Students' Affective-Motivational Research Dispositions

Modelling, Assessment, and Their Development Through Research-Based Learning

D I S S E R T A T I O N

zur Erlangung des akademischen Grades

Doctor rerum naturalium
(Dr. rer. nat.)

eingereicht an der
Lebenswissenschaftlichen Fakultät der Humboldt-Universität zu Berlin

von

Insa Lara Reichow (geb. Wessels)

Präsidentin der Humboldt-Universität zu Berlin:
Prof. Dr. Sabine Kunst

Dekan der Lebenswissenschaftlichen Fakultät der Humboldt-Universität zu Berlin:
Prof. Dr. Bernhard Grimm

Gutachter_innen:
Prof. Dr. Matthias Ziegler
Prof. Dr. Harald Mieg
Dr. Susanne Haberstroh

Tag der mündlichen Prüfung: 26. März 2021

Please cite as:
Reichow, I. (2021). *Students' Affective-Motivational Research Dispositions – Modelling, Assessment, and Their Development Through Research-Based Learning* [Doctoral dissertation, Humboldt-Universität zu Berlin]. Edoc-Server der Humboldt-Universität zu Berlin. https://doi.org/10.18452/22673

Table of Contents

List of Figures

List of Tables

Summary

Over the course of their studies, students of the social sciences are expected to learn how research findings are generated in their discipline. This does not only include the mere understanding of different empirical methods, but the ability to independently conduct research projects. This ability is described by the term *research competence*. For the social sciences, there exists a model that describes the cognitive facet of research competence (e.g. knowledge of methods), but there is no description and operationalisation of the affective-motivational dispositions that are additionally necessary for conducting research.

Research competence in the social sciences is thought to be fostered by implementing courses in the format of research-based learning. Research-based learning is a didactic format in which students independently complete a full research cycle under the guidance of an instructor in order to answer their own research questions. So far, however, it has not been empirically shown whether research-based learning is a suitable format for developing cognitive and affective-motivational research dispositions in the social sciences. In accordance with these research desiderata, three central goals were addressed in this dissertation project:

The first goal of this dissertation was to develop a comprehensive model of affective-motivational research dispositions for students of the social sciences. With the help of expert interviews and an expert rating, six challenging situations and nine affective-motivational research dispositions were identified.

The second goal was the development and validation of test instruments to assess the identified affective-motivational research dispositions. Based on the standards of psychological test construction, self-assessment scales were developed for all nine affective-motivational research dispositions and initial evidence for their validity was generated.

These previous steps formed the basis for addressing the third goal of this dissertation: To test the extent to which research-based learning is a suitable format for developing different cognitive and affective-motivational research dispositions in the social sciences. In a pre-post study in research-based learning courses, it was shown that students benefit from a favourable development of some of the research dispositions, whereas other dispositions decreased. The role of the facilitating instructor proved to be central.

The products of this dissertation include a model of affective-motivational research dispositions in the social sciences, self-assessment scales for assessing these dispositions, and findings on the effectiveness of research-based learning.

Zusammenfassung

Von Studierenden wird gefordert, dass sie im Rahmen eines sozialwissenschaftlichen Studiums lernen, wie in ihrem Fach Forschungserkenntnisse generiert werden. Dazu gehört nicht nur das bloße Verständnis verschiedener empirischer Methoden, sondern auch die Fähigkeit eigenständig Forschungsprojekte durchführen zu können. Diese Fähigkeit wird mit dem Begriff der *Forschungskompetenz* beschrieben. Für die Sozialwissenschaften liegt bereits ein Modell vor, dass die kognitive Facette von Forschungskompetenz (z.B. Methodenwissen) beschreibt, jedoch fehlt es an einer Beschreibung und Operationalisierung der affektiv-motivationalen Dispositionen, die für die eigenständige Durchführung von Forschungsarbeiten zusätzlich notwendig sind.

Die Ausbildung von Forschungskompetenz soll in den Sozialwissenschaften durch die Umsetzung von Lehrveranstaltungen im Format des Forschenden Lernens gesichert werden. Beim Forschenden Lernen handelt es sich um ein didaktisches Format, bei dem Studierende unter Anleitung einer Lehrperson eigenständig einen kompletten Forschungszyklus durchlaufen, um eine selbstentwickelte Forschungsfrage zu beantworten. Bisher ist jedoch empirisch nicht eindeutig geklärt, ob das Forschende Lernen tatsächlich ein geeignetes Format ist, um kognitive und affektiv-motivationale Forschungsdispositionen in den Sozialwissenschaften auszubilden. Entsprechend dieser Forschungsdesiderate wurden in der vorliegenden Arbeit drei zentrale Ziele adressiert:

Ein erstes Ziel war es, ein umfassendes Modell affektiv-motivationaler Forschungsdispositionen für Studierende der Sozialwissenschaften zu entwerfen. Mithilfe von Experteninterviews und einem Expertenrating wurden neun affektiv-motivationale Forschungsdispositionen identifiziert, die notwendig sind, um die Anforderungen eines sozialwissenschaftlichen Forschungsprozesses zu meistern.

Ein zweites Ziel lag in der Entwicklung und Validierung von Testinstrumenten zur Erfassung der identifizierten affektiv-motivationalen Forschungsdispositionen. Basierend auf den Standards der psychologischen Testkonstruktion konnten Selbsteinschätzungsskalen für alle neun affektiv-motivationalen Forschungsdispositionen erarbeitet und erste Validierungsnachweise erbracht werden.

Diese Arbeiten bildeten die Grundlage für das Erreichen des dritten Ziels dieser Dissertation: Es sollte getestet werden, inwieweit das Forschende Lernen ein geeignetes Format ist, um verschiedene kognitive und affektiv-motivationale Forschungsdispositionen bei Studierenden der Sozialwissenschaften auszubilden. Im Rahmen einer Prä-Post-Studie in Veranstaltungen des Forschenden Lernens zeigte sich, dass Studierende durch die Teilnahme am Forschenden Lernen sowohl positive als auch negative Entwicklungen verschiedener Forschungsdispositionen aufweisen. Als zentral erwies sich hier die Rolle der begleitenden Lehrperson.

Als Produkte dieser Arbeit stehen nun ein Modell verschiedener affektiv-motivationaler Forschungsdispositionen in den Sozialwissenschaften, Selbsteinschätzungsskalen zur Erfassung dieser Dispositionen und Erkenntnisse zur Wirksamkeit Forschenden Lernens zur Verfügung.

1 Introduction

1.1 Relevance of the Topic

Universities have two central educational aims: First, universities have the mandate to train students to become "enlightened citizens" – i.e. citizens who are educated, critical, and self-determined. Second, universities ensure that students receive an education that enables them to become skilled professionals, for both inside and outside academia (Bourgeois, 2002, p. 39). Against the background of our modern "knowledge societies", skilled professionals are those who ensure the production and evaluation of new knowledge (Välimaa & Hoffman, 2008). But what exactly do students need to learn to be able to participate in the production and evaluation of new knowledge?

What students are to learn is described by the Framework for Qualifications in the German Higher Education System (HRK, KMK, & BMBF, 2017). With an exponentially growing body of knowledge available, it does not concentrate on the knowledge to be taught but on the competencies students should gain as an outcome of their bachelor's and master's degrees. According to the framework, the competencies all students should acquire to participate in the production and evaluation of new knowledge include the capability to apply knowledge taking scientific findings into account and to critically generate knowledge using scientific methods. For the latter, students need to generate and operationalise research questions, choose suitable research methods, and discuss and interpret research results (ibid., p. 8). These qualifications are thought to hold for all study programmes in Germany but can be emphasized for the field of social sciences, where the ability to generate evidence in a methodologically sound way is a proposed learning objective (Engel, 2002). In the social sciences, these competencies should not only prepare students to pursue academic careers as researchers but also to work in professions outside academia (British Academy, 2012), e.g. in research-near occupations in market research and evaluation (Russ-Eft & Preskill, 2009).

It is however not entirely clear how the demands of the German Framework for Qualifications translate into concrete competencies within the individual disciplines. What exactly do students need to be able to do when they are asked to generate a research question in the social sciences? A recent project at Humboldt-Universität zu Berlin addressed this question among others and established a first model of research competence for the social sciences (Gess, Geiger, & Ziegler, 2018; Gess, Wessels, & Blömeke, 2017). This model describes cognitive research dispositions, like methodological knowledge, necessary for students to conduct their own pieces of research. It provides a specific account of what students need to learn as part of their study programmes in the social sciences. However, its focus on purely cognitive dispositions might render it incomplete in explaining competent research performance: Competent performance does not only require cognitive dispositions but affective-motivational dispositions just as well (Blömeke, Gustafsson, & Shavelson, 2015). That affective-motivational dispositions are involved in such a rational task, as scientific work usually is, seems surprising at first. But affective-motivational dispositions such as tolerance for frustration seem indeed relevant for research processes (e.g. J. John & Creighton, 2011). The observation that research education in the social sciences is connected with a range of affective-motivational problems like negative attitudes towards research (Williams, Payne, Hodgkinson, & Poade, 2008) provides additional justification for looking into the affective-motivational dispositions that shape student research processes.

A model that describes affective-motivational research dispositions necessary for student research in the social sciences is however non-existent. A coherent model of research competence incorporating both cognitive and affective-motivational research dispositions could clarify what students need to learn to fulfil the demands of the German Framework for Qualifications (HRK et al., 2017). The formulation of specific competencies could also facilitate the development and assessment of effective instructional formats to foster these competencies.

Research competencies are usually acquired in three types of learning opportunities in the social sciences: First, all students are required to write *bachelor's and master's theses* that include individual and original research work and serve as proof of the acquired competencies (cf. Hosein & Rao, 2017). Second, there are *research methods courses*. In these courses, students gain basic and advanced knowledge on different quantitative and qualitative methodologies in the respective discipline. Methods courses constitute the traditional and established form for fostering research competence in the social sciences. In psychology for example, a typical bachelor programme encompasses mandatory methods and diagnostic courses worth 35-52 credit points (out of 180 credit points). [1] In educational sciences, a typical bachelor programme encompasses mandatory empirical methods courses worth 20 credit points.[2] Internationally, a range of problems connected with research methods courses have been reported, for example students' perception of these courses as irrelevant, very difficult, or uninteresting (Earley, 2014). In Germany, similar problems are prevalent: Students in the social sciences often have unfavourable attitudes towards research methods courses caused by multiple factors such as a lack of basic mathematical knowledge but also motivational problems (Stark & Mandl, 2000). This results in difficulties to understand and apply even simple statistical concepts and procedures (Stark, Puhl, & Krause, 2009; Stark, Tyroller, Krause, & Mandl, 2008). One underlying problem might be that theory and research methods are often taught in distinct courses (Stark et al., 2009). Consequently, theoretical and methodological knowledge is acquired in dissociation which might lead to knowledge compartmentalisation and "inert knowledge" (Reinmann & Mandl, 2006) that does not easily transfer to real research situations.

Third, to tackle the aforementioned problems and to enable the acquisition of research competence, students are increasingly required to participate in *research-based learning* (RBL) as part of their studies. RBL seeks students to conduct their own research projects in a self-regulated manner, based on their own research questions. By participating in RBL, students are given the opportunity to acquire content and methodological knowledge while working on their own pieces of research. RBL is seen as a high-impact educational practice (Kilgo, Ezell Sheets, & Pascarella, 2015) and recommended to be incorporated in any study programme (Healey & Jenkins, 2009). In Germany, RBL is, for instance, a key element in the German Framework for Qualification (HRK et al., 2017) and recommended by the German Science Council as a promising way to acquire research competence (Wissenschaftsrat, 2006). However, while these theoretical claims have a strong empirical basis for STEM disciplines where various benefits of RBL are well-documented (e.g. Linn, Palmer, Baranger, Gerard, & Stone, 2015), RBL's effectiveness for the facilitation of research competence in the social sciences

[1] Study regulations for bachelor's programmes in Psychology were compared. Methods and diagnostics courses comprise 35 credits (out of 180) at Humboldt-Universität zu Berlin and 52 credits (out of 180) at Freie Universität Berlin.

[2] Study regulations for bachelor's programmes in Educational Sciences were compared. Methods courses comprise 20 credits (out of 180) at Humboldt-Universität zu Berlin and 20 credits (out of 180) at Freie Universität Berlin.

can only be assumed. Evidence on the effectiveness of RBL is necessary to gain evidence-based arguments for the wide-spread implementation of this instructional format.

1.2 Central Objectives

Against the background described above, this dissertation has three central objectives:

(1) The first objective is to empirically derive a model of those affective-motivational dispositions necessary to successfully conduct student research in the social sciences.

(2) The second objective is to develop and validate instruments to assess the affective-motivational research dispositions identified in the first step.

(3) The third objective is to examine whether cognitive and affective-motivational research dispositions can be facilitated through participation in research-based learning courses in the social sciences.

1.3 Structure of This Dissertation

The three central objectives and my chosen way of addressing them touch upon different theoretical approaches and debates from educational psychology, psychological assessment, educational sciences, and higher education policy. The following theoretical sections seek to provide the necessary information from these different disciplines to understand the background of my dissertation and the methodological procedures applied.

The growing orientation towards competencies in higher education settings forms the broad context for this dissertation. Hence, the background of the concept and definitions of competence are described in a first step (see section 2.2). Based on these general ideas on competence, the existing models of research competence are introduced (see section 2.3). Since it is the goal to identify affective-motivational research dispositions, affective-motivational aspects of learning are introduced (see sections 3.1 and 3.2) and form the baseline for identifying potential affective-motivational research dispositions (see section 3.3).

In order to measure affective-motivational research dispositions, they need to be operationalized in the form of valid instruments. Thus, in a next step, thoughts and theories on the modelling and measurement of competence are introduced (see chapter 4).

The third goal of this dissertation, namely, to examine whether RBL is suitable to foster cognitive and affective-motivational research dispositions, is underpinned by the theoretical background on RBL as an instructional format that links teaching and research (see chapter 5). The current evidence on the effectiveness of RBL is reviewed by the help of a systematic review (see chapter 6) to constitute an informed basis for my own study on the effectiveness of RBL.

The main research questions, hypotheses, and the methodological framework of this dissertation are described in chapter 7. In this chapter, the individual methodological steps are introduced and explained in greater depth if they are not part of one of the publications. Equipped with the necessary theoretical and methodological background information, the two published studies are presented (see chapters 8 and 9).

An overarching discussion summarizes the results of these and additional non-published studies, views the findings in the context of existing evidence, and draws implications for theory and practice of the growing field of research education (see chapter 10).

2 Research Competence

2.1 Background of the Construct "Competence"

Through the 1980s and 1990s, the predominant teaching conception in higher education was that of cognitivism. In this theory, the learner acquires knowledge in a rational and systematic way which was reflected in the teaching set-up: The focus was on the instructor and the content to be conveyed, whereas the student served a receptive function (Reinmann & Mandl, 2006). In the 90s, paradigms shifted: Cognitivism slowly gave way to constructivism, expressed by an increased attention to students internal learning processes. Students were viewed as learners who construct their own knowledge. This established a *shift from teaching to learning* (Barr & Tagg, 1995) – meaning that educational processes address students no longer as mere subjects of knowledge transmission processes but invite them to actively construct their own knowledge.

A few years later, the Bologna Declaration (Bologna Process Committee, 1999) formally established this shift from teaching to learning at European Universities. The traditional focus on content to be conveyed had to give way to reconsidering what students were to take away from the individual modules of their study programmes (Wildt, 2006). In the German debate, these learning outcomes are often operationalised in the form of different competencies.[3]

The term *competence* has its roots in three different and independent areas of research (cf. Klieme & Hartig, 2008). One dates back to Noam Chomsky's idea of linguistic competence (Chomsky, 1968). Competence in this understanding describes the innate and universal human capacity to learn a language. Another root lies in the juridical-sociological discussion initiated by Max Weber, who views competence as a defined set of bureaucratic responsibilities (cf. Kobelt, 2008). A third root lies in psychology, where competence denotes a set of abilities to perform a certain task (cf. Klieme & Hartig, 2008). Starting from this third conception of competence, a widespread debate has started about the definition, scope, measurement, and importance of different competencies for schools and higher education institutions in Germany. In schools, the new "competence orientation" informs the design of curricula (Künzli, 2010) and in international large scale studies like the PISA study, competencies are in the focus of assessment (e.g. Klieme et al., 2010). In higher education, the endeavours to find and define meaningful competencies for the different disciplines started in the 2010's and have subsequently shaped the teaching of thousands of students.

2.2 A Definition of Competence

The quest to identify a competence needs to start from a rigid definition of the construct. For the field of education, several definitions of competence exist which highlight different aspects of the construct. Weinert (2001) in its influential work defines competence as "cognitive, motivational, and social prerequisites necessary and/or available for successful learning and action" (p. 51). Competence here consists of a range of different dispositions that are necessary to actively solve specific problems of a given domain. The combination of cognitive, motivational, and affective aspects denotes a holistic understanding of competence

[3] Despite all controversy concerning these developments, at least the terms are clear in the German debate: One speaks of "Kompetenz" and "Kompetenzen". In English publications the terms "competency" and "competence" seem to be used interchangeably. Most authors cited for the purpose of this dissertation use "competence". However, while the term "competence" is a noncount noun without a plural form, the same authors often speak of "competencies", the plural form of "competency" (e.g. in Rychen and Salganik, 2003). Even though it might not be correct from a linguist's perspective, I will stick to this convention and consistently speak of "competence" to denote the singular, and "competencies" to denote the plural form.

(Rychen & Salganik, 2003). In addition, competence in Weinerts' definition does not only describe latent abilities but specifically refers to successful action and is thus termed "action competence" (Weinert, 2001).

Weinert's holistic definition of competence and its focus on acting has been the foundation of many other definitions, especially in the German discussion. Klieme and Hartig (2008) for example state that competence refers to the mental processes and capacities that are necessary to complete an action. These capacities include cognition, motivation, volition, knowledge, and ability (ibid., p. 13). A holistic definition of competence is also put forward by Blömeke et al. who claim that performance not only involves cognition but conation, affect, and motivation just as well: "Competence (...) involves complex intellectual characteristics along with affect-motivation that underlies observable performance" (Blömeke et al., 2015, p. 6). They base their definition on evidence from achievement research, e.g. Snows idea of two pathways that contribute to achievement: A cognitive and a commitment pathway (Snow, 1994). Based on Snow, aptitude includes motivational-conative processes that support cognitive functioning which – according to Blömeke et al. – should be reflected in any definition of competence. Another influential definition emphasizes that competence consists of very different dispositions and has a latent character: "Competency comprises both (latent) cognitive (knowledge and skills) and metacognitive (e.g. self-regulation), as well as non-cognitive (motivational, volitional, affective, and social dispositions) components and observed performance on criterion tasks in varying contexts and situations" (Zlatkin-Troitschanskaia, Shavelson, & Kuhn, 2015). This definition showcases the general impression: The term competence is extensive and seems to include a range of very different aspects from intellectual dispositions to motivational orientations. While the exact nature of the dispositions that constitute competence remains unclear, there are some key aspects that are repeatedly discussed in connection with the term competence. These aspects help to distinguish competence from other constructs such as intelligence.

Context-specificity: Competencies refer to specific situations and their demands. Basic or general cognitive functions such as attention span or memory capacity may influence the acquisition of competence but should not be part of the competence definition itself (Weinert, 2001). Instead, competence is tied to the specific context it refers to: "Competence is a product of the interaction of attributes of individuals and the context in which they operate" (Rychen & Salganik, 2003).

Learnability: Competencies are acquired with growing experience in dealing with certain situations. One characteristic element of competence is thus its learnability (Klieme & Hartig, 2008; Weinert, 2001). This is essential for the intended use of competence models: If competencies are to be acquired during teaching and inform the set-up of educational contexts, they necessarily need to be learnable.

Capacity to act: Competence encompasses the capacity to act. Acquiring competence does not mean to acquire inert knowledge but to be able to practically use this knowledge in specific situations of a domain (Klieme & Hartig, 2008).

Based on these key characteristics, Klieme and Hartig (2008) subsume that "competence in the psychological tradition can be understood as learnable, context-specific dispositions that functionally refer to situations and requirements in specific domains" (ibid., p. 17; own translation). Based on these key characteristics and a holistic understanding of competence, for the purpose of this dissertation, competence is defined as the learnable, cognitive, and affective-motivational dispositions that functionally refer to situations of a specific domain.

2.2.1 Cognitive and Affective-Motivational Aspects of Competence

As can be seen in the previous section, many definitions of competence include cognitive, affective, motivational, and volitional aspects. This breadth has both advantages and disadvantages: On the one hand, a holistic apprehension of competence matches the complex challenges of today's world and may be more suitable to capture the complexity of many domains or situations (Fröhlich-Gildhoff, Nentwig-Gesemann, & Pietsch, 2011). Cognitive dispositions alone often cannot explain competent performance in a given domain (ibid., p. 24). On the other hand, a holistic understanding of competence constitutes a difficulty when modelling competencies and developing suitable instruments for a specific field. It might also prove difficult to measure the success of specific educational measures or interventions when competence includes both cognitive and affective-motivational aspects (Fleischer, Koeppen, Kenk, Klieme, & Leutner, 2013; Klieme & Hartig, 2008). As a solution, Weinert (2001) suggests to model both cognitive and affective-motivational dispositions but to measure them separately to be able to examine their interplay.

