsen, C. (2009). Identity and agency: Pleasures and collegiality among the challenges of the doctoral journey. *Studies in Continuing Education*, *31*(2), 109–125. https://doi.org/10.1080/01580370902927378

Merton, R. K. (1938). Social structure and anomie. *American Sociological Review*, *3*(5), 672–682.
Merton, R. K. (1968). *Social theory and social structure* (Third edition). Free Press.
Meyer, J. H. F., & Land, R. (2005). Threshold concepts and troublesome knowledge (2): Epistemological considerations and a conceptual framework for teaching and learning. *Higher Education*, *49*(3), 373–388. https://doi.org/10.1007/s10734-004-6779-5
Meyer, J. W., Drori, G. S., & Hwang, H. (2006). World society and the proliferation of formal organizations. In G. Drori, J. W. Meyer, & H. Hokyu (Eds.), *Globalization and organization: World society and organizational change* (pp. 25–49). Oxford University Press.
Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. Sage.
Miller, C. Z. (2016). Towards transdisciplinarity: Liminality and the transitions inherent in pluridisciplinary collaborative work. *Journal of Business Anthropology*(Special Issue 2), 35–57. https://doi.org/10.22439/jba.v1i1.4959
Mintzberg, H. (1979). *The structuring of organizations* (Vol. 2). Prentice-Hall.
Mintzberg, H. (1980). Structure in 5's: A synthesis of the research on organization design. *Management Science*, *26*(3), 322–341. https://doi.org/10.1287/mnsc.26.3.322
Morgan, D. L. (1996). Focus groups. *Annual Review of Sociology*, *22*, 129–152.
Morgan, D. L. (1997). *Focus groups as qualitative research*. Sage publications.
Mouzelis, N. (1989). Restructuring Structuration Theory. *The Sociological Review*, *37*(4), 613–635. https://doi.org/10.1111/j.1467-954X.1989.tb00047.x
Müller, R. (2012). Collaborating in life science research groups: The question of authorship. *Higher Education Policy*, *25*(3), 289–311. https://doi.org/10.1057/hep.2012.11
Musselin, C. (2006). Are universities specific organisations? In G. Krücken, A. Kosmützky, & M. Torka (Eds.), *Towards a Multiversity? Universities between global trends and national traditions* (pp. 63–84). transcript Verlag.
Musselin, C. (2008). Towards a sociology of academic work. In A. Amaral, I. Bleiklie, & C. Musselin (Eds.), *From governance to identity* (pp. 47–56). Springer.
Neave, G., & Rhoades, G. (1987). The academic estate in Western Europe. In B. R. Clark (Ed.), *The academic profession: National,*

disciplinary, and institutional settings (pp. 211–270). University of California Press.

Newman, M. E. J. (2004). Coauthorship networks and patterns of scientific collaboration. *Proceedings of the National Academy of Sciences*, *101 Suppl 1*(Suppl 1), 5200–5205. https://doi.org/10.1073/pnas.0307545100

Nickel, S. (2012). Engere Kopplung von Wissenschaft und Verwaltung und ihre Folgen für die Ausübung professioneller Rollen in Hochschulen. In U. Wilkesmann & C. J. Schmid (Eds.), *Hochschule als Organisation* (pp. 279–291). VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-531-18770-9_16

Nickel, S., & Zechlin, L. (2005). Die Suche nach der optimalen Organisationsstruktur: Zur Reform der dezentralen Ebene in Universitäten. In H. Welte, M. Auer, & C. Meister-Scheytt (Eds.), *Management von Universitäten: Zwischen Tradition und (Post-)Moderne* (pp. 199–214). Rainer Hampp Verlag.

Nowotny, H., Gibbons, M., & Scott, P. (2001). *Rethinking science: Knowledge and the public in the age of uncertainty*. Polity Press.

Nyhagen, G. M., Bleiklie, I., & Hope, K. (2017). Policy instruments in European universities: Implementation of higher education policies. In I. Bleiklie, J. Enders, & B. Lepori (Eds.), *Managing Universities: Policy and organizational change from a Western European comparative perspective* (pp. 275–300). Springer. https://doi.org/10.1007/978-3-319-53865-5_11

OECD. (1972). *Interdisciplinarity: Problems of Teaching and Research in Universities.* OECD.

Orr, D., & Jäger, M. (2009). Governance in German higher education: Competition versus negotation of performance. In J. Huisman (Ed.), *International perspectives on the governance of higher education: Alternative frameworks for coordination* (pp. 33–51). Routledge.

Orton, J. D., & Weick, K. E. (1990). Loosely coupled systems: A reconceptualization. *Academy of Management Review*, *15*(2), 203–223.

Osterloh, M. (2012). 'New Public Management' versus 'Gelehrtenrepublik': Rankings als Instrument der Qualitätsbeurteilung in der Wissenschaft. In U. Wilkesmann & C. J. Schmid (Eds.), *Hochschule als Organisation* (pp. 209–221). VS Verlag für Sozialwissenschaften.

Parker, J. N., Penders, B., & Vermeulen, N. (Eds.). (2010). *Collaboration in the new life sciences* (1st ed.). Ashgate. https://doi.org/10.4324/9781315572628

Parsons, T. (1949). *The structure of social action*. Free Press.

Pasternack, P. (2008). Die Exzellenzinitiative als politisches Programm: Fortsetzung der normalen Forschungsförderung oder Paradigmenwechsel? In R. Bloch, A. Keller, A. Lottmann, & C. Würmann (Eds.), *Making Excellence: Grundlagen, Praxis und Konsequezen* (pp. 13–36). Bertelsmann.

Pastor, J. M., Serrano, L., & Zaera, I. (2015). The research output of European higher education institutions. *Scientometrics*, *102*(3), 1867–1893. https://doi.org/10.1007/s11192-014-1509-y

Patton, M. Q. (1987). *How to use qualitative methods in evaluation*. Sage.

Pellert, A. (1995). Die Besonderheiten der Organisation Universität und ihrer Veränderungsprozesse. In A. Pellert & M. Welan (Eds.), *Die formierte Anarchie: Die Herausforderung der Universitätsorganisation* (pp. 81–112). Wien.

Pettigrew, S. F. (2000). Ethnography and grounded theory: A happy marriage? *Advances in Consumer Research*, *27*(1), 256–260.

Phelps, R., Ledgerwood, T., & Bartlett, L. (2000). Managing the transition to online teaching: The role of project management methodology in the learning organisation. In M. Wallace, A. Ellis, & D. Newton (Eds.), *Moving online: A conference to explore the challenges for workplaces, colleges and universities. Proceedings of the Moving Online Conference, 18-19th August 2000 Gold Coast, Australia* (pp. 203–216). Southern Cross University. https://www.researchgate.net/profile/Renata_Phelps/publication/39730940_Managing_the_transition_to_online_teaching_the_role_of_project_management_methodology_in_the_learning_organisation/links/02bfe5148b63f5e5e4000000.pdf

Porter, A. L., Cohen, A. S., David Roessner, J., & Perreault, M. (2007). Measuring researcher interdisciplinarity. *Scientometrics*, *72*(1), 117–147. https://doi.org/10.1007/s11192-007-1700-5

Powell, W. W. (1991). Expanding the scope of institutional analysis. In W. W. Powell & P. J. DiMaggio (Eds.), *The new institutionalism in organizational analysis* (pp. 183–203). University of Chicago Press.

Powell, W. W., & DiMaggio, P. J. (Eds.). (1991). *The new institutionalism in organizational analysis*. University of Chicago Press.

Reeves, S., Kuper, A., & Hodges, B. D. (2008). Qualitative research methodologies: ethnography. *Bmj*, *337*, a1020.

Reichert, S., Winde, M., & Meyer-Guckel, V. (2012). *Jenseits der Fakultäten: Hochschuldifferenzierung durch neue Organisationseinheiten für Forschung und Lehre*. *Positionen*. Stifterverb. für die Deutsche Wirtschaft.