However, when it comes to turning these theoretical definitions and suggestions into practice, most research and teaching projects almost exclusively focus on cognitive dispositions of the underlying competence models. A prominent example is the "DFG-Schwerpunktprogramm Kompetenz", a DFG-funded programme (2007–2016) consisting of 30 research projects all over Germany that aimed at modelling and measuring different competencies for primary and secondary education (Fleischer et al., 2013). In the programme, a holistic understanding of competence including affective and motivational aspects was acknowledged theoretically, while a cognition-based concept of competence was used in any empirical stages of the different projects. The definition used was given as "the cognitive dispositions necessary to perform in a specific situation" (ibid., p. 6; own translation). Affective factors were excluded from a definition of competence for "research-strategic" (Klieme & Hartig, 2008, p. 14) or "pragmatic" reasons (Fleischer et al., 2013, p. 7).

Due to the participating researchers and the size of this programme, the decisions made had far reaching effects for subsequent educational research in Germany. The cognition-based conception of competence used in this programme informed a range of other projects, also in the field of higher education, e.g. the German programme "Modeling and Measuring Competencies in Higher Education". The programme was funded by the German Ministry of Education and Research from 2011–2019 and encompassed 70 research projects devoted to modelling and measuring different competencies relevant to higher education (Zlatkin-Troitschanskaia, Pant, & Greiff, 2019). In some of the projects, affective-motivational aspects are incorporated into models of competence (e.g. math anxiety, Jenßen, Dunekacke, Eid, & Blömeke, 2015).The majority of these projects however applied a cognition-based conception of competence; usually with a reference to Klieme and Hartig. These developments constitute a gap between what is defined theoretically in the competence and achievement literature and what is looked at empirically. It remains an open task to turn a holistic understanding of competence into practice and to define and measure both cognitive and affective-motivational aspects in higher education.

2.3 Existing Research Competence Models

Since the rise of the discussion on competence (a discussion that received its own name in the German context and is often accompanied by eye-rolling: *Die Kompetenzdebatte*) and the concentration on learning outcomes instead of teaching content, there have been a range of attempts to define various specific competencies for different areas of teaching and learning

in higher education. In the field of research education, different models of research-related competencies were modelled and operationalised. The goal of these efforts is to determine what students need to know and be able to do to conduct research. These competencies can then inform research-based teaching, e.g. by using suitable instructional formats or tasks to facilitate the development of these competencies.

Existing models of research and research-related competencies can be distinguished by which research steps they refer to. Some models refer only to individual phases of research: One example is *research literacy*, the competence to structure, evaluate, and reflect the current state of research based on the literature. For the field of educational sciences, a domain-specific competence model to capture educational research literacy was established (Schladitz, Groß Ophoff, & Wirtz, 2015; Shank & Brown, 2007). Another example of a competence pertaining to a specific research phase is *statistical literacy* which refers to the ability to interpret, to critically evaluate, and to communicate statistical information (Gal, 2002). Statistical literacy also includes knowledge of different concepts and terms from the field of statistical data (Ben-Zvi & Garfield, 2004, p. 7).

Since one of the educational objectives of academic study programmes is to qualify students to carry out complete research projects, models that aim at single research steps fail to describe the broad range of necessary competencies. Other models thus refer to the whole research process. Since these will be used as the basis for further work on the dissertation, I will introduce these models in greater detail.

RSD-framework: The research skill development framework (RSD) by Willison and O'Reagan (2007) is a transdisciplinary framework that conceptualizes how students progress through different facets or phases of the research process. It depicts six different phases of research (e.g. "Students generate data using appropriate methodology") and five different levels of autonomy that students show in working on these phases. The framework provides a broad orientation on what researching students need to do in order to professionalize but does not give precise descriptions of competent behaviour at certain levels (Willison & O'Regan, 2007, p. 401). The RSD-framework needs to stay rather vague due to its transdisciplinary nature. The framework is thus not suitable to precisely define research competence or to serve as a base to develop instruments.

RMRC-K-model: Likewise, the research competence model by Thiel and Böttcher (2014) has a transdisciplinary orientation and refers to the whole research process. It is based on the definition of competence by Klieme and Hartig (2008) and only incorporates cognitive dispositions. The model incorporates four "dimensions of skill" and one "dimension of content knowledge" (Böttcher & Thiel, 2018). Among the four skill dimensions are skills in reviewing the state of research (e.g. evaluating relevant literature), methodological skills (e.g. selecting appropriate research methods), skills in reflecting on research findings (e.g. reflecting on practical implications), and communication skills (e.g. presenting research findings). Based on this model the *R-comp*, an instrument to assess research competence, was developed. It consists of 32 self-report items, e.g. "I am able to systematically review the state of research regarding a specific topic." Since the model and the instrument were developed for the purpose of evaluating research-oriented teaching formats across all disciplines, all items remain generic and may refer to different aspects for students of disciplines as different as philosophy and engineering.

Gess' research competence model: The model of research competence established by Gess et al. (2018, 2017) refers to those disciplines that work with methods from empirical social research. It covers disciplines such as psychology, sociology, political sciences, and educational sciences. The underlying thought was that a uniform model of research competence can only exist for those disciplines that work with the same methods to ensure a specific description of those situations that research competence refers to. The model encompasses methodical, methodological, and research process knowledge necessary to conduct critical steps in the research process. The model is operationalised by the help of an objective test instrument that assesses these knowledge dimensions with items referring to both quantitative and qualitative research. Both the underlying competence model and the test refer to the cognition-based understanding of competence by Klieme and Hartig (2008, see section 2.2).

As can be seen, existing models of research competence can be distinguished by the disciplines they refer to. The RSD-framework and the RMRC-K-model are transdisciplinary and thus address very broad competencies. Since competence refers to specific situations (see section 2.2) and scientific practice differs between different disciplines (Brew, 2001), it seems questionable whether transdisciplinary models can indeed describe the necessary competencies for competent performance in a concrete research domain. Huber claims that any model of research competence needs to account for disciplinary differences and can thus only be discipline-specific (Huber, 2003, p. 20). Gess' research competence model fulfils this claim by referring to a group of disciplines (the social sciences) that work with similar research methods.

What these three models have in common is their concentration on dispositions necessary to actively conduct one's own piece of research. Research competence is conceptualized as the dispositions necessary to *engage in research*, in contrast to authors who view research competence as the dispositions necessary to understand and use research results, i.e. to *engage with research* (Borg, 2007).

Another shared aspect of these three models is their concentration on cognitive dispositions: They either assess existing knowledge or the processing of information. None of these models explicitly mentions affective or motivational dispositions that might be necessary to explain competent research performance.

What is missing, is a model of research competence that conceptualizes research competence as the necessary cognitive and affective-motivational dispositions to successfully conduct research ("engagement in research"). This model thus needs to capture all the central phases of the research process and – based on holistic definitions of competence – includes affective-motivational aspects. A model of research competence should additionally pertain to one or similar disciplines to ensure its specificity. Gess et al. (2018) proposed a model for research competence in the social sciences, encompassing only cognitive dispositions. This model can be regarded as the cognitive facet of research competence in the social sciences. The aim of this dissertation will thus be to expand the existing model and describe the affective-motivational facet of research competence in the social sciences by identifying the affective-motivational dispositions necessary to conduct student research.

3 Affective-Motivational Research Dispositions

If one wants to describe a holistic model of competence, including both cognitive and affective-motivational dispositions, one needs to clarify what affective-motivational dispositions are and how they influence academic achievements. Thus, in the following chapter, I want to briefly state what can be understood by affective-motivational dispositions and review existing evidence on the importance of affective-motivational dispositions for learning and achievement in higher education. This will constitute the basis for considering potential affective-motivational dispositions relevant for student research contexts.

3.1 Affective-Motivational Dispositions

A clear-cut definition of the term *disposition* in the educational-psychological context is hard to find. Often, the term disposition is simply used to describe other constructs which are hard to explain themselves. The term disposition serves as an umbrella term to denote a range of latent, personal resources like attitudes, traits, and abilities. Dispositions are relatively stable structures that determine how an individual normally acts in a certain situation (Schmidt-Atzert & Amelang, 2012, p. 63). I thus regard affective-motivational dispositions as those personal resources that are not purely analytic or cognitive but involve some degree of affective or motivational regulation and determine typical behaviour in certain situations.

To further clarify what I mean by *affective-motivational*, affect and motivation are briefly explained. Affect encompasses both *emotions* and *mood*. *Emotions* are intense, but short multidimensional processes with motivational, physiological, cognitive, expressive, and affective components (Scherer, 2009). *Mood* rather denotes diffuse long-lasting feelings without a specific referent (Pekrun, 2006). The term affect is often used in a broad sense, to also include "cognitive feelings" like self-concept and appraisals (Pekrun & Stephens, 2012).

Motivation can be defined "as an internal process that activates, guides, and maintains behaviour over time" (Slavin, 2009, p. 297) . There exists a range of theories that seek to further describe the concept and nature of motivation, but little consensus on what motivation exactly is (Townsend, 2011). In educational psychology, the concept of motivation is often further differentiated into intrinsic and extrinsic motivation (Schiefele, Köller, & Schaffner, 2018). Intrinsically motivated activities are those that are performed because the activity itself is interesting and rewarding (Deci & Ryan, 2000). Extrinsic motivation is the desire to perform an activity for the sake of an external reward or in order to avoid negative consequences (Schiefele et al., 2018).

Affect and motivation are highly, sometimes inseparably, intertwined with cognitive processes and have far-reaching effects on basic cognitive functions important for learning. Examples for this claim are provided by a range of studies. It was shown that emotional arousal influences formation (Bradley, Greenwald, Petry, & Lang, 1992), storage (Sharot, Delgado, & Phelps, 2004), and retrieval (Kuhlmann, Piel, & Wolf, 2005) of memory. Positive emotions are associated with widening the scope of attention (Fredrickson & Branigan, 2005), global information processing (Gasper & Clore, 2002), and creative problem solving (Subramaniam, Kounios, Parrish, & Jung-Beeman, 2009). Because of evidence like this, educational psychologists increasingly acknowledge that affects are not irrelevant epiphenomena but central to academic learning, achievement, and personality development (Pekrun & Linnenbrink-Garcia, 2012, p. 260). Likewise, motivational variables play a substantial role in learning settings: In a meta-analysis, intrinsic motivation was a medium to strong predictor of performance in school and work settings, especially the quality of performance (Cerasoli, Nicklin, & Ford, 2014). Motivational beliefs, e.g. the type of achievement goal a student

holds, have been shown in a range of studies to influence academic achievement and enthusiasm for learning (Dweck, Mangels, & Good, 2004).

Since motivation and affect are so highly intertwined with cognitive functioning and performance, an exact distinction between cognitive and affective-motivational dispositions remains difficult. Interest for example is a disposition that cannot be clearly categorized but unites cognitive, affective, and motivational components (Hidi, Renninger, & Krapp, 2004). Possibly, an affective-motivational disposition, especially one that refers to a task like research, can never be a construct that is entirely free from cognition. Hence, for the purpose of this dissertation I regard those dispositions as affective or motivational that *predominately* refer to affective or motivational resources of the individual, i.e. those dispositions that have an emotional component and motivate certain behaviours in specific situations.

3.2 Affect and Motivation in Academic Contexts

Research on affect and motivation pertaining to learning is far more advanced in the area of primary and secondary schools. One of the first lines of research that acknowledged the importance of affective-motivational variables for learning in schools concentrated on test anxiety (for a comprehensive overview Zeidner, 2007). The focus was extended quickly to incorporate other so-called academic or achievement emotions (Pekrun, 2006) such as enthusiasm (Keller, Goetz, Becker, Morger, & Hensley, 2014), boredom (Baker, D'Mello, Rodrigo, & Graesser, 2010), and confusion (D'Mello, Lehman, Pekrun, & Graesser, 2014). Other constructs that have an affective-motivational connotation and are related with academic performance are academic self-concept (Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2005), interest (Hidi & Renninger, 2006), and epistemic curiosity (Litman & Mussel, 2013). These and other studies show that different affective and motivational dispositions seem to be highly related with school performance and personal well-being and are thus interesting variables to consider for instructional contexts. During the past years, research on affective-motivational dispositions in primary and secondary education became an established field and slowly influences learning and instruction practices (Pekrun & Linnenbrink-Garcia, 2014).

For the field of higher education, some authors criticize that the affective domain is still largely neglected (Bolin, Khramtsova, & Saarnio, 2005), due to its far-reaching and complex effects and the difficulty to validly assess affective-motivational variables. However, when looking at the literature base, a shift of focus can be observed. During the past two decades, affective and motivational dispositions received increasing attention in higher education settings. There are studies on the affective-motivational states of instructors, researchers, and students. On the instructors' side for example, some studies investigated the influence of university teachers' emotions and their impact on teaching (Hagenauer & Volet, 2014; Kordts-Freudinger, 2017; Postareff & Lindblom-Ylänne, 2011), and the emotions of new faculty concerning both teaching and research (Stupnisky, Pekrun, & Lichtenfeld, 2016). On the students' side, there is increasingly sophisticated research on how affective and motivational variables influence learning and performance: For example, positive emotions like joy seem to enhance the acquisition of new knowledge (Levin, Kurtzberg, Phillips, & Lount, 2010) and facilitate deep approaches to learning (Trigwell, Ellis, & Han, 2012). Likewise, the intrinsic motivation of university students is positively correlated with deep processing of learning material and a positive predictor for self-regulated learning (Donche, De Maeyer, Coertjens, Van Daal, & Van Petegem, 2013). In the existing studies, it can be observed that affective and motivational variables are examined in different functions: First, they are viewed as influencing factors in learning processes (e.g. how does enjoyment influence the

acquisition of new knowledge?). Second, affective-motivational variables are increasingly viewed as outcomes or objectives of learning settings (e.g. how can a specific type of interest be fostered?).

What role affect and motivation play in the context of research and its teaching is discussed in the next section.

3.3 Potential Affective-Motivational Research Dispositions

> *"Science is often introduced to students as a rational, cold, methodical and solitary process, where only observations and data have an impact on the findings and conclusions scientists draw. The image of the lone scientist toiling away in a laboratory with mysteriously bubbling beakers in the background may align with some students' attitudes and views about science. However, the idea of science as a dispassionate and emotionless pursuit is belied by the fact that science is a human endeavor. Like all human endeavors, science is conducted and learned with the full range of emotions present in all human pursuits, including joy, wonder, amazement, surprise as well as anxiety, anger, fear, and hopelessness."*
>
> (Sinatra, Broughton, & Lombardi, 2014, p. 415)

Sometimes, one might indeed get the impression that conducting research is a field free from emotions and motivational states and their facilitating or hindering effects. Research seems to be one of the most rational human occupations. Still, the role of emotions is increasingly acknowledged for their impact on professional researchers and their work, e.g. in terms of the chosen research topics and the nature of the research process (Broussine, Watts, & Clarke, 2014; Widdowfield, 2000). Brun and Kuenzle (2008) see research as a process that involves both rational and emotional aspects. They acknowledge that emotions do have an impact on discovery, since they influence the way researchers proceed in their research, e.g. what topics they choose, or which details they turn to. However, Brun and Kuenzle claim the results and their justification remain or must remain independent of emotions and be based on ratio (ibid., p. 3).

Likewise, affective and motivational aspects are increasingly considered in the context of student research. For students, conducting their own research project involves various cognitive, behavioural, and affective experiences (Lopatto, 2009, p. 29) and is a very demanding task. While the intellectual challenges are one aspect of conducting research, here I want to look at the affective-motivational challenges associated with it. Identifying the set of affectively and motivationally challenging situations helps to determining which dispositions are likely to be needed to master working on one's own research project. This will serve as a first idea of what an affective-motivational facet of research competence might encompass.

First, for students to conduct research, they must shift from passively consuming knowledge, like it is the case in many of higher education's learning opportunities, to actively creating insight (J. John & Creighton, 2011). Curiosity is a disposition that motivates the active search for knowledge and might thus constitute an important variable in research contexts. Often, both the topic of interest and the process of conducting research are new fields for students. Instructors serve as facilitators in the research process, but the main work needs to be done by the students themselves. As such, conducting research requires strategies for self-regulating one's learning. Interest and self-efficacy motivate the use of self-regulated learning strategies (Sorić & Palekčić, 2009; Zimmerman, 2000) and are among the central affective-motivational dispositions investigated in research contexts. The "messy, frustrating, and unpredictable" (Wellington, 2015, p. 3) nature of research might require additional dispositions.

John and Creighton (2011) report researching students struggle in particular with large numbers of setbacks, which might induce strong feelings of self-blame or other negative affects. Because frustrations are "integral to the nature of research" (ibid., p. 789), the disposition to handle them well, i.e. frustration tolerance, might be another central element of affective-motivational research competence.

The uncertainty and tentativeness inherent to scientific evidence (Bromme & Goldman, 2014) might constitute an additional challenge that students do not experience in other study courses. Many students were taught in schools with the idea that answers are either right or wrong. Conducting one's own research often shows that things are not that simple. Especially in the social sciences, existing findings do not represent an ultimate truth but only tentative evidence (Bryman, 2012, p. 383). Conducting research thus confronts students with large amounts of uncertainty or conflicting evidence. Students might thus need dispositions to handle research-related uncertainty and cognitive conflicts (Kang, Scharmann, & Noh, 2004).

These are first ideas which challenges research processes hold and which dispositions help in mastering them. In the following, these potential affective-motivational research dispositions are described in greater depths based on existing studies and theoretical considerations.

3.3.1 Curiosity

The personal need to discover new fields or the urge to find out how things really are, is often the starting point of research. Indeed, curiosity is seen as one of the driving forces or even prerequisites of research (Willison & O'Regan, 2007). This type of curiosity that motivates research endeavours is captured by the term epistemic curiosity. Epistemic curiosity is defined as the desire for new knowledge. It involves a directed search for specific knowledge, in contrast to diverse and perceptual curiosity (Litman & Spielberger, 2003). Litman (2008) distinguishes two facets of epistemic curiosity: Curiosity that is motivated by an interest and stimulates positive feelings is referred to as the I-type. Curiosity that relieves the feeling of being deprived of knowledge is referred to as the D-type. The I-type is also strongly correlated to the personality trait openness (Litman & Mussel, 2013). In one study, the discriminant validity between epistemic curiosity and openness could not be established (Mussel, 2010). This raises doubts whether curiosity is a construct of its own at all, or whether it is already captured by the personality trait openness. Mussel argues that curiosity does indeed share many aspects with openness, but the remaining differences do not allow for postulating equivalence (ibid., p. 509). These differences become more apparent when context-specific measures of curiosity are looked at: For instance, the contextualized work-related curiosity measure showed higher incremental validities above the general measures when predicting performance on the job (Mussel, Spengler, Litman, & Schuler, 2012).

Likewise, research-related curiosity might be involved in motivating high research performance. Since conducting research is by definition about the search for specific knowledge, it is likely that epistemic curiosity plays a role in this process. Especially the I-type motivates intellectual explorations and is associated with positive affect towards learning new ideas. These are important prerequisites for conducting research and might serve as a strong motivator in research contexts. In context with student research, curiosity has been mentioned as an attitude that underpins research (Hunter, Laursen, & Seymour, 2007) but has – to my knowledge – not been investigated. Thus, even though curiosity can be considered an important factor in conducting research, its exact impact on student research processes is unclear.

3.3.2 Research Interest

Interest is a multidimensional construct with cognitive, motivational, and affective components (Hidi et al., 2004). Activities that serve one's interest combine positive cognitive (e.g. increased attention) with positive affective (e.g. enjoyment) qualities (Krapp & Prenzel, 2011). Interest is always directed towards something, e.g. an activity, a topic or an object. Interest is seen as a disposition that emerges from engaging with the environment (Hidi & Renninger, 2006) and motivates an individual to gain more domain-specific knowledge in the area of his or her interest (Krapp & Prenzel, 2011). Thus, interest plays an important role in the growth of knowledge and expertise (Silvia, 2008). As such it has been increasingly looked at in educational contexts – both as a factor that stimulates learning and as an important goal of education.

The domain-specificity of interest can be located on different levels: Interest can refer to a whole area of knowledge or very specific activities (Krapp & Prenzel, 2011). The RIASEC-typology by Holland (1997) is a model that describes interests on the level of personality types. It comprises the six (vocational) interest types realistic (R), investigative (I), artistic (A), social (S), enterprising (E), and conventional (C). Interest in research is most likely exhibited by individuals with the investigative personality type (Bishop & Bieschke, 1998). However, interest in research is much more specific and thus different from Holland's interest types. Interest in research can refer to a person's interest in the research of a discipline, e.g. psychology, or be focused on research on a specific topic, like memory research. Research interest can also denote a person's interest in practically performing research activities (e.g. Bishop & Bieschke, 1998). Since interest is a disposition that motivates the search for new knowledge and enhances the time spent on the topic of interest (Silvia, 2006), interest in research is probably a necessary prerequisite to nurture successful research processes.

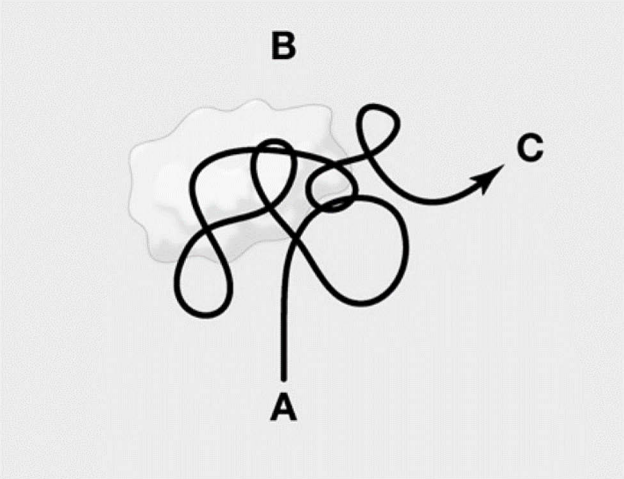
3.3.3 Research-Related Self-Efficacy

Bandura (1997) conceptualizes self-efficacy as the beliefs an individual holds about his or her ability to accomplish a task or goal. Self-efficacy proved to be an important motivational variable in different educational contexts: It has been shown that it improves – among others – the persistence to work on a task, the level of effort invested and self-regulated learning (Zimmerman, 2000).

Self-efficacy is not a universal trait but refers to different domains. Having a high sense of self-efficacy in one area does not mean one has a high sense of self-efficacy in another area (Bandura, 2006). Accordingly, concepts and measurement of self-efficacy are context-specific. For the area of research, research self-efficacy is defined as the degree to which a person believes he or she has the competencies needed to conduct research (Forester, Kahn, & Hesson-McInnis, 2004). The most prominent model of research self-efficacy is discipline-general and refers to the humanities and sciences (see Bieschke, 2006). Other models of research self-efficacy refer to more specific domains, e.g. research self-efficacy pertaining to quantitative social research (Phillips & Russel, 1994). For any model of research-related self-efficacy it remains thus important to carefully define the context it should refer to.

3.3.4 Frustration Tolerance

In various anecdotal descriptions, conducting research is connected to experiencing frustrations. Some authors even state that frustrations are "integral to the nature of research" (J. John & Creighton, 2011, p. 789). The biologist and experienced researcher Uri Alon (2009) visualizes the research process as a non-linear path through a cloud of frustration and confusion (see Figure 1). In a study of 84 Nobel Prize laureates the sociologist Merton states that all laureates exhibited "a great capacity to tolerate frustration in their work, absorbing repeated failures without manifest psychological damage" (Merton, 1973, p. 453). It is therefore plausible to assume that successfully conducting research means to be able to handle or tolerate these research-related frustrations. In general, frustration tolerance denotes the disposition to endure frustrations or disappointments without additional negative consequences (Stavemann & Yvonne, 2016, p. 15). It is mostly acquired in early childhood but is thought to be trainable.



There is first evidence that participating in student research projects helped students to increase their frustration tolerance (Hunter et al., 2007). The participating students realized that tolerating frustrations is an inevitable part of authentic research. However, the evidence remains anecdotal. There are – to my knowledge – no quantitative analyses of research-related frustration tolerance in student research.

Figure 1: A realistic research process, including "the cloud" (Alon, 2009, p. 728)

3.3.5 Uncertainty Tolerance

Uncertainty tolerance describes how a person reacts emotionally, cognitively, and behaviourally to uncertainty (Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994). Thus, this construct addresses both the evaluation of and dealing with uncertain situations. Uncertain situations are those in which there is too little information about the future development of a situation, or where the correct handling of the situation is uncertain.

Uncertainty-tolerant individuals evaluate uncertain situations as a positive challenge and consequently enjoy uncertain situations or even actively seek them. Uncertainty-intolerant persons, on the other hand, try to avoid such situations or end them as quickly as possible (for an overview of the different reactions see Hillen, Gutheil, Strout, Smets, & Han, 2017). Uncertainty tolerance is sometimes conceptualized as a general personality trait (Rosen, Ivanova, & Knäuper, 2014), sometimes as a context-specific disposition (Durrheim & Foster, 1997) that requires contextualized assessments (Herman, Stevens, Bird, Mendenhall, & Oddou, 2010).

For the field of research, it has often been stated that uncertainty is one of its inherent features (Auchincloss et al., 2014). To successfully navigate these uncertainties, students thus need to tolerate research-related uncertainty. However, students' research-related uncertainty tolerance has – to my knowledge – not been examined, yet. There is, however, research on

uncertainty tolerance in other complex fields, such as medical decision-making (Hillen et al., 2017; Nevalainen, Mantyranta, & Pitkala, 2010).

The above affective-motivational dispositions were derived by the help of empirical studies and theoretical considerations. It is plausible to assume that they all play a role in students' research projects. But while theoretical considerations and some evidence can be useful to determining what affective-motivational dispositions are potentially necessary for students to conduct self-regulated research, these remain speculative. There is no empirically derived and tested model of affective-motivational research dispositions necessary for social scientific research. Establishing such a competence model will be one aim of this dissertation.

4 How to Model and Measure Competence

In this section I will explain the general procedure for modelling and measuring competencies, based on established procedures from the test construction literature. For each step in this process, it is briefly explained how it was specifically implemented for the purpose of this dissertation. The actual work on modelling and measuring affective-motivational research dispositions is described in the methodological chapter of this dissertation (see sections 7.2 and 7.3).

In a previous section (see section 2.2), I defined competence as the cognitive and affective-motivational dispositions that functionally refer to situations of a specific domain. Weinert (2001) and Klieme and Hartig (2008) recommend to model and measure cognitive and affective-motivational dispositions separately. Hence, the cognitive and affective-motivational facets of research competence in the social sciences were worked on in two different projects. Since this dissertation focuses on the affective-motivational facet of research competence, the methodical requirements for the cognitive facet are only briefly mentioned. More details can be found in the publications by Gess et al. (Gess et al., 2018, 2017).

4.1 Modelling of Competence

Modelling a construct means to determine which indicators (e.g. behaviour or attitudes of a person) make up or describe a construct and to use these indicators to set a clear definition (Bühner, 2011). Two approaches can be used to identify meaningful indicators: The top-down approach and the bottom-up approach. Using the top-down approach means to find indicators based on the construct, e.g. by viewing existing construct definitions. The bottom-up approach implies to define the construct based on the indicators that were identified, e.g. by interviewing others about the behaviours that describe the construct. Competencies are often defined by making use of existing educational standards and existing empirical studies on the matter (Mayer & Wellnitz, 2013); thus, by using a top-down approach. However, affective-motivational competencies are rarely reflected in educational standards or frameworks, possibly because they are regarded as more difficult to clearly define (Stecher & Hamilton, 2014, p. 12). Thus, a bottom-up approach to modelling affective-motivational competencies might be more promising.

Competence is a latent trait that cannot be directly observed but is inferred from observed behaviour in certain situations (see section 2.2). Descriptions of competent and incompetent behaviour can serve as the indicators to describe affective-motivational competencies. For the field of higher education, modelling competencies should also include the specific situations that students should be able to master with the respective competencies (Zlatkin-Troitschanskaia et al., 2015).

To model the affective-motivational facet of research competence, these considerations were implemented by applying both top-down and bottom-up approaches: Based on expert interviews, challenging research situations and students' competent and incompetent behaviours in these situations were identified. These served as indicators for the different relevant affective-motivational dispositions. Then in a bottom-up fashion, the experts' statements were synthesized into individual construct definitions for each of the dispositions. Specific definitions and a clear picture of related constructs are important to later ensure a high content validity of a test (Bühner, 2011). To further sharpen dispositions' definitions, an analysis of the literature on existing constructs was conducted. The exact procedure for modelling the affective-motivational facet of research competence is explained in the methodological chapter of this dissertation (see phase 1 in section 7.2).

4.2 Measurement of Competence

A rigid and clear definition of competence and of competent performance is the prerequisite for operationalizing this definition and subsequently developing instruments (Klieme & Hartig, 2008). The construction of a test consists of several critical steps (e.g. Bühner, 2011) that will be introduced in the following. Again, for each step it is briefly explained how these steps were put into practice for operationalizing the affective-motivational facet of research competence.

4.2.1 Determining the Type of Indicator

First, one needs to decide whether the instrument is to measure a construct based on objective or subjective indicators (Bühner, 2011). Instruments in which the answer can be clearly classified as correct or incorrect, can generally be seen as consisting of objective indicators. Instruments that generate data from questionnaires with self- or third-party ratings often use subjective indicators. In the context of competence assessment, these two types of measurement are called direct and indirect assessment (Zlatkin-Troitschanskaia et al., 2015). Direct assessment often targets knowledge and uses multiple choice questions, e.g. for the purpose of university admission. Indirect assessments usually employ self-reports and therefore rely on students' truthful assessment of themselves. Due to social desirability biases, indirect assessments predict academic success less well than direct methods of assessment (Zlatkin-Troitschanskaia et al., 2015). For assessing cognitive facets like knowledge indirect assessment methods are thus not recommended. Accordingly, the cognitive facet of research competence was operationalized using direct assessment (Gess et al., 2017). Indirect assessment is the method of choice when assessing affective and motivational facets of competence since these are based on internal processes related to affect and motivation. These internal states are most often only available via introspection. Thus, for the affective-motivational facet to be developed as part of this dissertation, an indirect assessment procedure involving self-assessment questionnaires is chosen.

4.2.2 Decision for Target Group of the Instrument

In a next step, it is important to determine which target group will later process the instrument to describe its characteristics relevant for assessment. These characteristics can pertain to age, educational level, language abilities or test fairness (Bühner, 2011, p. 87).

For the assessment of research competence, the intended target group will be bachelor's and master's students of the social sciences. Most of the student characteristics relevant for test taking are similar among these students (e.g. age, educational level, and language ability). Crucial differences lie in the different disciplines and the different amount of research experience of the students. Any item content that refers to very discipline-specific terminology should be avoided to ensure the instrument is understood by students of different disciplinary background. In addition, the instrument should not exclude beginners in student research but at the same time be sensitive enough to map differences in research experience. These criteria will have to be considered when developing and selecting items (see section 7.3.1).

4.2.3 Determining the Intended Use of the Instrument

It needs to be determined what the instrument is to measure and how the instrument will be used (Wilson, 2005; Ziegler, 2014b). Three principle goals of an instrument can be distinguished: Determining a characteristic or a capability of a person, distinguishing between groups, and knowledge tests (Bühner, 2011).

The instrument to assess the affective-motivational facet of research competence seeks to determine the individual research dispositions of students. It is therefore of special importance to find content-valid items which clearly pertain to only one construct and not several (Bühner, 2011). In our case, the affective-motivational facet of research competence consists of several distinct dispositions which will be assessed by distinct measures that all need to fulfil these requirements. In addition, the instruments will not only be used to assess the research dispositions at one time point but to examine any differences in the development of affective-motivational research dispositions over time. The instruments must thus be sensitive for possible changes over one semester.

4.2.4 Determining the Construction Strategy

Instruments can be developed using a deductive or inductive procedure (Bühner, 2011). Deductive (or rational) test construction implies to develop items based on a well-defined theory of the construct. The quality of the definition determines the quality and ease of the item construction process. The quality of the construct definition can be enhanced by involving experts, e.g. by the help of the critical incident technique (Flanagan, 1954). Inductive test construction implies to work without a concrete definition of a construct. Instead, based on the analysis of data (e.g. explorative factor analysis) from large numbers of items, a theoretical model is derived. For the area of competence tests, it is recommended to use a deductive procedure, i.e. to use a well-defined competence model as a basis for constructing items (Koeppen, Hartig, Klieme, & Leutner, 2008).

For the affective-motivational facet, a mixture of both deductive and inductive test construction is chosen: First, items are deductively generated based on definitions of the individual dispositions (see section 7.3.1). Later, items are selected based on empirical properties (see section 7.3.4). Mixing deductive and inductive construction principles combines their advantages (Bühner, 2011): by using a deductive procedure, items directly pertain to the construct's definition while the data-based item selection enables us to identify items that do not work in practical application.

4.2.5 Determining Item Format and Item Construction Principles

Before a set of concrete items is developed, one needs to determine a general item and answer format. In the case of self-assessment scales, the basic item format often consists of simple and easy to understand statements that are rated on a scale. Typically, four- or five-point scales are chosen, whereas four-point scales have the advantage, that there is no neutral or middle option. Participants are thus forced to favour one of the two poles. In contrast, five-point scales provide the chance to depict neutral answers and produce more variance due to a larger number of answering categories. Five-point scales are thus chosen for the assessment of affective-motivational research dispositions.

Instruments should match the to be measured criterion in specificity (Schmidt-Atzert & Amelang, 2012, p. 12). For example, if an individual's behaviour in a specific situation is to be measured a contextualized instrument referring to this specific situation shows higher

accuracy than an instrument with general items (e.g. Heggestad & Gordon, 2008). Since competence expresses the latent variables underlying observable performance in specific situations, it is advisable to use items that refer to these situations. For our purpose this means that all items should make a reference to a concrete research situation in the social sciences. To ensure a systematic and uniform construction of items, these and other criteria were incorporated into fixed item construction principles (Wilson, 2005). The concrete set-up of these item construction principles is further explained in the methodological chapter of this dissertation (see section 7.3.1).

5 Research-Based Learning in the Social Sciences

Research-based learning is an instructional format that is increasingly integrated into various study programmes to facilitate the acquisition of research competence. In the following, the historical background of this instructional format, its characteristics, and its implementation in the social sciences are outlined.

5.1 Historical Development of Research-Based Learning

Research-based learning is an instructional format that seeks to integrate research and teaching in undergraduate and graduate education. The integration of research and teaching is possible in a range of instructional formats that have undergone different developments in different higher education systems.

In Germany, RBL dates back to Humboldt's ideal of uniting research and teaching which involves the idea that research and teaching inform each other reciprocally (Humboldt, 1809/2010). The principle regained attention in 1970, when German universities experienced increasing democratization tendencies and it was claimed that students should have a part in science, too. RBL was recommended as a didactic tool to achieve that (Bundesassistentenkonferenz, 1970) and implemented in many social scientific study programmes. At the turn of the millennium, the Bologna Process profoundly changed study structures across Germany: Established Diploma and Magister degrees gave way to bachelor's and master's programmes. The former possibilities of freely choosing one's study programme were often substituted by fixed curricula. Some claim these changes made due to the Bologna Process lead inadvertently to a flood of graduates that are incapable of critical reflections (Kühl, 2012, p. 68). It does not come coincidentally that RBL faces its reincarnation a little later. The German science council recommended RBL as a way to foster dearly needed scientific competencies among students (Wissenschaftsrat, 2006). RBL is seen as an opportunity for students to produce and acquire knowledge in a self-regulated manner and thus as a promising measure to counter the developments of the Bologna Process (Deicke & Mieg, 2020). Since then, several German universities have implemented projects to develop, foster, and disseminate research-based learning, especially within the larger programme of the "Quality Pact for Teaching" ("Qualitätspakt Lehre"), a government-funded programme to improve tertiary education. These developments led to an increasing number of RBL courses in study programmes and an increasing number of research projects on the topic.

In the US, the MIT was a leading actor in establishing RBL. In 1969, the "Undergraduate Research Opportunities Program" (UROP) was implemented and gave students the opportunity to work on student-initiated and faculty-supported research projects (S. A. Cohen & MacVicar, 1976). Many other US universities followed and established their own programmes. The underlying motivation was not only to create a larger number of scientifically capable students, but also to bridge the notable gap between teaching and research – which were seen as competing endeavours (Willison & O'Regan, 2007). Boyer formulated that there was a need to "break out of the tired old teaching versus research debate" (Boyer, 1990, p. xii) and RBL could achieve exactly that. Despite these strong claims for RBL, the Boyer Commission, a commission convened by the Carnegie Foundation and aimed at improving undergraduate education in the US, criticized in 1998 that huge numbers of students still underwent university education without contact with genuine research (Boyer Commission on Educating Undergraduates in the Research University, 1998, p. 3). Instead, the commission suggested that universities should form communities of learners that all participate in

the endeavour of knowledge production (Boyer Commission on Educating Undergraduates in the Research University, 1998, p. 9). Since then, RBL was integrated into a range of curricula in different disciplines, not just at research-intensive universities (S. Hu, Kuh, & Gayles, 2007).

Meanwhile, similar developments took place in other anglophone countries. Commissions or councils across the world recommended to integrate RBL into their respective national study programmes during the past 20 years (e.g. the British Centre for Excellence in Teaching and Learning, the Australian Learning and Teaching Council, and the Ministry of Education in New Zealand). Consequently, RBL was increasingly incorporated into many academic study programmes around the globe (Healey & Jenkins, 2009). Different higher education systems and political contexts have come to the same conclusion: Research and teaching should inform each other to provide a meaningful education with long-lasting effects for both the individual student and their surrounding societies.

While RBL was implemented into various study programmes for similar reasons, the contexts in which RBL is offered remain different between different countries. In Germany, RBL is mainly offered as part of compulsory or elective modules during the academic year (e.g. as analysed by Rueß, Gess, & Deicke, 2016). In the US, RBL is additionally offered in the form of optional summer research courses, especially for particularly gifted students who need to apply to be able to participate (e.g. Junge, Quiñones, Kakietek, Teodorescu, & Marsteller, 2010). In addition, in the US and Australia, the tendency to offer RBL within community-based projects is more advanced (e.g. Mello-Goldner, 2019). These historical developments and contextual differences should be kept in mind, when comparing learning gains associated with RBL.

5.2 Definition and Characteristics of Research-Based Learning

RBL shows a range of different implementations across the globe and is given several names. It is thus of special importance to identify a set of minimal criteria that are shared by all variations of RBL.

The definition of RBL can be sharpened when RBL is compared to other forms of research-related teaching. A popular model by Healey and Jenkins (2009) distinguishes different ways of linking teaching and research along two axes: The focus of teaching (research results vs. research process) and the activity level of the students (audience vs. participants). The resulting grid characterizes four different types of how research might inform teaching. During research-led teaching, students learn about current research results; during research-oriented teaching, students learn about the research process and techniques. Research-tutored learning engages students in discussions on research, whereas during research-based learning students actively undertake research and inquiry. What this activity entails is shaped by how one understands "research and inquiry". The English term *research* can include both methodologically sound scientific work and simple search activities. In Germany, RBL makes reference to the German term *Forschung* and is called *Forschendes Lernen*. Unlike the English term *research*, the term *Forschung* only includes activities pertaining to methodological scientific work. The definition of RBL used for this dissertation is shaped by the stricter German idea of research.

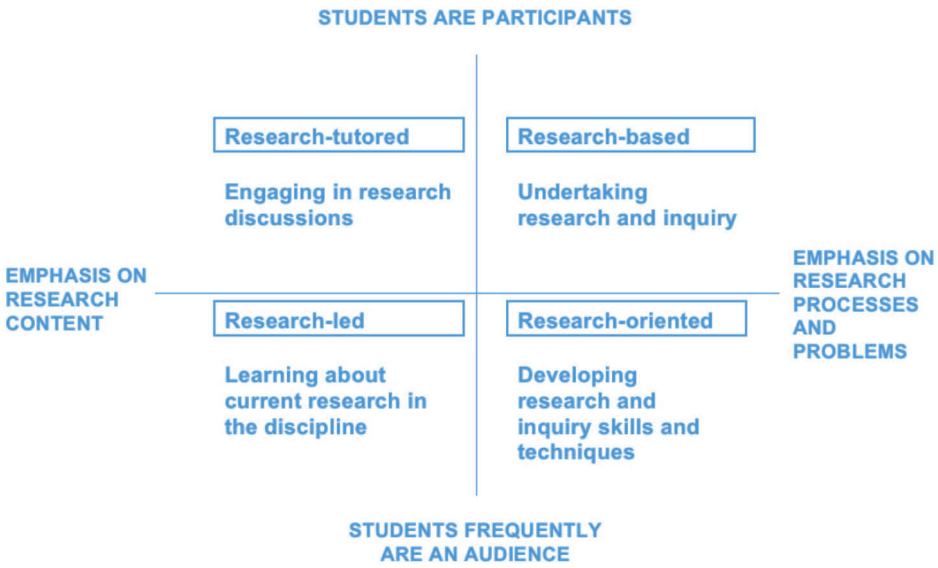


Figure 2: Research-teaching nexus by Healey and Jenkins (2009, p. 7)

RBL in this sense can be understood as "learning through research" (Huber, 2009). Students conduct research in orientation towards scientific standards and a self-critical approach to their own results. Hence, RBL goes beyond the mere activation of students; the research process and the question that guides it are at the centre of students' learning (Huber, 2003, p. 15). The research question as the central element of RBL can fulfil two different functions: Either the research question is a didactical means to deepen student engagement with a specific research method or topic. Or the research question is not seen as a tool to stimulate learning but the quest to answer it is at the centre of the course (Rueß et al., 2016). Unlike in professional academic research, the research question that is pursued does not need to be new to the discipline; it suffices if it is new to the student researcher (Fichten, 2010). In order to answer the research question, students usually need to complete a full research cycle from viewing the literature and developing a research question to collecting, analysing, and interpreting data (Huber, 2003). Other definitions of RBL are less strict and include also those formats where students complete only individual research phases (Fichten, 2010).