Rhoten, D. (2003). *A multi-method analysis of social and technical conditions for interdisciplinary collaboration*. Final Report to the

National Science Foundation (BCS-0129573). The Hybrid Vigor Institute.
Rhoten, D. (2004). Interdisciplinary research: Trend or transition. *Items and Issues*, *5*(1-2), 6–11.
Rhoten, D., & Pfirman, S. (2007). Women in interdisciplinary science: Exploring preferences and consequences. *Research Policy*, *36*(1), 56–75.
Ridder, H.-G. (2017). The theory contribution of case study research designs. *Business Research*, *10*(2), 281–305. https://doi.org/10.1007/s40685-017-0045-z
Rindermann, H. (2000). Das Selbstobjektivierungsproblem im akademischen Milieu (II): Zusammenhang zwischen wissenschaftlicher Methodik und dem Einfluß sozialer Hintergrundvariablen in der Lehrevaluationsforschung. *Das Hochschulwesen*, *48*(4), 117–123.
Rip, A. (1990). An exercise in foresight: The research system in transition - to what? In S. E. Cozzens, P. Healey, A. Rip, & J. Ziman (Eds.), *The research system in transition* (pp. 387–401). Springer. https://doi.org/10.1007/978-94-009-2091-0_29
Ritzer, G. (1985). The Rise of Micro-Sociological Theory. *Sociological Theory*, *3*(1), 88. https://doi.org/10.2307/202176
Rose, A.-L., Dee, J. R., & Leišytė, L. (2020). Organizational learning through projects: A case of a German university. *The Learning Organization*, *27*(2), 85–99.
Sá, C. M. (2008). 'Interdisciplinary strategies' in US research universities. *Higher Education*, *55*(5), 537–552.
Salonius, A. (2007). *Working in the lab: social organization of research and training in biomedical research labs in Canada and its relationship to research funding* [PhD dissertation]. McGill University, Montreal. https://escholarship.mcgill.ca/concern/theses/6q182p719
Schimank, U. (2005a). 'New Public Management' and the academic profession: Reflections on the German situation. *Minerva*, *43*(4), 361–376. https://doi.org/10.1007/s11024-005-2472-9
Schimank, U. (2005b). Die akademische Profession und die Universitäten: „New Public Management" und eine drohende Entprofessionalisierung. In T. Klatetzki & V. Tacke (Eds.), *Organisation und Profession* (pp. 143–164). VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-322-80570-6_6
Schön, D. A., & Agyris, C. (1996). *Organizational learning II: Theory, method and practice*. Addison-Wesley.
Schulz, M. (2012). Quick and easy!? Fokusgruppen in der angewandten Sozialwissenschaft. In M. Schulz, B. Mack, & O. Renn (Eds.),

Fokusgruppen in der empirischen Sozialwissenschaft: Von der Konzeption bis zur Auswertung (pp. 9–22). Springer.
Scott, W. R. (2013). *Institutions and Organizations: Ideas, Interests, and Identities*. Sage.
Senge, P. M. (1990). *The art and practice of the learning organization*. Doubleday.
Shattock, M., Enders, J., & Horvath, A. (2023). *The governance of European higher education: Convergence or divergence?* Bloomsbury Publishing.
Sicotte, C., D'Amour, D., & Moreault, M.-P. (2002). Interdisciplinary collaboration within Quebec Community Health Care Centres. *Social Science & Medicine*, *55*(6), 991–1003. https://doi.org/10.1016/s0277-9536(01)00232-5
Sigl, L., & Leišytė, L. (2018). Imaginaries of invention management: comparing path dependencies in east and West Germany. *Minerva*, *56*(3), 357–380.
Silverman, D. (2007). *A very short, fairly interesting and reasonably cheap book about qualitative research*. Sage.
Sim, J., & Snell, J. (1996). Focus groups in physiotherapy evaluation and research. *Physiotherapy*, *82*(3), 189–198.
Singh, V., & Dickson, J. (2002). Ethnographic approaches to the study of organizations. In D. Partington (Ed.), *Essential skills for management research* (pp. 117–135). Sage.
Sjoberg, G., Williams, N., Vaughan, T., & Sjoberg, A. (1991). The case study approach in social research. In J. R. Feagin, A. M. Orum, & G. Sjoberg (Eds.), *A Case for the Case Study* (pp. 27–79). The University of North Carolina Press.
Smith, J. A., Harre, R., & van Langenhove, L. (Eds.). (1995). *Rethinking methods in psychology*. Sage.
Somers, M. R. (1998). Symposium on historical sociology and rational choice theory "We're No Angels": Realism, rational choice, and relationality in social science. *American Journal of Sociology*, *104*(3), 722–784.
Sonnenwald, D. H. (2007). Scientific collaboration. *Annual Review of Information Science and Technology*, *41*, 643–681.
Steen, K., & van Bueren, E. (2017). The defining characteristics of urban living labs. *Technology Innovation Management Review*, *7*(7), 21–33. https://doi.org/10.22215/timreview/1088
Stichweh, R. (1992). The sociology of scientific disciplines: On the genesis and stability of the disciplinary structure of modern science. *Science in Context*, *5*(1), 3–15. https://doi.org/10.1017/s0269889700001071
Stichweh, R. (2005). Wissen und die Professionen in einer Organisationsgesellschaft. In T. Klatetzki & V. Tacke (Eds.),

Organisation und Profession (pp. 31–44). VS Verlag für Sozialwissenschaften.
Stichweh, R. (2013). *Wissenschaft, Universität, Professionen: Soziologische Analysen* (2nd ed.). transcript Verlag.
Stichweh, R. (2016). Akademische Freiheit in europäischen Universitäten: Zur Strukturgeschichte der Universität und des Wissenschaftssystems. *Die Hochschule: Journal Für Wissenschaft Und Bildung*, *25*(2), 19–36.
Strauss, A., & Corbin, J. M. (1990). *Basics of qualitative research*. Sage.
Terhart, E. (2005). Zentren für Lehrerbildung: systematische Probleme, institutionelle Widersprüche, praktische Schwierigkeiten. In H. Merkens (Ed.), *Lehrerbildung: Zentren für Lehrerbildung* (pp. 15–31). VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-322-80717-5_3
Thompson, J. B. (1989). The theory of structuration. In D. Held & J. B. Thompson (Eds.), *Social theory of modern socieites: Anthony Giddens and his critics* (pp. 56–76). Cambridge University Press.
Townsend, T., Pisapia, J., & Razzaq, J. (2015). Fostering interdisciplinary research in universities: A case study of leadership, alignment and support. *Studies in Higher Education*, *40*(4), 658–675.
Trow, M. (1994). Manageralism and the academic profession: The case of England. *Higher Education Policy*, *7*(2), 11–18.
Turner, J. H. (2005). A New Approach for Theoretically Integrating Micro and Macro Analysis. In C. Calhoun, C. Rojek, B. Turner, C. J. Calhoun, & B. S. Turner (Eds.), *The Sage handbook of sociology* (1. publ, pp. 405–422). Sage. https://doi.org/10.4135/9781848608115.n24
van Maanen, J. (1975). Police socialization: A longitudinal examination of job attitudes in an urban police department. *Administrative Science Quarterly*, 207–228.
van Maanen, J. (1979). The fact of fiction in organizational ethnography. *Administrative Science Quarterly*, *24*(4), 539–550.
van Rijnsoever, F. J., & Hessels, L. K. (2011). Factors associated with disciplinary and interdisciplinary research collaboration. *Research Policy*, *40*(3), 463–472. https://doi.org/10.1016/j.respol.2010.11.001
van Rijnsoever, F. J., & Hessels, L. K. (2021). How academic researchers select collaborative research projects: A choice experiment. *The Journal of Technology Transfer*, *46*(6), 1917–1948. https://doi.org/10.1007/s10961-020-09833-2
Velden, T., Haque, A., & Lagoze, C. (2010). A new approach to analyzing patterns of collaboration in co-authorship networks: mesoscopic analysis and interpretation. *Scientometrics*, *85*(1), 219–242. https://doi.org/10.1007/s11192-010-0224-6