Altogether, RBL can be defined as an instructional format that seeks students to answer a research question by completing a research process in a self-regulated manner and by following scientific standards.

5.2.1 Positioning RBL Among Other Forms of Research-Related Teaching

In the international literature, a range of different terms and formats is used to describe student research. In the following, I want to outline how the definition of RBL stated above (see section 5.2) is related to these other concepts.

A concept that is frequently mentioned in the same contexts, is inquiry-based learning (IBL). IBL is often used as an umbrella term for a range of different instructional formats that seek students to perform investigative work (Aditomo, Goodyear, Bliuc, & Ellis, 2013). The concrete definitions of IBL thus vary a lot. According to Spronken-Smith (Spronken-Smith, 2010, 2012), IBL is an instructional format that is characterized by student-centred teaching. Students' learning is stimulated by a question and they construct their knowledge in a self-

regulated manner. The inquiry can be framed differently: If students explore a question that is new to the discipline, they pursue "discovery-oriented IBL". If students explore already existing knowledge, they pursue "information-oriented IBL". These formats can be further distinguished by who chooses question and method (mode of inquiry): Open (question and method chosen by student), guided (instructors provide question, students choose method), and structured (both determined by instructors). Framing and mode of inquiry can be combined; the resulting different forms of IBL have different associated learning outcomes (see Spronken-Smith, Walker, Batchelor, O'Steen, & Angelo, 2012).

In this sense, IBL with an open mode of inquiry (students choose question and method) and a discovery-oriented framing (students explore genuinely new questions), resembles RBL as defined above. A difference between IBL and RBL is however that the inquiry during IBL is not necessarily based on the use of research methods (Oliver, 2008). For RBL, the correct application of research methods to answer the research questions is in contrast a prerequisite.

Apart from IBL there are a range of other terms that have been formed to describe student-research. Among these are e.g. "Undergraduate Research Experiences" (URE), "Summer Undergraduate Research Experiences" (SURE) or "Course-based Undergraduate Research Experiences" (CURE). These terms are especially prevalent in papers from the US. Most of these terms show a description of the temporal context ("in summer") or the type of participating students ("undergraduates"), and less so of the instructional set-up per se. When one looks closer at what students do during UREs, CUREs and related formats, many of these are very similar to RBL. For example, the Council for Undergraduate Research defines URE as "an inquiry or investigation conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline" (Council on Undergraduate Research, 2020).

URE, SURE, and CURE courses often implement RBL as the underlying instructional format but use different names to emphasize specific context factors. In contrast, I use the term RBL to refer to a concrete instructional format independent of the exact duration or the type of participating students. RBL can be undertaken with undergraduates and graduates, it can be implemented in summer courses or as part of a year-long course. Some of the evidence on the effectiveness of RBL (see section 6) is taken from studies examining CUREs or UREs. In these cases, I carefully checked that the students' research experiences comply with the above definition of RBL.

5.3 Underlying Didactical Principles of Research-Based Learning

RBL is an instructional format that seeks students to generate and integrate new knowledge in a self-regulated manner by the help of discipline-specific research methods. By doing so, RBL incorporates elements from various learning theories. It is often claimed that RBL lacks a strong theoretical basis for describing why students achieve specific learning gains by participation in RBL (Auchincloss et al., 2014). Conceptualizing RBL in relation to existing learning theories can help to realise why and how RBL might be effective to facilitate the acquisition of research competence. The central didactical principles underlying RBL are introduced in the following.

5.3.1 Student-Centred Pedagogy

By engaging in RBL, students conduct their own research projects with the help of a lecturer or supervisor. The learner is assumed to take the responsibility of his or her own learning.

Students do not passively follow a course outline created and presented by the lecturer. Instead, they are actively involved by choosing their own background readings, developing questions, gathering and analysing data, and coming to individual conclusions. RBL thus strongly emphasizes a student-centred approach to teaching (Kember, 1997). The lecturer serves the function of a supporting and enabling learning facilitator or coach (Oliver, 2008). However, most RBL courses also have phases where knowledge transmission prevails, e.g. when essential content or methodical knowledge needs to be conveyed. These instructional phases are always aimed at facilitating the student research process.

5.3.2 Constructivism

RBL is rooted in the idea of constructivist learning (Hunter et al., 2007). By pursuing research processes, students are stimulated to construct their own knowledge. According to the theory of constructivism, knowledge is continually and actively constructed and reconstructed by the learner to integrate new bits of information with existing knowledge (Bruner, 1990). The learner cannot simply reproduce somebody else's knowledge but needs to construct a subjective reality through experience and interaction with the environment (Piaget, 1972). This view is called cognitive constructivism. In RBL, students get the chance to actively work on fields they are not knowledgeable in and thereby construct knowledge on the subject matter (like the theme of their research question and its underlying theories), on how to use specific research methods, and on the research process as a whole. Students thus are provided with experiences that are needed to construct their individual research-related knowledge.

5.3.3 Community of Practice

The theory of social constructivism emphasizes the social aspect of knowledge construction. The idea of a *community of practice* postulates that a community with a common interest facilitates learning (Lave & Wenger, 1991): A learner is slowly socialized into a community and acquires its practices and knowledge by learning from more experienced community members. In a prototypical set-up, a RBL course represents such a community of practice. The instructor or supervisor serves as an experienced researcher and enables other community members, the students, to implicitly and explicitly learn the practice of research (Hunter et al., 2007). RBL thereby facilitates the socialisation into the field of professional research (Hunter et al., 2007).

5.3.4 Authentic Learning

During authentic learning, students are given the opportunity to apply their knowledge to real world practice. Authentic learning experiences thus bridge the gap between a learning experience and the demands of the world outside the classroom (cf. Hui & Koplin, 2011). RBL allows students to connect the methodical knowledge acquired in methods classes with the actual doing of a researcher. Especially when students seek to answer new research questions and follow the methodological demands of professional research, RBL constitutes an authentic learning experience that resembles the later practice of a professional researcher. Finding an answer to the research question serves as a goal of the course while the research process provides a structure. Clear course objectives and requirements are key characteristics of meaningful learning experiences and among the variables that show the strongest associations with achievement in higher education (Schneider & Preckel, 2017). Using an authentic learning approach, RBL can be seen as a meaningful learning experience. The authenticity of the research experience can be further intensified when students work on real-world problems or questions by a third party, like organisations or members of the community

(community-based participatory research; Wallerstein & Duran, 2017). If students know that an external stakeholder has a genuine interest in their work and in their potential solution to a practical problem, this might serve as an additionally motivating factor.

As can be seen, RBL incorporates aspects from a range of different learning theories that proved suitable to facilitate learning and motivation. From looking at the theoretical underpinnings of RBL, one would assume that RBL provides authentic research experiences which enable students to construct their own research knowledge that is applicable to real-world research. The collaborative and authentic set-up are thought to elicit student motivation and interest. Whether RBL lives up to these theoretical promises and proves as an effective learning format will be reviewed in chapter 6.

5.4 Research-Based Learning in the Social Sciences

5.4.1 What are the Social Sciences?

The domain looked at for the purpose of this dissertation, is that of research training in the social sciences. But what exactly constitutes the disciplinary group "social sciences"? Different institutions of the educational landscape in Germany use different classifications of the social sciences (see Table 1).

While there is some overlap between the disciplines, another criterion is necessary to come to a clear picture of what the social sciences are. Since this dissertation aims at conceptualising research competence and at investigating research-based learning in the social sciences, the type of research performed in the individual disciplines is taken as the classification criterion. Social sciences then encompass those disciplines that employ similar research methods and methodologies, namely those of empirical social research. Thus, "the social sciences" for the purpose of this dissertation comprise sociology, psychology, political, and educational sciences, as these disciplines employ similar empirical methods and methodologies (Diekmann, 2007). In Germany, the social sciences are a smaller disciplinary group. In 2018, 27,202 students graduated with either bachelor's or master's degrees in the social sciences (political sciences, educational sciences, psychology, and sociology), making up 12 % of the overall 228,123 students that graduated 2018 from German universities (Statistisches Bundesamt, 2019).

5.4.2 Research Conception in the Social Sciences

Since RBL is about linking teaching and research, it is important to consider the underlying conceptions of research employed by the discipline. In the following, the most prevalent methodologies and phases of the social scientific research process are outlined.

In general, research can be understood as the "creative and systematic work undertaken in order to increase the stock of knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge" (OECD, 2015, p. 44). Research activities across all disciplines are characterized by five criteria: They must be aimed at new findings, creative, uncertain about the final outcome, systematic, and transferable and/or reproducible (OECD, 2015, p. 45). The methods and rules of this systematic exploration however differ between the disciplines (Huber, 2003).

Table 1: Classification of social scientific disciplines by different institutions

Institution (and source)	Title of the disciplinary group	Disciplines included
German Research Foundation (Fachkollegien)[4]	Social Sciences	▪ Educational sciences and educational research ▪ Psychology ▪ Social sciences (including political sciences)
German Ministry for Education and Research (Student survey)[5]	Social and Educational Sciences	▪ Educational sciences ▪ Special education ▪ Social welfare ▪ Political / administrative sciences ▪ Social sciences ▪ Psychology
German Rectors' Conference (Hochschulkompass)[6]	Humanities and Social Sciences	▪ Consultation ▪ Pedagogy, educational sciences ▪ Political sciences ▪ Psychology ▪ Social work, curative education ▪ Social sciences ▪ Sports ▪ Theology, religion

In the social sciences, research is based on the methodology of social research. Methodologies in general comprise an array of strategies and procedures to study the empirical world (Blumer, 1969). Research methods are part of these procedures. In the social sciences these are often classified as either quantitative or qualitative.

Quantitative research emphasizes the quantification in the collection and analysis of data. These methods usually make use of a deductive approach, which means they are concerned with testing theories. Quantitative methods are based on a natural scientific model and incorporate the view of an external and objective reality (Bryman, 2012, p. 36). Accordingly, the researcher is seen as distanced from the research field and without influence on the findings.

Qualitative research in contrast usually emphasizes word-based data and is predominately concerned with induction, i.e. with generating theories from research. Qualitative research often neglects the idea of an objective reality and regards reality as subjective and constantly changing (Bryman, 2012, p. 36). Under the qualitative paradigm the researcher often enters and interacts with the research field, e.g. to make observations or to conduct interviews, and is thus actively involved in constructing reality.

These two groups of methodologies evolved from different practices and have often been perceived as incompatible "camps" (Alasuutari, Bickman, & Brannen, 2008, p. 3). In recent

[4] The German Research Foundation is structured into "Fachkollegien", i.e. different disciplinary groups. Information retrieved from: https://www.dfg.de/dfg_profil/gremien/fachkollegien

[5] Information retrieved from the student survey by the German Ministry for Education and Research: https://www.bmbf.de/de/der-studierendensurvey-1036.html

[6] Information retrieved from the degree programme search by the German Rectors' Conference: www.hochschulkompass.de

years, it is acknowledged that the divide between different groups of methods and their underlying assumptions is not so clear (Ragin, 1994) or even simply false (Layder, 1993, p. 110). There exists, for example, a range of quantitative methods that aims at deductively generating theories rather than testing them (e.g. explorative factor analysis). Lately, a greater open-mindedness towards different types of social research can be observed (Alasuutari et al., 2008) and the field of mixed methods research that seeks to unite and profit from both paradigms constantly evolves (e.g. Onwuegbuzie & Leech, 2005).

As can be seen, research in the social sciences does not follow a single methodology but makes very different assumptions about the nature of reality or the link between theory and research. The social sciences are a multiparadigmatic discipline (Rettberg, 2017, p. 313) which make it impossible to give a unique and clear picture of what they encompass. What unites most social scientific research projects is their inherent self-reflexivity. Since the research objects in the social sciences are humans, organisations or other social phenomena, the researcher is always in some way or other linked to what he or she seeks to study. These links need to be considered and require a certain degree of reflexivity (Rettberg, 2017, p. 310). In addition, even though the social sciences show a range of epistemological methodological differences, a prototypical research process can be identified. According to Bryman (2012, p. 14), a typical research processes in the social sciences consist of the following stages:

Literature review:	Critical examination of existing research and theoretical ideas relating to the phenomena of interest
Concepts and theories:	Relevant concepts and variables are identified and conceptualized
Research questions:	The specific question that expresses what the researcher wants to find out
Sampling cases:	The cases (e.g. people) that are relevant to the research question are selected
Data collection:	The data from the sample are gathered applying a social research method, so that the research question can be answered
Data analysis:	The data is managed, analysed, and interpreted
Writing up:	The research and its findings are written up and disseminated

This list is not necessarily exhaustive, nor is it followed linearly. In practice, the research process is more similar to a cycle where individual phases inform each other and are revisited multiple times.

5.4.3 Practical Implementation of RBL in the Social Sciences

The phases of the research process and the learning process in a discipline can be regarded as overlapping or even identical (Wildt, 2009). Thus, the typical research process of a discipline influences how RBL in that discipline is conducted: RBL in the social sciences often consists of the same phases as the research cycle. However, just like in a research project, these phases do not have to be followed chronologically, they can be repeated or intertwined (Huber, 2003, p. 22).

The implementation of the prototypical research cycle in RBL settings can take a range of different forms. Huber categorizes these practical implementations of RBL (Huber, 2009, p. 28) and notes that the predominant forms of RBL in the social sciences are case studies,

where concrete problems or cases are analysed; field studies, where a research questions is explored in the field; and study projects. RBL in the social sciences has the advantage that the quantitative and qualitative methodologies of empirical social research are easier to integrate into teaching than research methods of the experimental natural sciences, which often require costly infrastructure (Huber, 2003, p. 21). Additionally, the projects can easily take place on a smaller scale to be manageable within one or two semesters, e.g. less participants are studied than one would do for a professional research project. To handle the demand of the curriculum and the available resources of the facilitator, student research projects are often conducted in teams. This has several advantages: Students can share time-consuming research work among all group members, it resembles later professional research practice that is often performed in teams and it facilitates collaborative learning that is associated with deeper levels of engagement (Chi & Wylie, 2014).

From a theoretical standpoint, implementations of RBL in the social sciences seem well-thought-out and promising for a range of learning areas. But does RBL live up to its promises?

6 Effectiveness of Research-Based Learning

RBL has been established in a range of study programmes. Internationally, millions of students run through RBL courses every year. It is based on the premise that all students independent of discipline and study progress benefit from conducting their own research (Lambert, 2009). To examine the actual evidence on the topic, a systematic review of existing studies on the effectiveness of RBL was conducted.

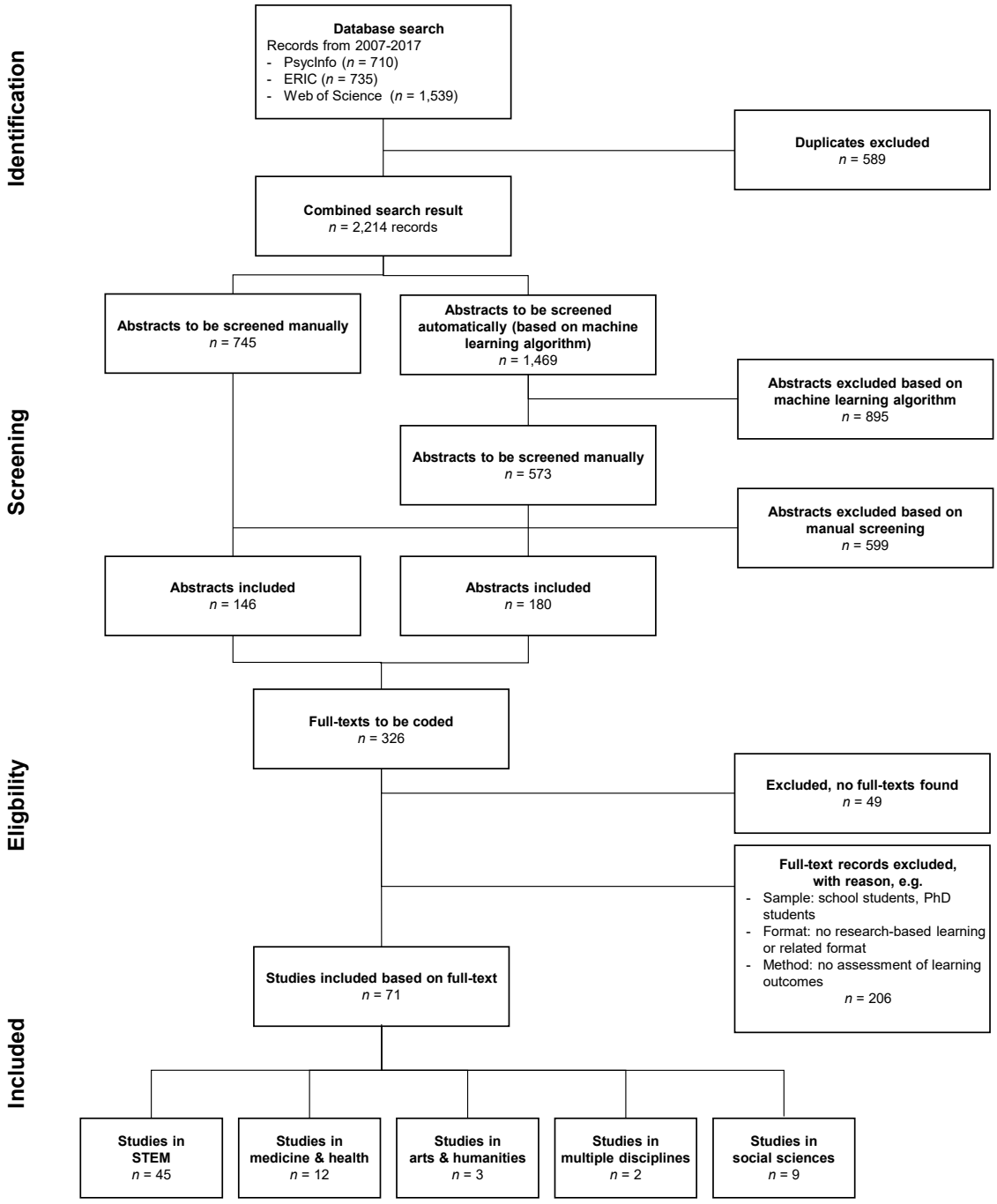


Figure 3: Overview of the search strategy

6.1 Systematic Review on the Effectiveness of RBL

Empirical research on the effectiveness of RBL is a fairly new field of study and grows with the number of projects that implement RBL in different higher education settings. A first increase in publications on the effectiveness of RBL can be found in the early 2000s. Until now, there is however no review that summarizes the results from these studies. Thus, to gain a systematic overview on the existing literature, a systematic search of several databases was conducted to identify studies that empirically investigate the effect of RBL courses in different disciplines (see Figure 3). The search resulted in 2214 abstracts which were then screened manually and by the help of a machine learning algorithm. The complete procedure of the systematic review, including criteria for inclusion and coding variables, can be found in the appendix (see Appendix C).

After completing several classification steps, 277 full texts remained and were analysed by the help of a coding scheme: Characteristics of participating students, the instructional format employed, the study design and outcome variables were categorized (see Appendix C). Eventually, 71 studies fulfilled all inclusion criteria and gave empirical evidence on the effectiveness of RBL. However, only 9 of these studies investigate students from the social sciences (see Table 12 in the appendix). Among these are students from psychology, sociology, social work, pedagogy, and educational sciences. Since the systematic review was performed in 2017, a few studies from the subsequent two years were manually added. A google scholar alert with similar key words as those for the systematic search was set to automatically receive matching articles.

The results from all coded full texts will be presented on three levels: First, studies discussing societal benefits of RBL will be introduced. Second, the claims for the effectiveness of RBL for non-scientific careers will be reviewed. Third, studies that show individual benefits from participation in RBL will be described. This third area, i.e. the individual learning gains from participation in RBL, also constitutes the focus for the remainder of this dissertation. In a fourth section the different student and course characteristics that influence the effectiveness of RBL are reviewed.

6.2 Societal Benefits: Fostering Scientific Careers

The need for highly educated personnel that produce, understand, and use knowledge is a key characteristic of our current knowledge societies (Snellman, 2015; Välimaa & Hoffman, 2008). RBL is thought to give students an opportunity to discover their passion for research and thus positively affect PhD beginning rates which ultimately lead to an increased participation in the scientific workforce (Hunter et al., 2007). RBL in this sense serves a distal, societal function and explains why RBL is so regularly mentioned by policy makers.

So far, none of the studies with solely students from the social sciences looked at long-term outcomes of RBL. Studies with multidisciplinary samples, among which there were students from the social sciences, indicate that students who participated in undergraduate research show higher rates of pursuing a graduate degree independent of their grade point average (Bauer & Bennett, 2003) and a greater interest in pursuing scientific careers (Lopatto, 2007). For the field of STEM the evidence is stronger: Students who participated in undergraduate research did indeed show increased retention rates (Jones, Barlow, & Villarejo, 2010). In a large-scale study by Russell et al. (2007), almost a third of the students reported they developed new expectations of obtaining a PhD after participating in an RBL experience. A first longitudinal study confirmed that these expectations translate into actual behaviour: Hernandez et al. (2018) used a ten-year longitudinal design to examine how the intensity and duration

of RBL impacts participation in the scientific workforce after graduation. They found that the odds of being engaged in a scientific career six years after graduation were three times greater for students with long-term, high-intensity RBL compared with those for a propensity-score matched control group with no undergraduate research experience. While this provides first evidence for the long-term, societal benefit of offering RBL courses in STEM disciplines, no such conclusion can be drawn for the social sciences.

6.3 Occupational Benefits: Competencies for Non-Scientific Professions

It is often emphasized that research skills are also necessary for occupations outside academia (British Academy, 2012). RBL could thus be effective in facilitating those learning outcomes that are necessary to work in non-scientific professions. One of these is the development of a "researcher's mindset" – the ability to objectively examine data or a situation and the enjoyment found in solving problems (Wood, 2003). A researcher's mindset could be effective in a range of professional activities, for example for the field of teacher education to critically reflect on one's own classroom activities (Fichten, 2013; Wildt, 2009) . In the field of psychotherapy therapists could draw upon their research knowledge to consult evidence on new therapeutic approaches (American Psychological Association, 2006), a practice captured by the established concept of the "reflective practitioner" (Schön, 1983). In addition, engaging in research is usually connected with being exposed to uncertainties and conflicting evidence. Having experience in doing self-regulated research might help in finding valid solutions in other uncertain fields outside academia (Brew & Jewell, 2012). To our knowledge, up to now, nobody has systematically studied the question, whether and how participation in RBL serves non-scientific professions in this sense. This claim on the effectiveness of RBL thus remains a theoretical one.

6.4 Individual Benefits: Research Competencies

A prerequisite for a later engagement in scientific and non-scientific careers is a range of research-related skills that RBL is thought to develop. These necessary dispositions can be differentiated into cognitive and affective-motivational aspects.

6.4.1 Cognitive Gains

Most empirical studies on the effectiveness of RBL have examined a range of cognitive research dispositions. However, the majority of these studies assesses STEM students, with only a few studies investigating the effect of RBL in the social sciences. In studies with students from different social sciences, students reported increased skills pertaining to individual research steps, e.g. in performing literature reviews and collecting data (McKinney & Busher, 2011), in using statistics software (Whipple, Hughes, & Bowden, 2015), in critically evaluating the data (Woodzicka, Ford, Caudill, & Ohanmamooreni, 2015), writing about the findings (Kazura & Tuttle, 2010), and in communicating and presenting one's research (Stanford, Rocheleau, Smith, & Mohan, 2017). In a study from the field of social work, students gained domain-general research knowledge (Whipple et al., 2015). Another study with students from multiple disciplines found that psychology students increased – among others – their research methods skills through participation in RBL (Taraban & Logue, 2012). Participation in RBL is said to also facilitate the development of more general dispositions like an understanding of the scientific process as a whole (Lloyd, Shanks, & Lopatto, 2019), critical thinking (Hunter et al., 2007; Kilgo et al., 2015), and the ability to work independently (Stanford et al., 2017).

6.4.2 Affective-Motivational Gains

Affective-motivational gains have drawn increased attention in research on RBL. Again, there are however only a few studies with students from a social scientific background that look at affective-motivational gains. In a study with social work students, Maschi et al. (2009) report that students experience a range of feelings while conducting research, e.g. anxiety, frustration, and excitement. Towards the end of the research experience, students gained confidence in conducting research and had an increased value of research. In a study with students from the educational sciences, students also gained confidence and developed enthusiasm towards research (Hosein & Rao, 2017). More evidence on RBL's potential to alter affective-motivational dispositions stems from studies with multidisciplinary samples. Demonstrated benefits include higher research self-efficacy (Deicke, Gess, & Rueß, 2014), increased intellectual curiosity (Bauer & Bennett, 2003), and a higher tolerance for obstacles in the research process (Lloyd et al., 2019). Studies with students from STEM disciplines demonstrated a greater desire to learn, an increased disposition towards working with ambiguity (Ward, Bennett, & Bauer, 2003), and an increased confidence in one's research skills (Russell et al., 2007).

6.5 Factors Affecting the Effectiveness of RBL Courses

Some of the above studies did not only investigate different outcome variables but also looked at the influence of different independent variables on any developments. These studies can help to further understand which additional factors influence the effectiveness of RBL and lead to identifying particularly effective forms of RBL. In the following, a distinction is made between variables referring to students' characteristics and characteristics of the course.

6.5.1 Students' Characteristics

Three different characteristics of the participating students have been investigated in the context of RBL studies: Students' intellectual ability, discipline, and gender.

Intellectual ability: It is often criticised that the positive effect of RBL in contrast to other forms of learning is due to a higher intellectual ability of the students participating in RBL. Students with higher grade point averages (GPA) are more likely to participate in RBL (Russell et al., 2007). However, studies looking at the effectiveness of RBL do not adequately control for academic performance or intellectual ability. In one of the few studies that looked at the influence of students' prior academic performance, it was shown that students with higher GPAs profited more from participation in RBL (Taraban & Logue, 2012).

Discipline: While students from a range of disciplines can benefit from participating in RBL (Haeger & Fresquez, 2016), the exact gain from participating in RBL can differ between disciplines. While most studies on RBL use mono-disciplinary research designs, Taraban and Logue (2012) conducted one of the few studies with students of different disciplinary background. The results indicate that biology students profited more from participation in RBL than psychology students. The authors speculate that biology students showed greater involvement in scientific work since the academic culture in biology is more focused on research than it is in psychology.

Gender: In some of the studies on the effectiveness of RBL there were significant differences for men and women. Kardash (2000) found that the participating male students gave higher ratings to their own ability to understand different concepts from their field than women. Taraban and Logue (2012) showed that male students showed larger (self-evaluated) gains in

research mindset and research methods compared to female students. It is however unclear, whether men do indeed profit more from participation in RBL or whether men on average react more optimistically to self-evaluations of skill gains.

6.5.2 Course Characteristics

Four different characteristics of RBL courses have been studied in the literature: The duration and timing of the research experience, voluntary participation, students' autonomy in choosing research question and method, and the influence of the supervisor.

Duration and Timing: The duration of the research experience seems to be a positive predictor of RBL's effectiveness. Bauer and Bennett (2003) found that the longer students had participated in research, the greater they perceived their own skill level. A study by Gilmore et al. (2015) supported this result by showing that the number of semesters spent with research experiences was indeed correlated with students' research skills (operationalised by research proposal grades). In addition, Jones et al. (2010) showed that earlier participation in RBL during the course of study was related with increased retention. The authors assume that motivation is an important factor to explain this result. However, it remained unclear whether students who seek out early research opportunities are more motivated to seek learning experiences or whether early research participation motivates students to continue their studies.

Voluntary participation: The evidence on the impact of voluntary and mandatory research participation on the development of different research dispositions is contradictory. While Russell (2007) assumes that mandatory research participation may be counterproductive, Vieyra et al. (2011) showed that students who had to conduct research gained from the experience as much as undergraduates who voluntarily chose to conduct research. In a more recent study, again, no correlation between voluntary or mandatory participation and perceived skill development were observed (Gilmore et al., 2015).

Autonomy: Spronken-Smith et al. (2012) distinguish between different forms of inquiry-based learning, depending on whether the instructor or the student chooses research question and method (see section 5.2.1). These forms are associated with different learning processes and outcomes: An open mode of inquiry (question and method chosen by student) is associated with more advanced learning processes, such as reflection, than a structured (question and method determined by instructors) mode of inquiry. Similarly, in the study by Gilmore et al. (2015), student autonomy was operationalised by students' control over choosing research problem and methodology. Students who reported higher rates of autonomy also reported higher skill development, e.g. increased disciplinary knowledge and research interest.

Supervision: A key characteristic of RBL is its form as a community of practice that gives students the opportunity to learn from their instructor (see section 5.3.3). A previous study shows that supervision determines whether the RBL experience is seen as a positive or negative learning experience (Howitt, Wilson, Wilson, & Roberts, 2010). In another study with about 15,000 students at different US universities, the participants were asked what would have improved their research experience. The most common response to this question related to improving supervision, either by increasing its quantity or effectiveness (Russell et al., 2007). How exactly different forms of RBL supervision relate to higher skills development cannot be inferred from the existing studies.

6.5.3 Main Gaps in the Literature

When looking at the empirical base on the effectiveness of RBL to facilitate different cognitive and affective-motivational research dispositions, four main gaps become apparent:

(1) Focus on STEM disciplines: Overall, studies on the nature and effectiveness of RBL in the social sciences are scarce – the majority of the studies was conducted in the context of STEM disciplines. However, one cannot assume that the evidence gained in these studies easily translates to the social sciences. Taraban and Logue (2012) for example found that biology students showed greater gains from participation in RBL than psychology students. They assume that research is more important to study programmes in the natural sciences than in the social sciences, both in terms of study focus and later career. Additionally, most research experiences within STEM-disciplines are made in structured lab environments where the pedagogical culture is different (Rand, 2016). This might influence how RBL is implemented and what students take away from these learning experiences. Furthermore, if discipline-specific outcome variables are to be investigated, a study must necessarily be conducted in that discipline. Stanford et al. (2017) for example did not find any substantial differences between the self-evaluated learning gains of STEM and non-STEM students who participated in summer research experiences. However, the cross-disciplinary nature of their investigation meant that discipline-specific learning gains could not be evaluated. There is still no large empirical study assessing the effectiveness of RBL within the social sciences on discipline-specific measures, like research methods knowledge.

(2) Type of measurement to assess cognitive gains: One problem concerning the interpretability of studies examining cognitive gains lies in their chosen methodological designs. Most existing studies focus on subjective ex-post assessments, such as self-evaluated skill gains (e.g. Stanford et al., 2017). Examples of the questionnaires in use are the Survey of Undergraduate Research (SURE; Lopatto, 2007) and the Undergraduate Research Questionnaire (URQ; Taraban & Logue, 2012). These two and instruments employed by many other studies ask for the self-evaluation of various research skills with single items, lack validation procedures (as described for the SURE in Auchincloss et al., 2014) and can thus only provide weak evidence for the effectiveness of RBL. Large-scale investigations using objective measures (e.g. Russell et al., 2007) provide more substantial conclusions, but are non-existent for students of social scientific disciplines. Linn et al. (2015) note that the underlying problem of the field is a lack of valid measures to objectively investigate the effectiveness of RBL.

(3) Lack of evidence for affective-motivational gains: There is a lack of studies looking at affective-motivational gains, in any discipline. While there is a range of anecdotal evidence on students' affective and motivational experiences during research (Rand, 2016), the number of studies that systematically investigate how students manage these experiences is scarce. Especially, there is no study that looks at the development of different affective-motivational research dispositions over the course of a research project by using pre-post measurements.

(4) Lack of evidence on influential factors in the social sciences: Different students' and course characteristics were identified as influential for the effectiveness of RBL, e.g. the autonomy granted to students in freely choosing research question and method, or the supervisor's role. Studies that investigate these different characteristics are entirely based in STEM disciplines. There is a lack of evidence of different RBL set-ups and their effectiveness for research education in the social sciences.

These main gaps in the literature on the effectiveness of RBL for the facilitation of individual research dispositions motivated the research questions of this dissertation.

7 Main Questions and Methodological Framework

7.1 Research Questions and Objectives of the Studies

This dissertation seeks to answer three central research questions.

In line with a holistic understanding of competence, affective-motivational dispositions can be considered as relevant for successfully conducting research in the social sciences. However, so far, existing models of student research competence concentrate on cognitive aspects like research knowledge. The first objective of this dissertation is thus to identify relevant affective-motivational research dispositions for students in the social sciences.

RQ 1: Which affective-motivational research dispositions constitute research competence in the social sciences? (Publication I)

Since affective-motivational research dispositions have not been investigated in a coherent manner, there is also a lack of suitable instruments to assess these dispositions. A second objective of this dissertation is thus to operationalize the identified research dispositions based on the principles of psychological test construction and to provide evidence for the validity of these instruments.

RQ 2: How can these affective-motivational research dispositions be assessed? (Without publication)

RBL is an instructional format that is often recommended to be implemented in study programmes to facilitate the development of different research dispositions. The evidence on these claims, especially for social scientific disciplines or the facilitation of affective-motivational research dispositions, is however scarce. A third objective is thus to examine whether RBL is an effective format to develop different cognitive and affective-motivational research dispositions in the social sciences.

RQ 3: Does participation in RBL facilitate the development of cognitive and affective-motivational research dispositions in the social sciences? (Publication II)

The research questions of this dissertation were addressed by employing a mixed-method design consisting of four sequential phases (see Table 2). The first phase addressed the first research question. Due to the exploratory nature of the question, a qualitative design was used. By the help of expert interviews, relevant challenges in student research processes and affective-motivational dispositions necessary to overcome these challenges were identified (phase 1, Publication I). After this explorative phase, for all identified dispositions scales were developed (phase 2) and tested in a validation study (phase 3). The final scales were used in a pre-post study on the effectiveness of research-based learning (phase 4, Publication II). The individual steps of these phases are described in the following, whereas those steps that are part of a publication are only roughly explained.

Table 2: Methodological phases of this dissertation project

Research question	Phase	Steps	Study details
RQ 1: Which affective-motivational research dispositions constitute research competence in the social sciences? ► Publication I	Phase 1: Identifying affective-motivational research dispositions	Expert interviews	Location: 3 universities in Berlin *N* = 16 professors and lecturers
		Expert rating	Location: Online-rating, 9 German universities *N* = 27 professors and lecturers
		Modelling and conceptualizing the research dispositions	
RQ 2: How can these affective-motivational research dispositions be assessed?	Phase 2: Developing test instruments	Item generation	
		Item discussion	
		Pilot study	Location: 2 German universities *N* = 248 bachelor's and master's students of the social sciences
		Item selection	
	Phase 3: Validating test instruments	Validation study	Location: 8 German universities *N* =371 master's students of educational sciences and psychology
RQ 3: Does participation in RBL facilitate the development of cognitive and affective-motivational research dispositions in the social sciences? ► Publication II	Phase 4: Pre-post study in RBL courses	Pre-post study – student survey	Location: 10 German universities *N* = 952 bachelor's and master's students in 70 RBL courses
		Post study – instructor survey	Location: 10 German universities *N* = 52 instructors of RBL courses

7.2 Phase 1: Identifying Affective-Motivational Research Dispositions (Publication I)

The objective of this phase was to identify and model affective-motivational research dispositions. Three steps were undertaken to accomplish this objective: First, an expert interview aimed at identifying challenging situations in the student research process and relevant student research dispositions. Second, these situations and dispositions were rated in content and relevance by the help of an expert rating. Third, a conceptualization phase ensured the dispositions were defined and embedded in the educational-psychological literature. All three steps are part of Publication I (see section 8) and thus only briefly introduced in the following. Supplementary information not provided in the publication is covered in greater depths.

7.2.1 Expert Interviews

Background: Since there exists no coherent model of affective-motivational research competence and necessary dispositions for student research can only be assumed based on the literature (see section 3.3), an exploratory, qualitative procedure was chosen. The test construction literature recommends expert interviews as a promising way to identify and define constructs (Bühner, 2011). Expert interviews provide the opportunity to use the experience of knowledgeable individuals while having the chance to openly discuss the novelty of the topic and flexibly react to unforeseen themes. We conducted semi-structured interviews to optimally extract the experts' contextual knowledge (Meuser & Nagel, 2009).

Sample: Eligible interview participants for our purpose were those that showed a substantial expertise in teaching RBL-courses and supervising researching students, e.g. mainly professors and post docs of different social scientific disciplines. Altogether, $N = 16$ professors and lecturers from five disciplines were interviewed.

Interview procedure: In line with the situation-specificity of competence, the objective of the interview study was to identify difficult situations in students' research processes and the dispositions needed to overcome these challenging situations. An adapted form of the critical incident technique (CIT) was chosen to identify these critical situations in the research process. Unlike in the original version of CIT (Flanagan, 1954), the interview participants were not asked for critical situations they mastered themselves but asked to recollect insight on their students' research processes.

The second part of the interview was theme-centred (Schorn, 2000) to specifically explore affective and motivational dispositions in the research process. The interview participants were free to elaborate on any aspect of student research if deemed relevant to the research question. The aim was not to gather answers on a standardised set of questions but to enable a discourse on affective-motivational dispositions that would allow experts to unearth their implicit knowledge.

Analysis and results: Further details on the study and its results can be found in Publication I (see section 8).

7.2.2 Expert Ratings

Since the focus of Publication I was on the expert interviews, the expert ratings were not described in full detail. Additional details on procedure and participants of the expert rating are thus provided in the following.

Background: After the preliminary research situations and dispositions were extracted from the interviews, an expert rating was conducted to further validate content and relevance of

the research situations and dispositions. Even though the interview participants in the first step were carefully chosen, we wanted to diminish the possibility that our interpretation of the data showed any bias towards a specific methodology or discipline. Especially in the field of higher education it is recommended to include a nationwide expert rating that accounts for different institutional practices to validate the content of competence models (Zlatkin-Troitschanskaia et al., 2015, p. 403).

Sample: An online expert rating was conducted with a sample of *N*=27 professors and advanced lecturers from nine German universities. The participants were carefully chosen to represent a broad range of social scientific disciplines and methodologies (see Table 3). All experts were invited individually via email (46 invitations were sent out). Expertise in judging relevant student research dispositions was ensured by their position as a full professor or their membership in an advisory network concerned with research-based learning. The experts had a wide range of experience in supervising students who were conducting research of *M*=13.25 years (*SD*=10, *min*=1.5, *max*=37).

Table 3: Participants of the online expert rating

	Research tradition			
Discipline	Qual	Quant	Both	Theoretical
Educational Sciences	2		7	
Ethnology and Cultural Studies	2			
Psychology	1	5	1	
Sociology	1		3	
Other (e.g. Communication Studies)		2	2	1
Total	**6**	**7**	**13**	**1**

Position/Function	
Professor (incl. senior professors)	11
Postdoc	5
Doctoral student	5
Coordinator	4
Other (e.g. lecturer)	2

Procedure: The online rating was implemented with SoSci Survey (Leiner, 2015) and made available on www.soscisurvey.de by the help of individual links. The online rating took 10 minutes on average (*M*=10.6 minutes, *SD*=4.6 minutes). The content and form of the online rating were based on the recommendations by Jenßen, Dunekacke and Blömeke (2015). Participants were asked to rate the relevance of the identified situations and respective affective-motivational dispositions for successfully conducting student research on a 4-point Likert scale (ranging from 1= *not at all relevant* to 4 = *very relevant*). In addition to this quantitative rating, participants were encouraged to add comments on any of the situations or dispositions presented or deemed missing. All experts rated and commented on all six situations and every disposition.

Analysis and Results: The central results of the expert rating are part of the published study (see publication I in section 8) and are thus not repeated here. The experts had the opportunity to suggest additional constructs relevant for student research in their discipline. Since these could not be explained in enough depth as part of the publication they are discussed here.

One professor noted that many of her/his students "are not very willing to throw their beloved hypothesis overboard, even if the empirical data suggest so". This expert proposed the

"falsification acceptance" as a relevant disposition for researching students, which denotes the ability to accept that one's hypothesis was falsified. Another expert noted that his/her students regarded the data analysis of field studies as "an unnecessary duty, because one has already perceived so much during the study that a gut feeling has already developed as to what the 'solution' to the question is". The students tend to trust their own ideas and intuitions and do not think a closer look at the data is necessary to come to a valid conclusion. This expert thus suggests that students do not just need any interest to pursue research but a "methodologically guided and scientific interest in knowledge". This implies that students need to understand the importance of methodologies and follow these procedures to come to scientific conclusions instead of following their instincts or beliefs.