Vereijken, M. W. V., Akkerman, S. F., te Pas, S. F., van der Tuin, I., & Kluijtmans, M. (2022). 'Undisciplining' higher education without losing disciplines: furthering transformative potential for students. *Higher Education Research & Development*, *42*(7), 1762–1775. https://www.tandfonline.com/doi/pdf/10.1080/07294360.2022.2156482

Vincenti, V. B. (2005). Family and consumer sciences university faculty perceptions of interdisciplinary work. *Family and Consumer Sciences Research Journal*, *34*(1), 81–104. https://doi.org/10.1177/1077727X05277742

Vollmer, H. J. (2014). Fachdidaktik and the development of generalised subject didactics in Germany. *Éducation Et Didactique*, *8*(1), 23–34. https://doi.org/10.4000/educationdidactique.1861

Wagner, C. S., Roessner, J. D., Bobb, K., Klein, J. T., Boyack, K. W., Keyton, J., Rafols, I., & Börner, K. (2011). Approaches to understanding and measuring interdisciplinary scientific research (IDR): A review of the literature. *Journal of Informetrics*, *5*(1), 14–26. https://doi.org/10.1016/j.joi.2010.06.004

Wang, Q., & Schneider, J. W. (2020). Consistency and validity of interdisciplinarity measures. *Quantitative Science Studies*, *1*(1), 239–263. https://doi.org/10.1162/qss_a_00011

Watson, T. J. (2011). Ethnography, reality, and truth: the vital need for studies of 'how things work'in organizations and management. *Journal of Management Studies*, *48*(1), 202–217.

Watson, T. J. (2012). Making organisational ethnography. *Journal of Organizational Ethnography*.

Weick, K. E. (1976). Educational organizations as loosley coupled systems. *Aministrative Science Quarterly*, *21*(1), 1–19.

Weick, K. E. (1982). Management of organizational change among loosely coupled elements. In P. S. Goodman (Ed.), *Change in organizations: New perspecrtives on theory, research, and practice* (pp. 375–408). Jossey-Bass.

Weingart, P. (2014). Interdisciplinarity and the new governance of universities. In P. Weingart & B. Padberg (Eds.), *University experiments in interdisciplinarity: Obstacles and opportunities* (pp. 151–174). transcript Verlag.

Weingart, P., & Padberg, B. (Eds.). (2014). *University experiments in interdisciplinarity: Obstacles and opportunities*. transcript Verlag.

Weingart, P., & Stehr, N. (Eds.). (2000). *Practising interdisciplinarity*. University of Toronto Press.

Whitley, R. (2000). *The intellectual and social organization of the sciences*. Oxford University Press on Demand.

Wilkesmann, U. (2012). Auf dem Weg vom Gelehrten zum abhängig Beschäftigten? Zwei deutschlandweite Surveys zur Lehrmotivation von Professoren. In U. Wilkesmann & C. J. Schmid (Eds.), *Hochschule als Organisation* (pp. 363–381). VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-531-18770-9_21

Wilkesmann, U. (2013). Effects of transactional and transformational governance on academic teaching: Empirical evidence from two types of higher education institutions. *Tertiary Education and Management*, *19*(4), 281–300.

Wilkesmann, U. (2017). Methoden und Daten zur Erforschung spezieller Organisationen: Hochschulen. In S. Liebig, M. Wenzel, & S. Rosenbohm (Eds.), *Handbuch Empirische Organisationsforschung* (pp. 565–588). Springer.

Wilkesmann, U. (2019). *Methoden der Hochschulforschung: Eine methodische, erkenntnistheoretisch- und organisationstheoretische Einführung*. Beltz Juventa.

Wilkinson, S. (1988). The role of reflexivity in feminist psychology. *Women's Studies International Forum*, *5*(11), 493–502.

Witzel, A. (2000). Das problemzentrierte Interview. *Forum: Qualitative Social Research*, *1*(1), Article 22. http://www.qualitative-research.net/index.php/fqs/article/view/1132/2519

Woelert, P., & Millar, V. (2013). The 'paradox of interdisciplinarity' in Australian research governance. *Higher Education*, *66*(6), 755–767. https://doi.org/10.1007/s10734-013-9634-8

Wray, K. B. (2002). The Epistemic Significance of Collaborative Research. *Philosophy of Science*, *69*(1), 150–168. https://doi.org/10.1086/338946

Wray, K. B. (2006). Scientific authorship in the age of collaborative research. *Studies in History and Philosophy of Science Part a*, *37*(3), 505–514. https://doi.org/10.1016/j.shpsa.2005.07.011

Yang, L., Albats, E., & Etzkowitz, H. (2021). Interdisciplinary organization as a basic academic unit? *Industry and Higher Education*, *35*(3), 173–187. https://doi.org/10.1177/0950422220956951

Yin, R. K. (2003). *Case Study Research: Design and methods*. Sage.

Yin, R. K. (2018). *Case study research and applications: Design and methods* (Sixth edition). Sage.

Želvys, R., Leišytė, L., Pekşen, S., Bružienė, R., & Rose, A.-L. (2021). From collegiality to managerialism in Lithuanian higher education. *Acta Paedagogica Vilnensia*(46), 27–42.

Zou, T. X. P., Casupanan, Y. C., Poon, H. K. H., Wong, S. Y. O., Park, J. H., & Hoang, A. P. (2025). 'It is ambiguous, but I know what I am doing': Undergraduates' experiences and agency in an

interdisciplinary programme. *Studies in Higher Education*, 1–13. https://doi.org/10.1080/03075079.2025.2481987

Zuber, S., & Hüther, O. (2013). Interdisziplinarität in der Exzellenzinitiative: Auch eine Frage des Geschlechts. *Beiträge Zur Hochschulforschung*, *35*(4), 54–81.

XIII. Annex

XIII.I Social network analysis: Descriptives

The social network analysis conducted within the scope of this study was based on co-publication between project participants within the first project phase and aimed at unravelling patterns of collaboration between members of different disciplinary communities within the case study project. For this purpose, scientific publications (journal articles, chapters in edited volumes, books) co-authored by at least two project participants within the time-frame of the first case study project phase (2016-2019) were analysed using the social network analysis software Gephi (version 0.9.2). The following table contains key descriptive metrics of this network analysis.

Metric	Value	Description	Interpretation (Caiani, 2014)
Nodes	60	Number of nodes (actors)	-
Connections	214	Number of connections between nodes	-
Network Diameter	6	Number of steps needed to bridge the distance between the two most distant nodes in the network	-
Graph density	0,121	Number of connections within a network in relation to the number of all possible relations	12.1 percent of possible connections within the network have been realised
Average degree	7,133	Average number of connections of nodes	Actors are connected to an average of 7.1 other actors
Average path length	2,722	Average number of steps necessary to reach the furthest node in the network from another node	Medium high in comparison to diameter, suggesting indirect connection of actors via brokers
Cluster Coefficient	0,757	Degree of connection of nodes to neighbouring nodes (clustering)	Medium high, suggesting strong clustering within network

XIII.II Interviews

XIII.II.I Memo on interview method

Interviews: Method and Guideline

Problem-centred interview = “theory generating method that tried to neutralize the alleged contradiction between being directed by theory or being open-minded so that the interplay of inductive and deductive thinking contributes to increasing the user’s knowledge” (Witzel, 2000, p. 1)

Three basic principles (Witzel, 2000, p. 2):

1) “Problem-centered orientation” and awareness and usage of “preceding interpretation”, “making use of formerly noted objective conditions of the observed orientations and actions (...) to continue questioning and re-questioning (...) [and] gradually making communication more precisely address the research problem”
2) “Object orientation”, prior collection of information on the object by conducting focus group, observation, ..., and flexible application of conversation techniques depending on the communication situation with the individual respondent
3) “Process orientation”, acknowledging that results are produced in cooperation between the interviewer and interviewer. Interviewer’s conversation techniques can lead to redundancies (which are welcome as they “often contain new formulations which facilitate interpretation”) or contradictions (which can show dilemmas, individual ambivalences, but also misunderstanding of what interviewee previously said by interviewer). NO “isolated answers to isolated questions” (Bahrdt, 1975, p.13).

Role of guidelines in problem centred interviewing: Making sure interviewer covers all topics and that interviews are comparable.

Structure of a problem centred interview (Witzel, 2000, p. 4): Start with a general question narrow enough to “focus the discussion on the problem under study” while keeping it open enough to create story telling with a flexible structure by the interviewee (Intro to problem, then: Tell me how it all happened). Then: further exploration, asking for concrete examples of experiences to “stimulate the respondent’s memory” and “clarifying abstraction”. Only at the end: Ad-hoc questions for covering topics that have been left out by interviewee - ask these “at the end of the interview to avoid a question-and-answer game in the main part of the interview”.

XIII.II.II Interview guidelines data collection phase 1

Einleitung und Informationen zum Dissertationsprojekt

... Mein Eindruck aus dem vergangenen Jahr ist, dass die fächerübergreifende Zusammenarbeit einen großen Teil von [Fallstudienprojekt] ausmacht – und das, obwohl die beteiligten Fachwissenschaften im Rahmen des Projektes alle eigene Forschungsprojekte verfolgen.

Es gibt mittlerweile zwar einige Studien zu Interdisziplinarität im wissenschaftlichen Kontext, oft liegt der Fokus aber auf Problemen mit und Hindernissen für Interdisziplinarität und häufig werden sehr stark formalisierte Strukturen, wie z.B. interdisziplinäre Forschungszentren, untersucht. Zur Frage des Entstehens und Gelingens fächerübergreifender Zusammenarbeit im Kontext wissenschaftlicher Projekte wie [Fallstudienprojekt], in welchen alle Projektteilnehmerinnen und –teilnehmer nicht nur in ihrer oder seiner Disziplin, sondern auch der jeweiligen Fakultät bzw. wissenschaftlichen Einrichtung verortet bleibt, gibt es aber bisher noch kaum Erkenntnisse. Im Rahmen meiner Doktorarbeit möchte ich deshalb untersuchen, wie interdisziplinäre Strukturen in wissenschaftlichen Projekten, genauer in [Fallstudienprojekt], im Projektverlauf entstehen, welche Akteure an der Entstehung dieser Strukturen beteiligt sind, und welche Hindernisse und Gelingensbedingungen es für die Entstehung interdisziplinärer Strukturen gibt.

Strukturen definiere ich als regelmäßig wiederkehrende Interaktionen einer Gruppe von Projektteilnehmerinnen und –teilnehmern aus mindestens zwei verschiedenen wissenschaftlichen Disziplinen mit einem klar definierten Ziel und Format.

[Freiwilligkeit und Anonymität, Einverständnis zu Aufzeichnung des Interviews]

X) Für Projektleitungen: Hintergründe der Entstehung des Projektes

Können Sie mir erzählen, wie es zur Entstehung des Projektes kam?

Aspekte für Nachfragen:

- *Wie kam es dazu, dass der Projektantrag geschrieben wurde? (Ziele, Vorarbeiten, beteiligte Personen)*
- *Wie wurden weitere Projektmitglieder ausgewählt?*

A) Prozess der Entwicklung interdisziplinärer Strukturen

Im Rahmen von [Fallstudienprojekt] haben sich verschiedene fächerübergreifende Formate und Strukturen entwickelt. Beispiele hierfür sind z.B. die Nachwuchswissenschaftler-Runde, die diversen Arbeitsgruppen, sowie auch Kooperationen in Forschung und Lehre mit Beteiligung von mehr als einem Fach.

Können Sie mir erzählen, an welchen interdisziplinären Strukturen Sie beteiligt sind und wie Sie die Entwicklung dieser von der Entstehung bis zu ihrer momentanen Form erfahren haben?

Bitte um konkrete Beispiele. Aspekte für Nachfragen:

- *Zu welchem Zweck haben sich die Strukturen entwickelt, welche Ziele werden mit Ihnen verfolgt (Forschung oder Lehre)?*
- *Welche Akteure haben die Entstehung und Weiterentwicklung der Strukturen Ihrer Meinung nach maßgeblich angestoßen? Rolle verschiedener Statusgruppen; von oben initiiert (top-down) oder aus der Projektbasis heraus entstanden (bottom-up)?*
- *Haben Sie im Rahmen der Entstehung und Weiterentwicklung der Strukturen Probleme oder Widerstände beobachtet oder erfahren, so ja, welche?*
  (Für Projektleitung und -koordination: In der Literatur findet sich die Behauptung, von oben, also top-down initiierte Prozesse würden vor allem an Universitäten zu Widerständen führen - haben Sie dies im Rahmen von [Fallstudienprojekt] *erfahren?*

B) Einfluss der Beteiligung an interdisziplinären Strukturen auf professionelle Praxis und Netzwerke

Können Sie beschreiben, ob und wie die Beteiligung an interdisziplinären Strukturen in [Fallstudienprojekt] Ihre wissenschaftliche Praxis und Vernetzung innerhalb der Organisation beeinflusst?

Bitte um konkrete Beispiele. Aspekte für Nachfrage:

- *Bestanden bereits vor dem Projekt Kooperationen mit den anderen Teilnehmer/innen der interdisziplinären Strukturen, an denen Sie beteiligt sind?*
- *Hat die Beteiligung an interdisziplinären Strukturen zu neuen fächerübergreifenden Kooperationen geführt und so ja, um welche handelt es sich hier und welches Ziel wird mit diesen Kooperationen verfolgt?*

C) Lern(erfolge) im Projekt

1) Was haben Sie im Projektverlauf bisher gelernt? Bitte nennen Sie ein oder mehrere konkrete Beispiele.
2) Können Sie näher beschreiben, wie der Lernprozess in Bezug auf (Beispiel) ablief?
   i) Unter welchen Umständen und in welchen Situationen haben Sie gelernt?
   ii) Welche Akteure haben den Lernprozess angestoßen bzw. zum Gelingen des Lernprozesses beigetragen?

iii) *Wo hatte der Lernprozess Ihrer Meinung nach seinen Ursprung - auf individueller oder auf kollektiver Ebene? (Falls auf individueller Ebene: (Wie) konnte der Lernprozess von der individuellen auf die kollektive Ebene überspringen?)*

2) Wie, wenn überhaupt, kann [Fallstudienprojekt] Ihrer Meinung nach die Forschung und Lehre an der Universität jenseits der Reichweite und des Zeitrahmens des Projektes beeinflussen? (Gibt es einen nachhaltigen Einfluss auf die Organisation oder werden Lernerfolge nur innerhalb des Projektes sichtbar?)
   i) *Haben Sie vor, das in* [Fallstudienprojekt] *Gelernte auch nach Ablauf der Projektlaufzeit weiter zu verfolgen und wenn ja, wie?*
3) Gibt es Aspekte, die Sie im Rahmen von [Fallstudienprojekt] zwar als wichtig erachten, bezüglich derer aber bisher keine erfolgreichen Lernprozesse erfolgt sind? So ja, welche sind dies und haben Sie Vermutungen, warum erfolgreiches Lernen hier nicht möglich ist oder bisher nicht möglich war?
4) Wie sehen Sie die Zukunft inklusionsorientierter Lehrerbildung an der Universität?
   iii) *Welche Faktoren stehen einer Implementierung inklusionsorientierter Lehrerbildung an der Universität im Weg?*

D) Nachfrage, ob Interviewpartner noch weitere Aspekte erwähnen möchte

E) Abschluss und Verabschiedung

XIII.II.III Interview guidelines data collection phase 2

Einleitung und Informationen zum Dissertationsprojekt

Die vergangenen Jahre haben gezeigt, dass die fächerübergreifende Zusammenarbeit einen großen Teil von [Fallstudienprojekt] ausmacht – und das, obwohl die beteiligten Fachwissenschaften im Rahmen des Projektes alle eigene Forschungsprojekte verfolgen.