Since these and other constructs remained individual suggestions for possible affective-motivational research dispositions they were not included in the model. Instead, these and other interesting suggestions were born in mind while continuing to work in the field. Furthermore, three experts commented on the level of the models' dispositions: One expert stated that the affective-motivational dispositions do not only apply to student research but are also important for advanced research. Two other experts commented that the affective-motivational dispositions were important for both students and professionals, but even professional researchers would lack many of the dispositions. These comments gave additional weight to considering the "difficulty" of the identified dispositions.

7.2.3 Modelling and Conceptualizing Research Dispositions

The interviews and subsequent ratings aimed at identifying possible affective-motivational research dispositions. Several inclusion criteria were set to ensure that the extracted dispositions were indeed of affective or motivational nature, research-specific, and coherent with definitions of competence (see section 2.2). Descriptions that denoted general personality or primarily cognitive aspects like knowledge were excluded. Moreover, to ensure research-specificity, general academic abilities like self-regulated learning were also excluded. The remaining dispositions were specific to the student research context in the social sciences but not specific to individual disciplines or specific research methodologies.

Additionally, following the recommendations of Meuser and Nagel (2002), the resulting dispositions were *conceptualized*. This means to view the dispositions in the context of the prevalent theories and constructs of the field; in our case the educational-psychological literature. Existing theories and definitions of related dispositions were viewed and used to gain additional insight into the dispositions. For example, based on the interviews, the disposition *research-related uncertainty tolerance* was identified as a relevant and helpful disposition in student research processes. The psychological and educational literature on general uncertainty and ambiguity tolerance was viewed. Dimensions and constituting elements of these constructs (e.g. behavioural, cognitive, and emotional components of uncertainty tolerance) were identified and helped to further sharpen our own definition of research-related uncertainty tolerance. For all other dispositions it was proceeded likewise. This conceptualization step ensured the theoretical foundation of the model and guaranteed its compatibility with the prevalent scientific discourse.

The insights of the conceptualization process directly fed into the model of affective-motivational research dispositions and are thus described as part of Publication I (see section 8).

7.2.4 Conclusion of the First Phase

As a result of this first phase, a model of affective-motivational research dispositions was identified. The model encompasses six challenging research situations and nine dispositions deemed necessary to cope with these challenges. The interviews, the ratings, and the conceptualization based on the literature made it possible to coherently define each of the affective-motivational research dispositions which is a prerequisite for the subsequent development of test instruments.

The interviews and the expert rating provided further questions on the nature and conditions of student research and different disciplinary and theoretical perspectives of researcher development. While it was impossible to address all of these thoughts and questions within an individual model of affective-motivational research dispositions they provided a deepened, personal background for all subsequent work phases.

7.3 Phase 2: Developing the Instruments

The second phase aimed at developing instruments for the assessment of the affective-motivational dispositions identified in phase 1 (see Publication I in section 8). Since there is no publication on the second phase, the full procedure is explained in the following. The test construction process followed the general steps recommended by Bühner (2011) and Moosbrugger and Kelava (2012) and the more specific recommendations for modelling competencies by Terzer et al. (2013). These steps are further explained in the theoretical part of this dissertation (see section 4.2). The test construction process started with generating a large number of items. An item discussion panel chose a promising set of items which were then tested in a pilot study. Based on the data, the final sets of items for each disposition were selected and refined.

7.3.1 Item Generation

Items for each disposition were generated based on the definitions for all affective-motivational research dispositions that were identified in phase 1. In addition, existing instruments for the constructs to be measured were reviewed as recommended by Stecher and Hamilton (2014). Thus, existing instruments of both general and domain-specific dispositions (e.g. general uncertainty tolerance and uncertainty tolerance in the field of medicine) were reviewed to get an idea of construction principles employed by others.

Construction principles: Afterwards, following the recommendations by Wilson (2005), principles for systematic item construction were fixed. These construction principles include information or themes that should be part of every item. These principles thus help to standardize the item construction procedure and ensure that all items have a clear connection to the construct's definition (Terzer et al., 2013).

As an example, I will explain the construction principle for research-related uncertainty tolerance. Competencies are context-specific and always relate to a certain situation or environment (see section 2.2). The assessment of competence needs to account for this situation-specificity (Rychen & Salganik, 2003, p. 55). Hence, all items for the assessment of uncertainty tolerance need to refer to specific research situations. Furthermore, based on the working definition of uncertainty tolerance, different emotional evaluations of uncertainty are an indicator for uncertainty tolerant (positive emotional evaluation like excitement) or intolerant students (negative emotional evaluation like fear). An emotional evaluation should thus be part of every item. Together, every item needs to consist of two components: An uncertain research situation and an emotional evaluation of this situation.

Situation: An uncertain situation in the research process is characterized by openness (e.g. "If I don't know which papers to read, then …"), an unknown topic (e.g. "If I have to use a completely new method, then …") or imponderability (e.g. "If I can't estimate whether I will find enough participants for my study, then …"). The situation must be research-specific to account for the context-specificity of the research dispositions. However, the situation must not be too discipline-specific, but relatable for students of all social scientific disciplines.

Emotional evaluation: The second component of every item is the emotional evaluation of the uncertain research situation. The evaluations can either be positive (e.g. "… I find that particularly exciting.") or negative (e.g. "… I feel helpless").

Likewise, for each affective-motivational disposition construction principles were formulated. Based on the construction principles, around 30-60 items were generated for each disposition. These items represented a range of different research phases, disciplines, competence levels, and methodologies.

7.3.2 Item Discussion

After 30-60 items were generated for each construct, an item discussion panel was conducted. Participants were – apart from myself – two colleagues from the field of higher education and a master's student from the field of psychology. All participants were familiar with the dispositions and their definitions and reviewed all items based on eight guiding questions. The guiding questions were developed based on the considerations on the intended use and target group of the test (see sections 4.2.2 and 4.2.3).

- Are the items suitable for students of all disciplines?
- Are the items suitable for all research traditions (qualitative, quantitative, mixed methods)?
- Are the items plausible and realistic?
- Is social desirability a problem or is it possible to read out which is the "right" answer?
- Can at least some items of each construct also be answered for beginners of student research?
- Does the "difficulty" of the items vary?
- Do the selected items as a whole still reflect the construct comprehensively?
- Are the selected items sufficiently distinct from items of other constructs?

Based on these questions, suitable items were selected, further discussed, and edited if necessary. For every construct, 20 items were selected in consensus. These items were chosen such that students of all disciplines, research methodologies, and study progress could answer them while variation in item content and difficulty remained.

7.3.3 Pilot Study

After generating and discussing the items, a pilot study was conducted at two German universities to test each item and choose the best items for each construct.

Sample: Altogether, *N*=377 students participated in the pilot study. However, to represent the target population with respect to study progress and discipline (Moosbrugger & Kelava, 2012), only those students were included who studied educational sciences, political sciences, psychology, science studies, and communication sciences as bachelor's or master's student. Since 129 students studied other disciplines such as computer science or linguistics, the final sample comprised *N*=248 students.

Procedure: Instructors of eight different courses and lectures were contacted via e-mail and asked to devote some of their class time during the first week of the semester for the pilot study. All instructors agreed to participate. The students were tested in class using paper-pencil questionnaires (see Appendix D). To reduce testing time, every student answered items for two thirds of the constructs. The constructs were distributed onto three blocks (A, B, C) and students received one of three questionnaire versions (consisting of AB, AC, or AB). There is a maximum of *n*=165 students who answered an individual item. Answering the questionnaire took approximately 25-30 minutes.

Measures: The items for the following affective-motivational dispositions were included in the questionnaires (for an overview see Table 4): Complexity tolerance, uncertainty tolerance, beliefs on the research process (all block A), epistemic curiosity, frustration tolerance, research interest, and joy towards conducting research (all block B), acceptance of divergent perspectives, willingness to seek feedback, acceptance of narrowing down, and self-efficacy (all block C). Additional variables were assessed, like the amount of experience with working on research projects and amount of credits received in quantitative and qualitative research methods (the full questionnaire can be found in Appendix D). Students were informed that they participated in a pre-testing and that any comments would be valuable to improve the questionnaire. Students were invited to write any remarks right next to critical items and to provide more extensive feedback at the end of the questionnaire (as recommended by Terzer et al., 2013). Especially the participating psychology students used their knowledge on test construction to comment on the questionnaire.

Preliminary results: The quantitative data was used for the item selection process (see next section). The additional comments were screened. Altogether, the students wrote almost 2,700 words of written feedback. The comments predominantly indicated that the test was perceived as being too long and the items seemed repetitive. Since 20 items were used per construct and the pilot study served as a way of reducing the number of items, this feedback did not come as a surprise. Other students criticised that too many items represented quantitative research methodologies or were "too emotional" for the context of research. The remaining comments referred to specific aspects such as wording, e.g. eight students commented that the word "Unwägbarkeiten" [imponderability] was old-fashioned or unknown to them. The feedback was incorporated into the item selection and improvement process.

7.3.4 Item Selection

Data from the pilot study (see previous section) was used for the item selection procedure. Both content and psychometric criteria were used to choose suitable items. Based on the recommendations by Bühner (2011), reliability, item difficulty, item variance, item discrimination, and factor loadings were considered. It is important to note that psychometric properties of the items only served as indicators of misfitting or ambiguous items. It was carefully avoided to overfit the item selection to the study sample (overadjustment; see Cronbach, 1990) or to produce homogenous scales without any discriminatory power. In the following, the chosen psychometric criteria are briefly explained.

Reliability: The reliability of the test was assessed by examining the internal consistency expressed by Cronbach's Alpha. The higher the correlations between the items of a construct, the higher Cronbach's Alpha. For every item, Cronbach's Alpha of the overall construct without this item was calculated. If an item was associated with clearly reducing overall Cronbach's Alpha, this item was likely to express something else than the other items.

Item difficulty: For performance tests, item difficulty is the proportion of correct answers on an item. A high value thus indicates that many of the participants were able to solve the item, i.e. a high difficulty indicates "easiness". In the case of personality tests where there is no right or wrong, item difficulty denotes whether the result is symptomatic for a construct or not (Moosbrugger & Kelava, 2012). The aim was to find an adequate mixture of items with low, medium, and high difficulty.

Item variance: The item variance denotes an item's power to differentiate between different individuals. Those items with very low or high difficulty show a lower variance and can thus not discriminate as well between different individuals. Those items with a medium difficulty have the highest variance.

Item discrimination: The discriminatory power of an item is expressed by the correlation of a person's answer to a single item with that person's value for all items of the construct (Moosbrugger & Kelava, 2012). Since item discrimination is based on a correlation, this parameter can have values $-1 < r < 1$. Values of $0.4<r<0.7$ indicate a good discriminatory power.

Factor loadings: To examine how well an item fits the overall construct, factor loadings of the individual items were considered by the help of a confirmatory factor analysis. A factor loading of <.3 was regarded as critical.

In addition to looking at the constructs individually by the help of the above psychometric criteria, they were examined conjointly by making use of hierarchical cluster analysis. The hierarchical cluster analysis was performed in R, using the iclust-function of the psych-package (Revelle, 2016). Items that were clustered with items from a different construct were inspected to examine any overlap between constructs and ensure a higher discrimination.

Item content: Values from both the item analysis and the hierarchical cluster analysis were used to identify and exclude unsuitable items. However, while it was a goal to ensure satisfactory statistical values, it was also important to balance the statistical with content-related considerations. For example, all disciplines and different research methodologies and research phases were to be part of the selected items. Furthermore, the selected items should represent the theoretical breadth of the construct.

In a last step, students' feedback from the pilot test was used to determine if any of the selected items were considered unclear, ambiguous, or unknown. In some cases, the wording of these items was changed slightly to ensure a high clarity of all items. Taking all these considerations into account, 6-9 items were chosen for every disposition that constituted a promising compromise of all content-related and psychometric criteria.

7.3.5 Conclusion of the Second Phase

As a result of the second phase, for each of the affective-motivational dispositions identified in the first phase, self-assessment scales consisting of 6-9 items each were developed. The complete instruments, including construct definitions and basic item properties can be found in the appendix (see Appendix B).

Table 4: Overview of the studies and the assessed dispositions

	Disposition	Pilot study (N = 248)	Validation study (N = 371)	Pre-post study (N = 952)
1	Frustration tolerance	yes	yes	yes
2	Complexity tolerance	yes	yes	yes
3	Uncertainty tolerance	yes	yes	yes
4	Finding joy in conducting research	yes	yes	yes
5	Research interest	yes	yes	yes
6	Epistemic curiosity	yes	no	no
7	Acceptance of divergent perspectives	yes	no	no
8	Willingness to seek feedback	yes	no	no
9	Acceptance of narrowing down	yes	no	no

7.4 Phase 3: Validating the Instruments

In a subsequent validation study with N=371 students, further insight on some of the affective-motivational research dispositions was created. Since this study was not published but provides important insight on the research dispositions under scrutiny, it is explained in greater depths in the following.

7.4.1 Background and Research Questions

When the affective-motivational dispositions were identified based on expert interviews, it was made sure that all dispositions were research-specific so they would comply with the definition of competence (see section 2.2). Throughout the study, the question remained whether these research-specific dispositions were different from and more explanatory than their general counterparts. For example, does research-related uncertainty tolerance explain more than general uncertainty tolerance when it comes to students' research performance? Are these in fact different constructs? Thus, one of the aims of this validation study was to study the convergent and discriminant validity between the research-specific and the general measures of complexity, frustration, and uncertainty tolerance by using a correlative multitrait-multimethod approach (Campbell & Fiske, 1959). Furthermore, it was important to find additional evidence for the content and criterium validity of the dispositions. It was assessed whether the three tolerances show substantial correlations with general mental ability (as approximated by the final high school grade), the cognitive facet of research competence, and students' research experience. It was also assessed whether the tolerances show differences between students of different disciplinary backgrounds. In addition, the incremental validity of the research-specific measures of uncertainty, frustration, and complexity tolerance over the general measures of these tolerances in explaining research performance was assessed.

Research questions: One research question aimed at the convergent and discriminant validity of the measures:

> RQ 1: Are the homotrait correlations (e.g. research-specific uncertainty tolerance and general uncertainty tolerance) higher than the heterotrait correlations for all measures?

Four more research questions aimed at gaining more insight on the content and criterium validity of the newly developed scales:

> RQ 2: Are the research-specific measures of uncertainty, complexity, and frustration tolerance correlated with general mental ability (as approximated by the final high school grade)?
>
> RQ 3: Do research-specific measures of uncertainty, complexity, and frustration tolerance show a higher correlation with research knowledge (as assessed by short version of the research competence test by Gess et al.) than the general measures of these tolerances?
>
> RQ 4: Do research-specific measures of uncertainty, complexity, and frustration tolerance show a higher correlation with research experience (as assessed by the number of research projects completed) than the general measures of these tolerances?
>
> RQ 5: Are there significant differences between the research-specific measures of uncertainty, complexity, and frustration tolerance between psychology and educational students or between students working with different research traditions (quantitative, qualitative, or mixed methods)?

In addition, the incremental validity of the research-related measures over the general measures was tested:

> RQ 6: Do research-specific measures of uncertainty, complexity, and frustration tolerance show incremental validity over general measures of these tolerances in explaining research performance (as assessed by the bachelor thesis grade)?

7.4.2 Methods

Sample and Procedure: In order to make sure that all students had at least some research experience in the social sciences, testing was conducted in master's courses of psychology and educational sciences. Instructors of suitable courses were contacted via email. Instructors of 17 different master's courses at eight German universities agreed to participate in the testing during class time. Altogether, *N*=371 students (361 students enrolled in master's programmes, 5 students enrolled in bachelor's programmes, 5 students did not provide an answer) participated in the study. The majority studied psychology (225 students) and educational sciences (127 students). The remaining students studied other subjects (15 students) or did not provide an answer (5 students). The measurement was done using paper-pencil tests. Testing time took approximately 25 minutes.

Measures: Assessed were different affective-motivational research dispositions and their general counterparts (see Table 5). The general measures were assessed by existing instruments taken from the literature. In addition, the cognitive facet of research competence was assessed using a short version of the test by Gess et al. (2017). The development and the properties of the 9-item short version are described in the appendix (see Appendix H). As a proxy for general mental ability, the final high school grade was assessed. As a measure of research performance, the bachelor thesis grade (not the overall bachelor grade) was assessed. Re-

search experience was assessed by the number of student research projects and "professional" research projects (e.g. as a student assistant) completed so far. Additional background data on study programme, study progress, and the predominant research tradition students work with (quantitative, qualitative, or mixed-method research) were asked for. The full questionnaire can be found in the appendix (see Appendix E).

Table 5: Overview on the instruments used in the validation study

Measure	Origin	Items	Reliability
Research competence test	Short version based on the 27-item version by Gess et al. (see Appendix H)	9	α = .50
Research-related uncertainty tolerance	Own development (see section 7.3)	8	α = .82
General uncertainty tolerance	Uncertainty tolerance scale UGTS (Dalbert, 1999, 2003)	8	α = .76
Research-related frustration tolerance	Own development (see section 7.3)	8	α = .77
General frustration tolerance	Impulsivity scale (facet N5) from the NEO-PI-R (Ostendorf & Angleitner, 2004)	8	α = .66
Research-related complexity tolerance	Own development (see section 7.3)	8	α = .84
General complexity tolerance	8 items taken from the complexity tolerance scale (Radant & Dalbert, 2006)	8	α = .72
Bachelor thesis grade		1	
Final high school grade		1	
Number of research projects completed		2	
Predominant research tradition		1	

Analysis: Data were manually entered into an Excel-sheet and checked for plausibility and missing values. None of the data sets had to be excluded. To answer the research questions, correlational analyses, regressions, and t-tests were used. All analyses were performed in SPSS (version 26).

7.4.3 Results

Convergent and discriminant validity (RQ 1)

RQ 1: The correlations between the research-related measures are between .53<r<.63 and indicate that they are related but distinct constructs (see Table 6). I expected the correlations between any research-related construct and its general counterpart (homotrait correlations) to be higher than with other general measures (heterotrait correlations). Contrary to the expectations, the research-related measures all show their highest correlation with general complexity tolerance.

Table 6: Correlations between research-specific dispositions, general measures, and criterion variables

	General UT	General CT	General FT	Research UT	Research CT	Research FT	Research experience	BA-thesis grade	High school grade	Research knowledge
General UT	1									
General CT	.408**	1								
General FT	-.129*	.137**	1							
Research UT	.520**	.536**	0.095	1						
Research CT	.324**	.648**	.133*	.630**	1					
Research FT	.379**	.509**	.262**	.533**	.585**	1				
Research experience	0.030	.126*	-0.100	0.073	.148**	0.015	1			
BA-thesis grade	-0.046	-0.107	-0.069	-.122*	- .150**	-0.059	-.139*	1		
High school grade	0.012	-0.047	-0.010	0.009	-.119*	-0.061	-.233**	.296**	1	
Research knowledge	-0.047	.149**	0.060	0.082	.240**	.156**	.192**	-.201**	-.324**	1

Note. BA-thesis and high school grades are rated reversely: Lower values indicate higher performance. * indicate significant correlations at $p<0.05$, ** indicate significant correlations at $p< 0.01$. UT= uncertainty tolerance, CT=complexity tolerance, FT=frustration tolerance.

Content and criterion validity (RQs 2, 3, 4, 5)

RQ 2: Research-related complexity tolerance shows a significant correlation with the final high school grade. This possibly indicates that those students with a higher final high school grade are also those that better cope with complexity in the research process. No other measure correlates significantly with the final high school grade. If the high school grade is used as a proxy for general mental ability this indicates that the measures, apart from research-related complexity tolerance, do indeed measure constructs that are different from general mental ability.

RQ 3: Research-related complexity tolerance and frustration tolerance are significantly correlated with research knowledge. This might indicate that the acquisition of research knowledge is facilitated by different affective-motivational research dispositions. Alternatively, a higher amount of research knowledge might lead to a higher tolerance for frustration. Possibly, knowledge has a compensatory effect when facing setbacks or uncertainty. Another study set-up would be needed to answer this question. For all measures, the research-specific measures correlate higher with research knowledge than the general measures. This indicates that all developed instruments measure research-related constructs.

RQ 4: Students' research experience – as assessed by the number of research projects completed so far – correlates significantly with research-related complexity tolerance. This could indicate that research-related complexity tolerance grows with increasing research experience or that those students with higher complexity tolerance are more motivated to take up research projects. Research-related uncertainty tolerance and frustration tolerance in contrast

are not related to research experience. For all measures, the research-specific measures correlate higher with research experience than the general measures. This indicates that all developed instruments measure research-related constructs.