Es gibt mittlerweile zwar einige Studien zu Interdisziplinarität im wissenschaftlichen Kontext, oft liegt der Fokus aber auf Problemen mit und Hindernissen für Interdisziplinarität und häufig werden sehr stark formalisierte Strukturen, wie z.B. interdisziplinäre Forschungszentren, untersucht. Zur Frage des Entstehens und Gelingens fächerübergreifender Zusammenarbeit im Kontext wissenschaftlicher Projekte, in welchen alle Projektteilnehmerinnen und –teilnehmer nicht nur in ihrer oder seiner Disziplin, sondern auch der jeweiligen Fakultät bzw. wissenschaftlichen Einrichtung verortet bleibt, gibt es aber bisher noch kaum Erkenntnisse. Im Rahmen meiner Doktorarbeit möchte ich deshalb untersuchen, wie interdisziplinäre Strukturen in wissenschaftlichen Projekten, genauer in [Fallstudienprojekt], im Projektverlauf entstehen, welche Akteure an der Entstehung dieser Strukturen beteiligt sind, und welche Hindernisse und Gelingensbedingungen es für die Entstehung interdisziplinärer Strukturen gibt. Besonders interessant ist in dieser Hinsicht auch der Übergang von einer ersten in eine zweite Projektphase mit teilweise veränderter personeller und disziplinärer Zusammensetzung.

Strukturen definiere ich als regelmäßig wiederkehrende Interaktionen einer Gruppe von Projektteilnehmerinnen und –teilnehmern aus mindestens zwei verschiedenen wissenschaftlichen Disziplinen mit einem klar definierten Ziel und Format.

[Freiwilligkeit und Anonymität, Einverständnis zu Aufzeichnung des Interviews]

A) Motivation zur Beteiligung an und Prozess der Entwicklung interdisziplinärer Strukturen

Im Rahmen von [Fallstudie] haben sich verschiedene fächerübergreifende Formate und Strukturen entwickelt. Beispiele hierfür sind z.B. die Nachwuchswissenschaftler-Runde, die diversen Arbeitsgruppen, sowie auch Kooperationen in Forschung und Lehre mit Beteiligung von mehr als einem Fach.

1) Können Sie mir erzählen, an welchen interdisziplinären Strukturen Sie im Rahmen des Projektes beteiligt sind?

- *Welche Ziele werden mit diesen Strukturen verfolgt?*
- *Was motiviert Sie persönlich zur Beteiligung an diesen Strukturen?*

- 2) Wie haben Sie die Entwicklung der genannten Strukturen von der Entstehung bis zu ihrer momentanen Form erfahren und welche Rolle spielte der Beginn der zweiten Projektphase hierbei?

3) Welche Akteure haben die Entstehung und Weiterentwicklung der Strukturen Ihrer Meinung nach maßgeblich angestoßen?

- *Rolle verschiedener Statusgruppen; von oben initiiert (top-down) oder aus der Projektbasis heraus entstanden (bottom-up)?*
    - *Speziell: Rolle der Nachwuchswissenschaftler, z.B. in Hinblick auf Arbeitsfeldkoordination*
- *Welche Rolle spielt die veränderte personelle Zusammensetzung in der zweiten Projektphase? (Einige Akteure haben das Projekt verlassen, andere sind neu dazu gestoßen)*

B) Einfluss der Beteiligung an interdisziplinären Strukturen auf professionelle Praxis und Netzwerke

4) Wie beeinflusst die Beteiligung an interdisziplinären Strukturen in [Fallstudienprojekt] Ihre wissenschaftliche Praxis und Vernetzung innerhalb der Universität?

Bitte um konkrete Beispiele. Aspekte für Nachfrage:

- *Bestanden bereits vor Beginn des Projektes Kooperationen mit den anderen Teilnehmer/innen der interdisziplinären Strukturen, an denen Sie beteiligt sind?*
- *Hat die Beteiligung an interdisziplinären Strukturen zu neuen fächerübergreifenden Kooperationen geführt und so ja, um welche handelt es sich hier und welches Ziel wird mit diesen Kooperationen verfolgt?*

C) Gelingensbedingungen für die Entstehung und institutionelle Verankerung interdisziplinärer Strukturen

5) Welche Faktoren und Bedingungen sind Ihrer Meinung nach für die erfolgreiche Entstehung und Weiterführung interdisziplinärer Strukturen – allgemein sowie in Bezug auf das Projekt - relevant und warum?

6) Wie schätzen Sie die Wahrscheinlichkeit einer Fortführung der verschiedenen fächerübergreifenden Formate auch nach Ende der Projektlaufzeit ein?

- *Welche Barrieren und Gelingensbedingungen bestehen Ihrer Meinung nach für eine institutionelle Verankerung der Strukturen?*

D) Nachfrage, ob Interviewpartner noch weitere Aspekte erwähnen möchte

E) Abschluss und Verabschiedung

XIII.III Focus group discussions

XIII.III.I Focus group discussion 1: Aims and organisation

Participants: PhD students and post-docs of the case study project

Place and time: Tuesday, 12.06.2018, 10:00-12:00, [redacted]

Equipment/ materials: Voice recorder, paper, flip-chart, post-its, pens

Discussions will be voice-recorded from a central point in the room after having asked participants' permission. Additionally, a person other than the moderator will take notes to cover the main aspects mentioned during discussions and note people who raised them. This person will be recruited from the early-career researchers to ensure they know all names and their presence does not disturb the rest of the group.

Prior to discussions, the moderator will shortly (<2mins) explain what the aim of discussions is and will provide a working definition of the term "interdisciplinary structures". Participants will be ensured that everything said during discussions will be handled confidentially and will be invited to actively participate. The moderator will then roughly follow a prepared guideline in leading discussions in order to ensure that all aspects are covered. The moderator will provide coffee, tea, and cookies for a more relaxed atmosphere.

Aim of the focus group discussion

Verifying the observations regarding interdisciplinary structures that emerged in the case-study project until the time of discussion, and finding out how early career researchers from the project have perceived the emergence of these structures.

Schedule

When?	What?
from 9:30	Setting up the room
10:00-10:05	Arrival, offering refreshments
10:05-10:10	Thank participants for coming; Explain aims of research; Confidentiality and permission to record
10:10-10:15	Introductory statement: What is the aim of discussion, encouragement to speak freely and ask questions Provide definition of "interdisciplinary structures"
10:15-10:30	Block I: Which interdisciplinary structures have emerged, in which structures are participants involved?
10:30-11:00	Block II: Perspectives on the emergence of interdisciplinary structures in the project
11:00-11:30	Block III: Change in attitudes and behaviour due to participation in interdisciplinary structures
11:30-11:40	Summarizing the discussion, giving participants room to correct, ask questions, follow-up
11:40-11:45	Ending the session, thanking participants

XIII.III.II Focus group discussion 1: Moderation guidelines

Diskussionsleitfaden Fokusgruppe 1

i. Begrüßung

Kurze Begrüßung; Vielen Dank, dass ihr heute alle zu dieser Diskussionsrunde gekommen seid.

ii. Informationen zum Dissertationsprojekt

Wie die meisten von euch wissen und ich auch im Vorfeld angekündigt hatte, stellt die heutige Fokusgruppendiskussion einen Teil der fokussierten Datenerhebung meines Dissertationsprojektes dar. Mein Eindruck aus dem vergangenen Jahr ist, dass die fächerübergreifende Zusammenarbeit einen großen Teil von [case study project] ausmacht – und das, obwohl jede und jeder von euch im Rahmen von [case study project] ein eigenes Forschungsprojekt verfolgt.

Es gibt mittlerweile zwar einige Studien zu Interdisziplinarität im wissenschaftlichen Kontext, oft liegt der Fokus aber auf Problemen mit und Hindernissen für Interdisziplinarität und häufig werden sehr stark formalisierte Strukturen, wie z.B. interdisziplinäre Forschungszentren, untersucht. Zur Frage des Entstehens und Gelingens fächerübergreifender Zusammenarbeit im Kontext wissenschaftlicher Projekte wie [case study project], in welchen alle Projektteilnehmerinnen und –teilnehmer nicht nur in ihrer oder seiner Disziplin, sondern auch der jeweiligen Fakultät bzw. wissenschaftlichen Einrichtung verortet bleibt, gibt es aber bisher noch kaum Erkenntnisse.

Im Rahmen meiner Doktorarbeit möchte ich deshalb untersuchen, wie interdisziplinäre Strukturen in wissenschaftlichen Projekten, genauer in [case study project], im Projektverlauf entstehen, welche Akteure an der Entstehung dieser Strukturen beteiligt sind, und welche Hindernisse und Gelingensbedingungen es für die Entstehung interdisziplinärer Strukturen gibt.

iii. Vertraulichkeitserklärung und Bitte um Zustimmung zur Aufnahme der Diskussion

Die Ergebnisse der heutigen Diskussion machen einen Teil der Datengrundlage meiner Doktorarbeit aus. Als solche werden alle Äußerungen, die heute in diesem Raum getroffen werden, völlig vertraulich behandelt. Ich würde mich freuen, wen ihr mir erlauben würdet, die Diskussion mit einem Tonbandgerät aufzunehmen. Zudem habe ich X gebeten, die wichtigsten Aspekte im Verlauf der Diskussion für mich zu notieren. Beim Transkribieren und Aufbereite der Notizen werde ich alle Angaben anonymisieren. Stimmt ihr unter dieser Voraussetzungen zu, dass ich die Diskussion aufzeichne?

iv. Einleitung in die Diskussion

[case study project] ist für mich eine besonders interessante Fallstudie, da nicht nur viele verschiedene Fächer und Fakultäten, sondern auch verschiedene wissenschaftliche Statusgruppen vertreten sind.

Im Rahmen der heutigen Fokusgruppendiskussion geht es mir vor darum, mehr darüber zu erfahren, wie ihr als Nachwuchswissenschaftlerinnen und –wissenschaftler in [case study project] die fächerübergreifende Zusammenarbeit im Projekt erfahrt. Ich möchte in der heutigen Diskussion drei Themenblöcke abdecken. Zuerst würde ich gerne wissen, welche interdisziplinären Strukturen ihr im Projekt beobachtet und an welchen interdisziplinären Strukturen ihr selbst beteiligt seid. Anschließend möchte ich mit euch darüber sprechen, wie ihr die Entstehung dieser Strukturen erfahren habt. Zuletzt würde ich gerne erfahren, ob und wie die Beteiligung an interdisziplinären Strukturen in [case study project] eure Tätigkeiten im Bereich der Forschung und Lehre beeinflussen.

Ich würde mich freuen, wenn ihr alle rege mitdiskutiert. Es geht nicht darum, „richtige" Antworten auf meine Fragen zu bekommen – ganz im Gegenteil möchte ich gerne wissen, was eure ganz subjektiven Erfahrungen mit Interdisziplinarität [case study project] sind.

Ich würde mich sehr freuen, wenn wir vor diesem Hintergrund auch ganz offen miteinander diskutiere können. Es soll auch kein Frage-Antwort-Spiel werden, im Rahmen des zu diskutierenden Themas dürft ihr selber auch gerne Fragen aufwerfen und auf die Äußerungen anderer Teilnehmerinnen und Teilnehmer eingehen.

v. Definition von „Strukturen"

Regelmäßige und wiederkehrende Interaktionen einer Gruppe von Projektteilnehmerinnen und –teilnehmern aus mindestens zwei verschiedenen wissenschaftlichen Disziplinen mit einem klar definierten Ziel und Format.

[In dieser Diskussion werden alle fächerübergreifenden Formate berücksichtigt – wie „interdisziplinär" multi-, inter-, trans) diese sind spielt zu diesem Zeitpunkt keine Rolle und soll im Projektverlauf erforscht werden.]

vi. Diskussion

Block I: Welche Interdisziplinäre Strukturen haben sich im bisherigen Projektverlauf von [case study project] entwickelt und an welchen Strukturen seid Ihr als Nachwuchswissenschaftlerinnen und –wissenschaftler maßgeblich beteiligt?

1. Welche fächerübergreifenden Strukturen haben sich im Projektverlauf bisher entwickelt?

2. An welchen dieser Strukturen seid ihr beteiligt?

Block II: Perspektive der Nachwuchswissenschaftlerinnen und –wissenschaftler auf die Entwicklung fächerübergreifender Strukturen in [case study project]

3. Zu welchem Zweck haben sich die eben genannten Strukuren Eurer Meinung nach entwickelt?
    i. Welche Ziele werden mit den Strukturen verfolgt (lehr- oder forschungsbezogen?

4. Wer hat die Entstehung der verschiedenen Strukturen Eurer Meinung nach maßgeblich angestoßen?
    a. Wie beurteilt Ihr die Rolle der verschiedenen im Projekt vertretenen Gruppen – der Projektleitung, der Professoren, und der Nachwuchswissenschaftler – bezüglich der Entstehung und Entwicklung der Strukturen?
    b. Wie würdet ihr die Entstehung und Entwicklung der verschiedenen Strukturen am eheste einordnen – als top-down, d.h. von oben implementierte, oder bottom-up, d.h. aus der Projektbasis heraus entstandene Prozesse?

5. Habt ihr im Rahmen der Entstehung und Weiterentwicklung der Strukturen Probleme oder Schwierigkeiten beobachtet oder erfahren? So ja, welche?
    a. Widerstände vonseiten bestimmter Gruppen oder Einzelpersonen?
        i. Aus welcher Statusgruppe
    b. Schwierigkeiten aufgrund disziplinärer Unterschiede
        i. z.b. Sprache, Kommunikation
        ii. Schwierigkeiten mit der Wertschätzung von in anderen Disziplinen üblichen theoretische und methodische Ansätzen

6. Konntet Ihr im Rahme der Entstehung und Weiterentwicklung der Strukturen Unterstützung und/oder Ermutigung erfahren? Wenn ja, welcher Art und von welcher Seite?

7. Für wie weit entwickelt erachtet Ihr die verschiedenen Strukturen – haben sie Eurer Meinung nach bereits ein voll entwickeltes Stadium erreicht oder befinden sie sich noch im Wandel?

Block III: Inwiefern beeinflussen die Strukturen die Lehr- und Forschungspraxis von Nachwuchswissenschaftlerinnen und –wissenschaftlern in [case study project]?

8. Inwiefern beeinflusst die Teilnahme an den verschiedenen Strukturen eure wissenschaftlichen Tätigkeiten, sowohl in der Lehre als auch in der Forschung?
    a. Wie üblich war fächerübergreifende Zusammenarbeit für euch vor Beginn des Projektes? (Könnt Ihr Beispiele nennen?)
    b. Inwiefern hat sich Eure Lehr- und/oder Forschungspraxis aufgrund der Teilnahme an den verschiedenen Strukturen gewandelt?
        i. Könnt Ihr hier Beispiele nennen? (z.B. Ko-Publikation mit Kolleginnen aus anderen Disziplinen)
    c. Haben manche fächerübergreifende Strukturen einen stärkeren Einfluss auf diesen Wandel als andere?

9. Inwiefern beeinflusst die Teilnahme an fächerübergreifenden Strukturen Eurer Meinung nach Euren wissenschaftlichen Tätigkeiten über [case study project] hinaus?