RQ 5: It was tested whether there are significant mean differences between students of educational sciences (n=117) and students of psychology (n=225) for the three research-related tolerances. There were no significant differences between students of educational sciences and psychology for research-related uncertainty tolerance (educational sciences: M=2.97, SD=.74; psychology: M=2.83, SD=0.7), research-related complexity tolerance (educational sciences: M=3.46, SD=.68; psychology: M=3.47, SD=.66), or research-related frustration tolerance (educational sciences: M=3.12, SD=.61; psychology: M=3.13, SD=.62). Furthermore, by the help of a one-way ANOVA it was tested whether any of the research-related tolerances shows mean differences between students who associate themselves predominately with quantitative (n=145), qualitative (n=114), and mixed methods (n=87) research. For none of the tolerances, significant mean differences between the three groups were found.

Based on these analyses it can be concluded that the instruments do not show any bias based on discipline or research tradition of the students.

Incremental validity (RQ 6)

RQ 6: To assess the incremental validity of the research-specific measures over the general measures, two regression models were calculated for each of the tolerances. The bachelor thesis grade, as an indicator of research performance, was used as the predictor variable.

Table 7: Incremental validity of research-specific measures over general measures

	R	R^2	ΔR^2	F	p
Model 1: General UT	0.05	0.002		.669	.41
Model 2: General UT & Research UT	0.12	0.015	0.013	2.397	0.09
Model 1: General KT	0.11	0.011		3.616	0.6
Model 2: General KT & Research KT	0.16	0.024	0.013	3.913	0.02
Model 1: General FT	0.07	0.005		1.526	0.22
Model 2: General FT & Research FT	0.08	0.007	0.002	1.063	0.35

For all three tolerances, the research-specific measures provide incremental validity over the general measures in predicting the bachelor thesis grade. However, in all three cases the additional variance explained is small (see Table 7).

7.4.4 Conclusion of the Third Phase

In this third phase, some of the self-assessment scales developed in the second phase, were tested in a validation study. The interpretation of the test scores indicates that research-related uncertainty tolerance, frustration tolerance, and complexity tolerance are distinct constructs and different from general uncertainty, frustration, and complexity tolerance. For all

measures, the research-specific measures correlate higher with research knowledge and research experience than the general measures. In addition, the measures do not show any bias towards a specific research tradition (e.g. qualitative research) or discipline (e.g. psychology).

This validation study indicates that the measures validly assess research-related tolerances that are important in research contexts and more meaningful in predicting performance than general measures of these tolerances.

7.5 Phase 4: Pre-Post Study of RBL Courses (Publication II)

7.5.1 Background and Method

The fourth phase aimed at studying the effectiveness of RBL to develop different research dispositions in the social sciences using a pre-post-test study design. Paper-based measurements were conducted at the beginning and the end of N=70 RBL courses offered in different disciplines of the social sciences at ten different German universities. The courses took either one or two semesters and allowed students to experience a full research cycle in a self-regulated manner – in line with our definition of RBL (see section 5.2). The study comprised a student survey and an instructor survey.

Student survey: The student survey consisted of four parts: Basic demographic data, questions on the instructional format of the course, cognitive research competence, and affective-motivational research dispositions. The full questionnaire is provided in the appendix (see Appendix F).

Instructor survey: The instructor survey (N=52) took place during the post-test to gather information on the didactical concept of the course from the instructors' perspectives. This enabled us to verify and compare information on the course from both the students' and the instructors' perspectives and to gain a deeper understanding of different RBL formats in the social sciences. The full questionnaire is provided in the appendix (see Appendix G).

More details on the procedure and results of the pre-post study can be found in Publication II (see section 9).

7.5.2 Conclusion of the Fourth Phase

As a result of the fourth phase, evidence on the effect of participation in RBL on the development of research competence was collected. By applying pre–post measurements in 70 courses, we examined changes in different cognitive and affective-motivational research dispositions: Research knowledge increased significantly, but no interindividual differences were observed that could be further investigated. Research-related uncertainty tolerance increased, whereas research interest and joy in working with scientific literature decreased over the course of RBL participation. Subsequent regression analyses showed that the change in uncertainty tolerance was significantly predicted by research self-efficacy. The change in interest was predicted by the instructor's perceived interest in the students' work.

8 Publication I – A Model of Affective-Motivational Research Dispositions

Wessels, I., Rueß, J., Jenßen, L., Gess, C., & Deicke, W. (2018). Beyond cognition: Experts' views on affective-motivational research dispositions in the social sciences. *Frontiers in Psychology*, *9*. https://doi.org/10.3389/fpsyg.2018.01300

Beyond Cognition: Experts' Views on Affective-Motivational Research Dispositions in the Social Sciences[7]

Insa Wessels[1,2], Julia Rueß[2], Lars Jenßen[3], Christopher Gess[2], and Wolfgang Deicke[2]

[1]Institute for Psychology, Humboldt-Universität zu Berlin, Berlin, Germany

[2]bologna.lab, Humboldt-Universität zu Berlin, Berlin, Germany

[3]Department of Education and Psychology, Freie Universität Berlin, Berlin, Germany

Keywords: research competence, affective-motivational research dispositions, research-based learning, higher education, expert interview

Abstract

Research competence as a key ability of students in the social sciences has thus far been conceptualized as consisting primarily of cognitive dispositions. However, owing to its highly complex and demanding nature, competence in conducting research might require additional affective and motivational dispositions. To address this deficiency in the literature, first, we conducted a qualitative interview study with academic experts (N = 16) in which we asked them to identify challenging research situations and the affective-motivational research dispositions needed to cope with them. We employed a subsequent online rating (N = 27) to evaluate the situations and dispositions that had been identified. The resulting affective-motivational facet of research competence encompasses 6 challenging situations that are often encountered and 9 dispositions that are necessary to successfully conduct research in the social sciences and may be used to both inform and evaluate research-based learning. The interview-based approach may serve as an exemplary procedure to postulate affective-motivational facets of competence models.

8.1 Introduction

A central aim of higher education is to help students acquire research competence (RC; e.g. British Academy, 2012), and this aim is reflected in the curricula of study programs. The debate on how to correctly teach RC to students has thus gained increased attention (Lewthwaite & Nind, 2016; L. D. Roberts, 2016). In the social sciences, a range of research method courses and research-based study projects (e.g. undergraduate research opportunity programs; J. John & Creighton, 2011) are aimed at equipping students with the competencies that are necessary for understanding and conducting research. RC enables students to write final theses and to graduate but is also deemed important for their subsequent professional careers. Research-intensive occupations in the fields of market-, social-, and evaluative research require the ability to conduct research in a self-regulated manner (e.g. Russ-Eft & Preskill, 2009). Other professionals (e.g. teachers and psychologists) are increasingly asked to employ evidence-based thinking and to integrate scientific findings into their daily praxis (American Psychological Association, 2006; Slavin, 2008).

Accordingly, RC can be understood as the ability to produce research ('engagement in research'; Borg, 2007, p. 391) and the abilities to understand and apply research results ('engagement with research,' ibid.). For the purpose of this paper, the term RC denotes the ability to conduct research in a self-regulated manner ('engagement in research'). This means that students have the competencies that are required to successfully complete a classical research cycle, ranging from developing a question to interpreting and communicating the results.

While there is wide agreement that equipping students with RC constitutes a central objective of social scientific study programs, existing conceptualizations of RC might be incomplete with respect to the extent to which they fully capture the challenges involved in successfully completing a research project.

Existing models of RC focus on cognitive aspects of research and conceptualize RC as primarily encompassing methodological knowledge and skills (Gess et al., 2017; Thiel & Böttcher, 2014). These models and the test instruments that are based on them can help in the capturing and evaluation of students' RC. However, a focus on cognitive dispositions might render a model incomplete for explaining performance (Blömeke et al., 2015). The highly complex and demanding nature of research might require specific affective and motivational factors. When students engage in research, they often experience emotional unsettlement, especially worry and nervousness (Rand, 2016), and they can be left feeling as though they are facing manifold uncertainties (Delamont & Atkinson, 2001). It has thus been described as 'fluctuating between chaos (frustration, disorientation) and cosmos (structures [the students] themselves constructed)' (Silén & Uhlin, 2008, p. 463).

While there is some recognition that the affective-motivational factors involved when students conduct research constitute an important facet of students' RC (Lei, 2010), a comprehensive description of the nature of these affective-motivational dispositions is missing. Therefore, the purpose of this study is to expand existing conceptions of RC by shedding light on the challenging situations that students face when conducting research and identifying the necessary affective-motivational research dispositions that have been mentioned anecdotally but never comprehensively described.

8.2 Background

8.2.1 The Affective-Motivational Facet of Competence

There is a long-fought debate that spans the field of educational science on whether competence is constituted solely by cognitive aspects or whether affect and motivation play roles as well. Commonly, the cognitive domain includes an individual's declarative and procedural knowledge (e.g. skills such as problem-solving strategies and domain-specific knowledge; Weinert, 2001). The affective-motivational domain encompasses beliefs and feelings about the situation or task at hand. These commonly include self-efficacy, interest, achievement goals, and perceived task values (Lau & Roeser, 2002). Weinert (2001) argues for a holistic stance and states that competence 'includes all those cognitive, motivational and social prerequisites necessary and/or available for successful learning and action' (p. 51). Blömeke et al. (2015) claim that 'competence involves complex cognitive abilities along with affective and volitional dispositions to work in particular situations' (p. 6). In their view, performance emerges from cognitive and affective-motivational dispositions and situation-specific skills, such as the perception and interpretation of a situation.

Despite these and other theoretical views arguing that competence cannot be reduced to its cognitive dimension (Rychen & Salganik, 2003), many competence models that have been specified for different contexts have addressed only cognitive aspects. These models have often made reference to an article by Koeppen, Hartig, Klieme, and Leutner, who defined competence as 'context-specific cognitive dispositions that are acquired and needed to successfully cope with certain situations or tasks in specific domains' (2008, p. 62). However, the same authors also stated that when researchers model competence in different domains, they often consider only cognitive dispositions for 'pragmatic reasons' (Fleischer et al., 2013) because cognitive competence models are easier to operationalize and assess than those that incorporate non-cognitive aspects as well (Zlatkin-Troitschanskaia & Seidel, 2011). Thus, there seems to be a gap between theoretical views on what competence is and the work that is done to develop competence models: Whereas, from a theoretical perspective, competent performance requires both cognitive and affective-motivational dispositions, the latter are often disregarded in competence models in order to simplify the models.

The same can be observed when referring specifically to the domain of RC. Existing models of RC tend to focus on the cognitive dispositions that are necessary to conduct research (Gess et al., 2017; Groß Ophoff, Schladitz, Leuders, Leuders, & Wirtz, 2015; Thiel & Böttcher, 2014). However, a number of studies have described the spectrum of emotions that students experience when they conduct research. Among these are intellectual confusion, emotional unsettlement, worry (all by Rand, 2016), anxiety (Onwuegbuzie & Wilson, 2003), feelings of isolation (Love, Bahner, Jones, & Nilsson, 2007), the feeling of being 'stuck,' disappointment (both by J. John & Creighton, 2011), and joy about new findings (Fischer et al., 2014). Against this background, it seems shortsighted to assess RC in a purely cognitive way.

8.2.2 Potential Affective-Motivational Constructs Influencing Research

So far, no comprehensive RC model that includes affective-motivational dispositions exists, but initial clues about which components might constitute the affective-motivational facet of RC can be derived from a discussion of the difficulties students encounter when conducting research.

For students to conduct research, they must shift from passively consuming knowledge to actively creating insight (J. John & Creighton, 2011). This means they must step into an unknown field with unfamiliar topics and methods that need to be mastered. Open questions and a lack of expertise need to be tackled while advisers offer only limited guidance. As such, conducting research requires strategies for self-regulating one's learning. Interest and self-efficacy motivate the use of self-regulated learning strategies (Sorić & Palekčić, 2009; Zimmerman, 2000) and are among the central affective-motivational dispositions investigated in research contexts. Research interest, defined as finding interest and enjoyment in conducting different research activities (Bishop & Bieschke, 1998), has been considered in many studies as both a variable of influence and an outcome of research processes. Research self-efficacy, defined as the degree to which a person believes he or she has the competencies needed to conduct research (Forester et al., 2004), has been suggested to positively influence beginning and enduring research processes and to predict aspirations for research careers (Adedokun, Bessenbacher, Parker, Kirkham, & Burgess, 2013).

While research interest and self-efficacy seem to be helpful dispositions, the 'messy, frustrating and unpredictable' (Wellington, 2015, p. 3) nature of research might require additional dispositions. John and Creighton (2011) reported that students struggle in particular with large numbers of setbacks, which induce strong feelings of self-blame. Because frustrations are 'integral to the nature of research' (p. 789, ibid.), the ability to handle them well might be another central element of affective-motivational RC. Moreover, the uncertainty and tentativeness inherent to scientific evidence (Bromme & Goldman, 2014) might cause feelings of worry: When a student is tackling a new research topic, not even existing findings can provide the ultimate truth. Students might thus need the ability to find meaning and structure in a sea of uncertainty.

To summarize, many studies have described affective-motivational difficulties from the students' perspective. However, one deficit of the studies mentioned above is that they have described only individual emotional experiences of students as the students conduct research. Another deficit is that previous studies have often examined only single research dispositions. What is lacking is a systematically derived model of challenging research situations and the affective-motivational dispositions that can help students overcome these challenges.

8.2.3 The Present Study

Given this state of research, we set out to further explore affective-motivational research dispositions in the social sciences and to synthesize them into a coherent model. Different systematic procedures have been described for postulating new competence models, e.g. through the analysis of requirements and learning goals as stated in national and international curricula (Mayer & Wellnitz, 2013). Alternatively, researchers can employ theoretical psychological-pedagogical considerations to postulate a competence model and empirically validate its structure with factor analysis, as done in the domain of ICT literacy (Zylka, Christoph, Kroehne, Hartig, & Goldhammer, 2015). A third approach involves synthesizing the literature to develop competence models that are then empirically tested, e.g. a model of inductive reasoning (Christou & Papageorgiou, 2007).

The application of any of these three approaches would mean that the only aspects that would be considered are those that have already been described elsewhere or are preconceived by the authors. Because affective and motivational aspects are underrepresented in higher educational contexts (Beard, Clegg, & Smith, 2007), we chose an empirical-exploratory approach that we could use to capture new, unexpected aspects and reflect the novelty

of the topic. We chose expert interviews as a first method for the present study because they constitute a time-effective way to access the experience-based practical knowledge of the target group (Bogner, Littig, & Menz, 2009).

Experts in this context are people who have both extensive knowledge about how to conduct research and many years of experience teaching and supervising students in conducting research. Because affective-motivational dispositions are latent and cannot be directly observed, they have to be inferred from observable behavior (Blömeke et al., 2015). Experts can provide aggregated information on the observed behavior of hundreds or thousands of students while their expertise provides well-founded judgments of what dispositions are necessary for students to successfully conduct research.

In our understanding, the affective-motivational facet of RC consists of research-specific affective-motivational dispositions that functionally refer to the situations and demands of the social scientific research domain (following Koeppen et al., 2008). The first central research question that guided our development of a model of affective-motivational RC was thus (1) *Which challenging research situations require dispositions beyond cognitive ones?* The second question was (2) *Which affective-motivational dispositions are needed to master these situations?*

8.3 Methods

We employed an exploratory sequential design of the form QUAL -> [quan+qual] (Creswell & Plano Clark, 2011) to identify and evaluate relevant research dispositions in a two-step procedure. We applied expert interviews to postulate a model that was then evaluated and refined via an online expert rating.

8.3.1 Participants

The subsample for the interview study consisted of 16 lecturers (5 women) from three German universities (see Table 8). We chose these experts on the basis of three selection criteria. Participants (1) had a social-scientific background including political science, sociology, educational science, ethnology, and psychology, (2) represented qualitative, quantitative, and theoretical research, and (3) had substantial experience in the instruction and supervision of students who were conducting research (M=16.01 years, SD=12.81, min=3, max=46). Their years of experience served as the criteria for expertise in this context. For participants with shared expertise, small sample sizes are sufficient (Romney, Weller, & Batchelder, 1986). However, we did not pre-set the number of participants but conducted the interviews until no substantially new insights were offered after two consecutive interviews (point of saturation).

An additional subsample of 27 professors and lecturers in various social science disciplines from 9 German universities completed the subsequent online expert rating. Expertise in judging different student RCs was ensured by their position as a full professor or their membership in an advisory network concerned with research-based learning. The experts had a moderate range of experience in supervising students who were conducting research of M=13.25 years (SD=10, min=1.5, max=37). Experts were contacted via e-mail.

Table 8: Background of the Interview Participants

	Research tradition		
Discipline	Qual (QL)	Quant (QN)	Theoretical (TH)
Educational Sciences (ED)	2	3	-
Ethnology and Cultural Studies (ET)	2	-	-
Political Sciences (PO)	-	1	1
Psychology (PS)	-	3	-
Sociology (SO)	2	1	1

Position/Function	
Research associate or research management	3
Postdoc	5
Full professor	6
Professor emeritus	2

Note. Discipline, research tradition and position are not reported conjointly to avoid identification of individual participants. Abbreviations for discipline and research tradition are used to denote participants in the article. Example: ED.QN.1 = Educational sciences, quantitative research tradition, sequential number 1.

8.3.2 Procedure and Analysis

Interviews

We conducted semi-structured interviews to optimally extract the experts' contextual knowledge (Meuser & Nagel, 2002). The first part of the interview was based on the Critical Incident Technique (Flanagan, 1954): We asked the experts to describe individual students who handled the research process particularly well or poorly. Possible contexts to think about were students writing their final theses, conducting study projects, or working as research assistants at an institute. The second part of the interview was theme-centered (Schorn, 2000) to specifically deepen their thoughts on affective and motivational dispositions. An interview guide (see ESM 1) was used as the basis for the interview, but the participants were free to elaborate on any aspects they were asked about. All interviews were conducted by the first author of the study. The interviews were conducted in the offices of the interview participants to provide a quiet and comfortable atmosphere.

The mean duration of the interviews was 00:54 h (*min* = 00:34 h; *max* = 01:28 h). After informed consent was obtained, the interviews were audiotaped and transcribed verbatim. The interviews were conducted and analyzed in German. Selected statements were translated into English for the purpose of this article.

The analysis of the transcripts was based on recommendations made by Meuser and Nagel (2002) and included the paraphrasing and grouping of central text segments. The corresponding author performed the inductive coding process on half of the transcripts. This resulted in a preliminary categorical system.

In order to test the categorical system and its interpersonal application, two raters applied the categories to the remaining transcripts in two steps. In a first step, the corresponding author marked the relevant text segments (based on Schreier, 2012). In a second step, these 283 segments were assigned to the categories by both raters independently. An interrater reliability of Cohen's kappa = 0.87 demonstrated that the categorical system worked well.

Because the central aim was to identify feasible dispositions, we had several inclusion criteria: Dispositions had to be affective or motivational in nature. We thus excluded descriptions that denoted general personality or that primarily denoted cognitive dispositions. Moreover, dispositions had to be research-specific and could not describe only general academic abilities.

Expert rating

In order to evaluate the model, the relevance of the identified situations and respective dispositions for successfully conducting research were rated on a 4-point Likert scale (ranging from 1= 'not at all relevant' to 4 = 'very relevant') in an online expert rating (Jenßen, Dunekacke, & Blömeke, 2015). Mean scores and standard deviations were calculated to assess the perceived relevance of the dispositions. In addition to this quantitative rating, participants could add comments about any situations or dispositions. These comments were used to sharpen the construct definitions.

On the basis of recommendations by Meuser and Nagel (2002), who discussed the importance of 'sociological conceptualization,' the dispositions were then linked to existing concepts from the educational-psychological literature. This provided the theoretical foundation for the model and guaranteed its compatibility with the prevalent scientific discourse.

8.4 Results

In the process of identifying critical situations, it became obvious that the experts' presentations of the critical situations did not follow the steps of a prototypical research cycle (e.g. literature review, data collection). Rather, the experts named challenges that spanned several steps or recurred throughout the research cycle and the particular dispositions that are necessary to cope with the challenges. In the following section, we describe the situations with their corresponding dispositions one after another (see also Figure 4). We jointly present the results from the interview study and the subsequent expert rating.