10. Welche Erfahrungen habt ihr mit der Unterstützung Eurer Betreuerinnen und Betreuer bezüglich Eurer fächerübergreifenden Tätigkeiten gemacht?
    a. Für diejenigen von euch, die Ihre Betreuer bereits vor Projektbeginn kannten: Wie üblich war fächerübergreifende Zusammenarbeit an Euren Lehrstühlen vor Projektbeginn und welche Veränderungen konntet ihr im bisherigen Projektverlauf von [case study project] feststellen?

Block IV (falls noch Zeit): Reflektion der Gelingensbedingungen für die Entstehung interdisziplinärer Strukturen

11. Welche Faktoren und Bedingungen sind Eurer Meinung nach für die erfolgreiche Entstehung und Weiterführung interdisziplinärer Strukturen – allgemein sowie in Bezug auf [case study project] - relevant und warum?

12. Wie schätzt ihr die Wahrscheinlichkeit einer Fortführung der verschiedenen fächerübergreifenden Formate nach Ende der Projektlaufzeit ein?

vii: Raum für Nachfragen an Teilnehmerinnen und Teilnehmer oder von diesen

viii: Erneute Aufklärung über weitere Verwendung der soeben erhobenen Daten.

iv: Verabschiedung

XIII.III.III Focus group discussion 2: Aims and organisation

Participants: PhD students and post-docs of the case study project

Place and time: Tuesday, 17.12.2019, 10:00-12:00, [redacted]

Equipment/ materials: USB-Stick for recordings, extra voice-recorder

Discussions will be video- and voice-recorded using the room's special equipment after having asked participants' permission. The moderator will make sure that camera and microphones are set at the right angles and are active before the discussion. As a safety precaution in case other recordings fail, an additional voice-recorder be used. As the video recordings will show who made which statements, note taking of central aspects and speakers will not be necessary.

Prior to discussions, the moderator will shortly (<2mins) explain what the aim of discussions is, will briefly recapitulate the key findings of the last discussion and will provide a working definition of the term "interdisciplinary structures". Participants will be informed that everything said during discussions will be handled confidentially and will be invited to actively participate.

The moderator will then roughly follow a prepared guideline in leading discussions in order to ensure that all aspects are covered.

The moderator will provide coffee, tea, and cookies for a more relaxed atmosphere.

Aim of the focus group discussion

Verifying the observations and results from a first focused data collection period regarding interdisciplinary structures that emerged in the case-study project in the first project phase; investigating which changes have taken place since then and especially when the first project phase ended and a second phase, partly with different participants, started.

Schedule

When?	What?
from 9:30	Setting up the room, setting and activating microphones and cameras
10:00-10:15	Arrival, offering refreshments
10:15-10:20	Thank participants for coming; Explain aims of research; Confidentiality and permission to record
10:20-10:30	Introductory statement: What is the aim of discussion, encouragement to speak freely and ask questions Provide definition of "interdisciplinary structures"
10:30-10:45	Block I: Which interdisciplinary structures have emerged, what is their aim, in which structures are participants involved?

10:45-11:15	Block II: Emergence and further development/change of interdisciplinary structures
11:15-11:30	Block III: Success factors and institutionalisation of interdisciplinary structures
11:30-11:40	Summarizing the discussion, giving participants room to correct, ask questions, add things
11:40-11:45	Ending the session, thanking participants

XIII.III.IV Focus group discussion 2: Moderation guidelines

Diskussionsleitfaden Fokusgruppe 2

i. Begrüßung

Kurze Begrüßung; Vielen Dank, dass ihr heute alle zu dieser Diskussionsrunde gekommen seid.

ii. Informationen zum Dissertationsprojekt

Wie die meisten von euch wissen und ich auch im Vorfeld angekündigt hatte, stellt die heutige Fokusgruppendiskussion einen Teil der fokussierten Datenerhebung meines Dissertationsprojektes dar. In den vergangenen drei Jahren hat sich gezeigt, dass die fächerübergreifende Zusammenarbeit einen großen Teil von [case study project] ausmacht – und das obwohl jede und jeder von euch im Rahmen von [case study project] ein eigenes Forschungsprojekt verfolgt.

Es gibt mittlerweile zwar einige Studien zu Interdisziplinarität im wissenschaftlichen Kontext, oft liegt der Fokus aber auf Problemen mit und Hindernissen für Interdisziplinarität und häufig werden sehr stark formalisierte Strukturen, wie z.B. interdisziplinäre Forschungszentren, untersucht. Zur Frage des Entstehens und Gelingens fächerübergreifender Zusammenarbeit im Kontext wissenschaftlicher Projekte wie [case study project], in welchen alle Projektteilnehmerinnen und –teilnehmer nicht nur in ihrer oder seiner Disziplin, sondern auch der jeweiligen Fakultät bzw. wissenschaftlichen Einrichtung verortet bleibt, gibt es aber bisher noch kaum Erkenntnisse.

Im Rahmen meiner Doktorarbeit möchte ich deshalb untersuchen, wie interdisziplinäre Strukturen in wissenschaftlichen Projekten, genauer in [case study project], im Projektverlauf entstehen, welche Akteure an der Entstehung dieser Strukturen beteiligt sind, und welche Hindernisse und Gelingensbedingungen es für die Entstehung interdisziplinärer Strukturen gibt.

iii. Vertraulichkeitserklärung und Bitte um Zustimmung zur Aufnahme der Diskussion

Die Ergebnisse der heutigen Diskussion machen einen Teil der Datengrundlage meiner Doktorarbeit aus. Als solche werden alle Äußerungen, die heute in diesem Raum getroffen werden, völlig vertraulich behandelt. Ich würde mich freuen, wenn ihr mir erlauben würdet, sowohl Ton- als auch Videoaufnahmen der Diskussion anzufertigen. Beim Transkribieren und Aufbereiten der Notizen werde ich alle Angaben anonymisieren, sodass außer Euch und mir hinterher niemand wissen wird, wer welche Äußerung getroffen hat. [Einverständnis Aufzeichnung]

iv. Einleitung in die Diskussion und Überblick über Kernergebnisse der letzten Diskussion

[case study project] ist für mich eine besonders interessante Fallstudie, da nicht nur viele verschiedene Fächer und Fakultäten, sondern auch verschiedene Statusgruppen

vertreten sind. Anfang 2018 habe ich bereits eine Gruppendiskussion zu interdisziplinären Strukturen im Projekt durchgeführt. Vielen Dank, dass ihr mir diese Möglichkeit gegeben habt. Seitdem ist noch sehr viel geschehen und auch der Übergang zwischen den Projektphasen und die teils geänderte Zusammensetzung ist sehr spannend für meine Datenerhebung. Im Rahmen der heutigen Fokusgruppendiskussion geht es mir deshalb darum, mehr darüber zu erfahren, wie ihr als Nachwuchswissenschaftlerinnen und –wissenschaftler in [case study project] die Weiterentwicklung interdisziplinärer Formate und Strukturen wahrnehmt, inwiefern ihr an der Gestaltung dieser beteiligt seid, und welche Gelingensbedingungen ihr für nachhaltige oder eventuell sogar institutionell verankerte interdisziplinäre Strukturen seht.

Ich würde mich freuen, wenn ihr alle rege mitdiskutiert. Es geht nicht darum, „richtige" Antworten auf meine Fragen zu bekommen – ganz im Gegenteil möchte ich gerne wissen, was eure ganz subjektiven Erfahrungen mit Interdisziplinarität in [case study project] sind. Ich würde mich sehr freuen, wenn wir vor diesem Hintergrund offen miteinander diskutiere können. Es soll auch kein Frage-Antwort-Spiel werden, im Rahmen des zu diskutierenden Themas dürft ihr selber auch gerne Fragen aufwerfen und auf die Äußerungen anderer Teilnehmerinnen und Teilnehmer eingehen.

v. Definition von „Strukturen"

Regelmäßige und wiederkehrende Interaktionen einer Gruppe von Projektteilnehmerinnen und -teilnehmern aus mindestens zwei verschiedenen wissenschaftlichen Disziplinen mit einem klar definierten Ziel und Format.

[In dieser Diskussion werden alle fächerübergreifenden Formate berücksichtigt – wie „interdisziplinär" multi-, inter-, trans) diese sind spielt zu diesem Zeitpunkt keine Rolle und soll im Projektverlauf erforscht werden.]

vi. Diskussion

Block I: Welche Interdisziplinäre Strukturen haben sich im bisherigen Projektverlauf von [case study project] I und II entwickelt und an welchen Strukturen seid Ihr als Nachwuchswissenschaftlerinnen und –wissenschaftler maßgeblich beteiligt?

1. Welche fächerübergreifenden Strukturen haben sich im Projektverlauf bisher entwickelt und an welchen dieser Strukturen seid ihr als NachwuchswissenschaftlerInnen beteiligt?
2.
3. Welches Ziel wird mit der Etablierung dieser Strukturen verfolgt?
    a. Fokus auf Forschung und/oder Lehre?

Block II: Perspektive der Nachwuchswissenschaftlerinnen und –wissenschaftler auf die Entstehung und Weiterentwicklung fächerübergreifender Strukturen in [case study project]

1. Könnt ihr mir mehr über die (Weiter-)Entwicklung der eben genannten Strukturen erzählen?

a. Wie haben die Strukturen sich entwickelt und ggf. auch verändert, vor allem auch in Hinblick auf das Einläuten einer zweiten Projektphase?
    i. Zusammensetzung?

13. Welche Akteure spielen in der Entwicklung und Veränderung der Strukturen eine bedeutende Rolle?
    a. Wie beurteilt Ihr die Rolle der verschiedenen im Projekt vertretenen Gruppen – der Projektleitung, der Professoren, und der Nachwuchswissenschaftler – bezüglich der Entstehung und Entwicklung der Strukturen?
    b. Wie haben sich diese Rollen im Verlauf der Zeit verändert?
    c. Welche Rolle spielen neue Projektteilnehmerinnen und -teilnehmer?

Block III: Gelingensbedingungen für die Entstehung und institutionelle Verankerung interdisziplinärer Strukturen

14. Welche Faktoren und Bedingungen sind Eurer Meinung nach für die erfolgreiche Entstehung und Weiterführung interdisziplinärer Strukturen – allgemein sowie in Bezug auf [case study project] - relevant und warum?

15. Wie schätzt ihr die Wahrscheinlichkeit einer Fortführung der verschiedenen fächerübergreifenden Formate nach Ende der Projektlaufzeit ein?
    a. Welche Barrieren und Gelingensbedingungen für eine institutionelle Verankerung der Strukturen bestehen eurer Meinung nach?

vii: Raum für Nachfragen an Teilnehmerinnen und Teilnehmer oder von diesen

viii: Erneute Aufklärung über weitere Verwendung der soeben erhobenen Daten.

iv: Verabschiedung

XIII.IV Focused coding tree

Theme	Main code	Sub code	Description
I. Interdisciplinary structures			
	Types of structures		*Types of interdisciplinary structures within case study project*
		EMCR group	
		Thematic working group	
		Teaching collaborations	
		Other and situative collaborations	*Other interdisciplinary formats/structures which do not fit the definitions above, e.g. co-publications, project meetings, workshops*
	Emergence of structures		*Evidence on emergence of structures*
		Pre-designed (project proposal)	
		Top-down steering	
		Bottom-up developments	
		Emergence as dynamic process	
	Participation		*Evidence regarding the participation of and selection of project participants to interdisciplinary structures*
		Obligation	
		Voluntary	
		Active participation	
		Inactive participation	
		Non-participation	
		Selection of participants	*Strategic: key positions, Research/teaching interests, Disciplinary scope*
	Operational dynamics		*Evidence regarding operational dynamics of structures, including their focus, regularity and formalization, as well as degree of output orientation*
		Focus	*e.g. teaching and/or research; topical focus*

		Regularity	
		Formalization	
		Output-orientation	
II. Interdisciplinary collaboration			
	Descriptions and perceptions of collaboration		*Project participants' perceptions of interdisciplinary collaboration, regardless of nature (positive or negative)*
		Confrontation	
		Reflection	
		Broadening own perspective	
		Leaving comfort zone	
		Learning about new things	
		Questioning own methods and approaches	
		Exchange	
		Culture of communication	
		Accessing knowledge	
		Reflection of boundaries between disciplines	
	Evaluation of collaboration		*Project participants' evaluation of interdisciplinary collaboration and resumé of perceptions of aspects of interdisciplinary work*
		Fruitful	
		Beneficial	
		Stimulating	
		Inspiring	
		Enriching	
		Irritating	
		Frustrating	
		Time-consuming	
		Overwhelming	

		Scary	
		Threatening	
		Excluding	
		Invasive	
	Characterisation of collaboration		*Characterisation of collaboration according to existing typologies of interdisciplinarity*
		Multi-disciplinary	*Juxtaposing of disciplinary knowledge, fulfilled by project design*
		Pluri-disciplinary	*Colaboration on a common theme,, descriptions such as additive, buying in*
		Cross-disciplinary	*Borrowing of concepts and methods to support own research or teaching*
		Interdisciplinary	*Integration of knowledge and methods for solving of common questions and problems*
		Transdisciplinary	*Transformation of disciplinary knowledge, either by creating something new in the context of academia itself, or through integration of external actors (living lab)*
	Outcomes of collaboration		*Evidence regarding outcomes of collaboration within interdisciplinary structures, e.g. publications, materials, …*
		Publications	
		Conference presentations	
		Further collaborations	
		Teaching materials	
		Technical infrastructure	
	Sustainability of collaboration		*Evidence regarding sustainability of interdisciplinary structures*
III. Actors and motivation			
	Actors: Descriptive		*Evidence on actors involved in emergence of interdisciplinary structures*
		Professors	*Sometimes with additional strategic position within university*
		EMCR	
		Working group coordinators	

		Project leaders	
		Project administration	
		Fachwissenschaften	
		Fachdidaktiken	
	Actors: Motivation		*Evidence on actors' motivation to engage in interdisciplinary collaboration*
		Access to resources	
		Legitimisation	
		Scientific quality	
		Responding to student needs	
		Advocating for inclusion-oriented teacher training	
		Other intrinsic motivation	
	Actors: Ideal types		*Ideal types of interdisciplinary actors, based on their participation in and motivation to collaborate as well as their contribution to the emergence of interdisciplinary structures*
		Non-participants	
		Routine actors	
		Discipline-based actors	
		Sense-making actors	
		Strategic actors	
IV. Barriers to and facilitators for interdisciplinarity			
	Barriers/ challenges to interdisciplinarity		*Barriers and challenges to the emergence of as well as to collaboration within interdisciplinary structures*
		Workload, time, resources	*Time-goal conflicts: Finding time for interdisciplinarity while having to finish own PhD project*
			Personal conflict
		(Disciplinary) differences and conflict	*Disciplinary conflict*
			Conflict Fachwissenschaften/ Fachdidaktiken

		Differences in language, lack of common understanding	
		Pre-existing organisational structures	
		Career (structures) / Socialisation	
		Dynamics of leadership and autonomy (neg.)	*Professorial autonomy*
			Lack of transparency
			Lack of appreciation of interdisciplinary work
	Facilitators for interdisciplinarity		*Facilitators for the emergence of as well as collaboration within interdisciplinary structures*
		Sympathy, trust, similarity	
		Previous ties	
		Predisposition for interdisciplinarity	
		Shared aims and understanding	
		Appreciation and encouragement	
		The project as an organisational framework	
		Dynamics of leadership and autonomy (pos.)	*Legitimisation of interdisciplinarity*
			Protection from other forces
			Responding to diverse needs of project participants
			Balance between obligation and voluntariness