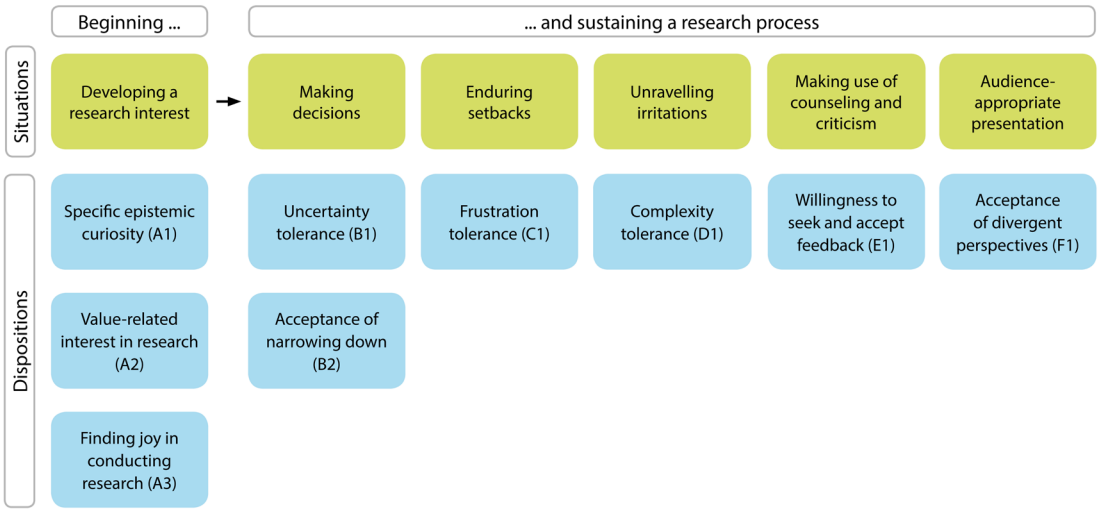


Figure 4: Resulting model of affective-motivational research competence

8.4.1 Developing a Specific Research Interest (A)

Developing a specific research interest is a crucial situation for commencing and sustaining the research process. It entails the process of transforming an existing personal thematic interest into a research interest. There are different potential origins of a personal interest, including the student's personal life or thematic stimuli from a lecture. Irrespective of the origin of the interest, it is essential to 'tame [the research interest] with regard to content' (SO.QL.1); i.e. a thematic interest has to be adapted so that it is appropriate for use in scientific discourse.

The relevance of this critical situation was rated $M = 3.73$ ($SD = 0.44$). Experts' qualitative comments furthermore emphasized that it is important for the research topic to be self-selected by the students.

8.4.1.1 Specific Epistemic Curiosity (A1)

According to the experts, curiosity is fundamental for developing a research interest. Almost all experts characterized it as an initial inner urge to investigate a topic or a question that a person finds exciting. They stressed the importance of the *inner* nature: The students 'have to be nuts about something. (…) And it must be *their* topic, not mine' (SO.QL.1). The urge to find out more about a topic is often connected to a strong desire to unravel the truth. Students do not settle for existing opinions found in the general public or textbooks but want 'to say how it *really* is' (ED.QN.1). Despite the experts' agreement on the description of this disposition, its exact origin remained unclear.

In line with Litman and Spielberger (2003), the term s*pecific epistemic curiosity* was chosen to describe this disposition. The term denotes a directed search for specific knowledge, in contrast to diverse and perceptual curiosity. Its relevance for successfully conducting research was rated $M = 3.64$ ($SD = 0.56$).

8.4.1.2 Value-Related Interest in Research (A2)

In order to turn curiosity about something into a research interest and use scientific rigor to answer a question, students need to value research as an appropriate way to do so. Students embody the motivation to do research when 'they realize that they can focus on a certain topic through research' (ED.QL.2). Research thus provides a way to learn more about a topic of interest. Students find research particularly valuable when they realize that it produces results that are relevant for praxis or daily life. According to the experts, these value attributions motivate students to conduct research themselves.

Because this disposition encompasses beliefs about the usefulness of research, we chose the term *value-related interest* in line with Schiefele (1991). Its relevance for successfully conducting research was rated $M = 3.16$ ($SD = 0.61$).

8.4.1.3 Finding Joy in Conducting Research (A3)

In order to successfully pursue a research interest, it is helpful when research and its individual activities are perceived as enjoyable. Positive emotions regarding research are important for creating a 'positive atmosphere' (PS.QN.1), supporting students' emotional well-being, and improving performance. In addition, joy has a protective effect during the more challenging phases when research tasks that are perceived as less enjoyable need to be completed in order to get back to the tasks that are more enjoyable. As such, joy acts as a driving force to sustain the research process.

We chose the term *finding joy in conducting research* to describe the positive affect experienced from engaging in different research activities. It resembles the feeling-related component of interest (Schiefele, 1991). Its relevance was rated $M = 3.44$ ($SD = 0.57$). The raters stressed the intrinsic origin of the joy experienced during research: 'Students are often far away from secondary motives such as publications, reputation, etc. They do it simply for the sake of doing it.'

8.4.2 Making Decisions (B)

Students have to make various decisions over the course of the research process, e.g. concerning the feasibility of research questions and matching research designs. Making decisions is difficult for many students, reflected in 'decision avoiding techniques' (ED.QN.1) and 'jumping from topic to topic' (ED.QN.1). It seems the abundance of alternatives in the research process coupled with a lack of experience poses problems for students, and they try to avoid these problems by employing different escape strategies.

Making decisions was rated as a crucial situation in the research process ($M = 3.52$, $SD = 0.64$). The qualitative comments underscored the prominence of decision making in the research process. It was noted, however, that 'wrong decisions provide opportunities for learning.' In this sense, higher education serves as a safe space from which to try one's hand at research.

8.4.2.1 Research-Related Uncertainty Tolerance (B1)

The process of conducting research was metaphorically described as being similar to entering 'a whole new planet' (ED.QL.2) or 'a dark chamber' (ED.QL.3). Especially at the beginning of their studies, students often fail to accept the openness of research because they are used to learning clear facts or having somebody guide them. Students begin to struggle during their studies when they 'discover that research is actually a lot of the unknown, is full of conflicting opinions, and is ambiguous' (ED.QN.1). The uncertainty arising from the 'unknown' quality of research is frequently amplified by the lack of an ultimate truth. To realize that evidence is always only tentative was described as a painful and intimidating experience. Thus, it is necessary to learn to accept and to endure the uncertainty and openness inherent to the research process.

As such, this disposition resembles Dalbert's (2003) conceptualization of general uncertainty tolerance. We chose the term *research-related uncertainty tolerance* to capture the research-specific nature of this disposition. Its relevance was rated $M = 3.48$ ($SD = 0.64$).

8.4.2.2 Acceptance of Narrowing Down (B2)

Both the research question and the research process as such need to be narrowed down to become manageable. Choosing and developing a realistic research question constitutes a particular challenge. It is a delicate task for students 'to choose research questions that are exciting and original but at the same time workable within the limits of the project' (ET.QL.1). A difficulty in making decisions might be the thought that every decision implies that other possibilities are neglected. Students need to accept that not everything possible or desirable can be worked on because the scope of the project sets limits. It is interesting that the comments indicated that good students in particular seem to have a problem narrowing their focus in order to realistically work on their research.

Another aspect of narrowing one's focus concerns the ability to terminate the research process. The decision to forgo further exploration and bring a project to a close causes great

difficulty. Some students tend to lose themselves in the open field of their research work and greatly enjoy the process of conducting research. These students need to learn to 'define their own boundaries' (ED.QL.2). This means that students must adopt a pragmatic stance and stop asking questions at some point.

The *acceptance of narrowing down* describes the ability to set boundaries for one's own work within the given context, both when defining the research question and terminating the project. Its relevance was rated $M = 3.64$ ($SD = 0.56$).

8.4.3 Enduring Setbacks (C)

Enduring setbacks seems to be an inevitable part of conducting research; it might even be at the heart of it: 'Research really is (…) an insane amount of frustration. I think I cannot imagine another work place that involves more frustration' (PS.QN.3). For students and senior researchers alike, setbacks might arise from the imponderability of the field, the need to cooperate with a research team or an adviser, or the object of research itself. Other sources of frustration were seen in the relationship between the amount of time spent and the amount of insight created and in recurring feelings of pointlessness when students expressed that they were not uncovering anything new. If these numerous frustrations of exogenous and endogenous origins are not handled well, they might lead to the aborting of the research project.

The relevance of this situation was rated $M = 3.52$ ($SD = 0.5$). One expert emphasized that students had greater trouble enduring setbacks that resulted from interpersonal tension (e.g. with an adviser) than those concerning the project's contents as such.

8.4.3.1 Frustration Tolerance in the Research Process (C1)

Students need to handle the numerous setbacks that occur during research. When experiencing a setback, 'one should not be overwhelmed by feelings of failure such that one does not want to continue' (PS.QN.1). Emotions evoked by setbacks need to be regulated in such a way that a productive continuation of work is possible. Successful students reframe setbacks to advance their current or future research projects by saying, for example, 'So that did not work out, but now we at least know what doesn't work' (PS.QN.3).

In line with the general conceptualization of frustration tolerance, the ability to prevent setbacks from having an action-inhibiting effect is denoted by the term *frustration tolerance in the research process*. Its relevance was rated $M = 3.76$ ($SD = 0.51$). We confirmed that frustration tolerance is not only about 'enduring' but rather about the ability to reinterpret a frustrating situation as something that creates 'insight, understanding, and learning.'

8.4.4 Unraveling Irritations (D)

Several events in the research process can cause astonishment or confusion (e.g. conflicting descriptions in the literature). These affective experiences were summarized as irritations. 'If you understand the research process as searching and questioning' (ED.QL.2), then irritations are a natural part of research. Irritations should therefore not be mistaken for setbacks but should rather be seen as 'the productive moments when they [the students] realize they were mistaken, they circled around something but did not find it' (ED.QL.2). Irritations can produce insight and help students become acquainted with the field. The beneficial effect of irritations can be unleashed when irritations are explored for their causes and examined for their epistemic value.

The relevance of unraveling irritations was rated $M = 3.32$ ($SD = 0.68$). One rater added that irritations might also create curiosity and provide the motivation to begin a new research process.

8.4.4.1 Complexity Tolerance (D1)

Irritations might have an epistemic value that potentially advances the research process if uncovered. Students thus need a willingness to search for explanations for the irritations they experience. Without this willingness, students do as they are told and stop when things get complicated. By contrast, other students 'go further, they do additional analyses, they add another thought (…). Or sometimes the data are very complex, and they nevertheless wade through it' (PS.QN.2). This means these students are not afraid of the complexity that might be added by considering additional thoughts or conducting additional analyses when trying to make sense of irritating situations.

Complexity tolerance thus denotes a constructive stance toward irritations and complexity. We chose the term to show its resemblance to the homonymous disposition described by Radant and Dalbert (2006). Its relevance was rated $M = 3.52$ ($SD = 0.5$). In one of the comments, the importance of the environment was mentioned for developing a tolerance for complexity: It is important that 'emerging questions are permitted and evaluated as positive.'

8.4.5 Making Use of Counseling and Criticism (E)

The presentation or discussion of one's own research project provides the opportunity for feedback from one's adviser, research team, or fellow students. The goal is to mutually work with each other's feedback to advance a project. Feedback can be of a positive, solution-oriented nature, or it can be presented as criticism. Both have the potential to enhance the project's quality but need to be accepted and understood correspondingly. If feedback and criticism are not requested or not accepted, students may miss an opportunity to improve their work or may become unnecessarily frustrated. The relevance of this situation was rated $M = 3.56$ ($SD = 0.57$).

8.4.5.1 Willingness to Seek and Accept Feedback (E1)

As consultation and criticism are essential for monitoring and improving research work, they should be actively sought. Students who exclusively produce their work 'in the isolation of their home offices' (SO.QL.1) are, according to the experts, not the best ones. Instead of working and reflecting on one's research alone, it is instead more productive for students to re-question the answers they find by seeking the opinions of others. This also requires the courage to put even unfinished research projects up for discussion. Once feedback is sought, it needs to be accepted in a second step. In fact, 'there is no point in (…) entering a research context at all if one does not want to learn anything' (ED.QL.2). Accepting feedback implies finding the right balance. On the one hand, students should not be so rattled by criticism that they are intimidated into adopting everything others suggest. On the other hand, they should not be immune to suggestions either.

The relevance of the *willingness to seek and accept feedback* was rated $M = 3.44$ ($SD = 0.7$). One rater explicitly confirmed the link between seeking advice and performance: 'I repeatedly have groups that seal themselves off from feedback. These usually have the worst results.'

8.4.6 Audience-Appropriate Presentation (F)

While conducting research and after completing it, students need to present their projects to different audiences such as fellow students, researchers, participants in the field, or practitioners. These presentations can be either verbal (e.g. classroom presentations) or written (e.g. theses). Content, demeanor, and speech have to be adapted so that they are appropriate for the target audience and can accommodate perspectives that deviate from one's own. The relevance of audience-appropriate presentations was rated $M = 3.08$ ($SD = 0.63$). The experts emphasized that the ability to communicate research results provides an important mechanism for self-evaluation.

8.4.6.1 Acceptance of Divergent Perspectives (F1)

Mastering the ability to present in front of different audiences requires students to respect and consider perspectives that do not conform to their own point of view. 'One needs to endure different positions—that they exist and that they might be interesting for both sides' (ED.QL.3). In order to make use of different perspectives, it is necessary to 'personally adapt to the listener in terms of speech, concepts, and behavior' (PS.QN.3).

We chose the term *acceptance of divergent perspectives* to denote the ability and willingness to adapt to others. Its relevance was rated $M = 3.56$ ($SD = 0.57$). Comments involved the ability to find a balance between one's passion and the need for factual presentation to others. Enthusiasm and reflection are not contradictory: 'One can be very amazed by one's own research (…), electrify others, and still act in a very reflected manner.' Accepting perspectives that diverge from one's own perspective thus means the ability to adapt the contents of one's research to different audiences and present one's findings in a factual way without suppressing one's genuine enthusiasm for the project.

8.4.7 Excluded Constructs

A number of additional dispositions were proposed in both the interviews and the expert ratings. We had to exclude these on the basis of the inclusion criteria outlined above (see section 2.2). One example of an excluded construct was knowledge about research ethics, especially for students conducting qualitative studies. While ethical considerations might involve affective aspects and thus be a feasible part of this model, knowledge about how to conduct research in an ethically sound way (e.g. respecting study participants' wishes to remain anonymous) is knowledge that can be acquired. It should be embedded in a model of the cognitive aspects of RC (as partially realized in Gess et al., 2017).

8.5 Discussion

8.5.1 The Model

The central concern of this study was to identify challenging research situations and the affective-motivational dispositions needed to master these challenging situations.

The resulting model covers a large breadth of dispositions, ranging from dispositions that concern introspective aspects to dispositions that concern interactions with others. In line with existing research findings, with our model, we acknowledge the importance of interest for successfully conducting research.

Other dispositions, however, were unexpected and had not been conceptualized elsewhere. The disposition we termed 'acceptance of narrowing one's focus' is perplexing: While the generation of new knowledge requires interest and curiosity to begin with, our experts also particularly stressed the importance of having the ability to terminate inquiries before they grew too large. RC, therefore, seems to entail a balance of elements: the open and exploratory, as facilitated by complexity tolerance, and the pragmatic and operational, as facilitated by the acceptance of narrowing down.

Overall, the model we developed here goes far beyond the affective-motivational aspects that are usually considered in academic contexts. There are three possible explanations for why the model presented here is different. First, it is possible that research itself is unique in that its challenging nature requires additional dispositions that have not been described in other academic contexts. Interest – that is, among the dispositions that were described previously – might be sufficient for initiating research but might not be enough to master the difficulties encountered during the ongoing research processes. Second, it is possible that the method chosen for the purpose of this study captured different constructs than literature-based procedures. Interviewing experts and specifically asking them to consider students' emotional and motivational experiences constituted a new step and might have provided a good way to go beyond the usual. Third, common conceptualizations of the affective-motivational facets of competence might focus on only short-term activities such as managing a lesson. Research usually spans several months, thereby increasing the importance of the abilities to regulate affective experiences and sustain motivation. Its long duration might therefore require more or different affective-motivational dispositions.

Because the model was designed to capture affective-motivational dispositions, the individual dispositions had to encompass a strong emotional component, such as feelings of being overwhelmed by uncertainty, or had to function as a motivational force in research contexts. However, it is difficult to fully separate cognitive and affective-motivational aspects – especially in the field of research as a highly cognitive endeavor. Competence models can thus only *primarily*, but never exclusively, be affective-motivational. Another open question concerns the interplay of cognitive and affective-motivational research dispositions. Only the combination of various cognitive and affective-motivational components are considered to produce competence in a domain (Zlatkin-Troitschanskaia et al., 2015). Previous studies have shown that cognitive variables were stronger predictors of performance, but affective-motivational variables such as engagement demonstrated incremental validity (Lau & Roeser, 2002). How exactly cognitive and affective-motivational dispositions interact to lead to competent performance is however unclear (Blömeke et al., 2015). Further studies should thus investigate the interplay between cognitive and non-cognitive facets of RC to provide initial answers to this question for the field of research education.

8.5.2 Developing Affective-Motivational Research Dispositions

As the dispositions we identified were perceived as very important for mastering critical research situations, whether or not they can be changed is an important question. The general belief is that the dispositions described above can be developed through research participation. Most experts stated that beginning students lack many of the RCs that are needed to be successful in research, but they gradually develop these affective-motivational dispositions through experience.

Research-based learning provides a promising method for facilitating RC development through active engagement in several steps of the research cycle. The potential of research-based learning for strengthening non-cognitive constructs such as research interest and self-efficacy was already shown (Deicke et al., 2014). However, classical teaching formats could also provide enough room to address individual dispositions. For example, lecturers might strengthen uncertainty tolerance by discussing the importance of uncertain results for objective research with their students.

Moreover, gaining knowledge about how affective-motivational dispositions influence students' research work might help in addressing problems in research education. It is often reported that students are not interested in learning about research (Vittengl et al., 2004). The complex nature of research might be overwhelming and might thus result in decreased interest. Reflecting on challenging situations in the research process might help lecturers foresee difficulties and address these difficulties in their teaching. The proposed model is thought to provide insights into particularly demanding components of the research process that need to be explicitly addressed to prevent negative effects of frustration. Moreover, the model provides a collection of objectives of research-oriented teaching besides the usual knowledge-based learning objectives and thus fills the research gap outlined by Earley (2014).

8.5.3 Limitations and Future Research

We developed this model on the basis of interviews and expert ratings of students' research experiences, mainly from professors. We chose the expert-based approach because a small number of professors can provide very valuable information about a large number of students, and the status of the people we interviewed guaranteed valid judgments of what is necessary to be successful. It would be interesting to complement the experts' views with the perspectives of students who might have different insights into their struggles and different ideas about what is necessary to conduct research in the long term.

Another limitation concerns the generalizability of the results to other disciplines. We conducted the study with a sample of experts from the social sciences because we decided to restrict the sample to disciplines working with the same set of methods, mainly those of empirical social science research. Thus, we were not able to determine whether the dispositions they identified will generalize to other disciplines or are exclusive to social science research. It seems plausible to assume that the ability to handle uncertainty or frustration is important in the natural sciences and the humanities as well, but this needs further investigation. We have already developed set of scales to evaluate students' affective-motivational research dispositions, and these scales are ready to be used in a range of university settings. Studies employing these scales will provide further insights into the relations between individual dispositions within and across different disciplines.

The range of affective and motivational dispositions mentioned in the interviews shows how demanding it is for students to conduct research, even apart from the cognitive work that

has to be carried out. However, these affective-motivational dispositions serve as only a prerequisite for competent research performance. As Blömeke, Gustafsson, and Shavelson (Blömeke et al., 2015) noted, cognitive and affective-motivational dispositions need to be complemented by a range of situation-specific skills to arrive at competent performance. Performance itself is indicated by observed behavior. For the field of student research as an emotionally challenging field, situation-specific skills could include emotion-regulation skills in frustrating situations (e.g. when a student receives critical feedback on his/her master's thesis from his/her adviser). These skills manifest themselves in observable coping behavior (e.g. the student follows some of the adviser's suggestions). However, additional research is needed to expand the understanding of how latent dispositions and situation-specific skills interact in student research contexts.

Altogether, this work constitutes a first study in which research dispositions beyond cognitive ones were systematically explored. It underlines the necessity to consider affective-motivational dispositions for the field of student research and is aimed at fueling the debate on affective-motivational aspects of student learning in contexts of higher education.

8.6 Electronic Supplementary Material

ESM 1 – Interview guide

9 Publication II – The Effectiveness of Research-Based Learning

Wessels, I., Rueß, J., Gess, C., Deicke, W., & Ziegler, M. (2020). Is research-based learning effective? Evidence from a pre-post analysis in the social sciences. *Studies in Higher Education.* https://doi.org/10.1080/03075079.2020.1739014

Is Research-Based Learning Effective? Evidence from a Pre-Post Analysis in the Social Sciences[8]

Insa Wessels[1,2], Julia Rueß[2], Christopher Gess[2], Wolfgang Deicke[2], and Matthias Ziegler[1]

[1]Institute for Psychology, Humboldt-Universität zu Berlin, Berlin, Germany

[2]bologna.lab, Humboldt-Universität zu Berlin, Berlin, Germany

Keywords: research-based learning, research knowledge, research literacy, affective-motivational research dispositions, social sciences didactics

Abstract

Research-based learning (RBL) is regarded as a panacea when it comes to effective instructional formats in higher education settings. It is said to improve a wide set of research-related skills and is a recommended learning experience for students. However, whether RBL in the social sciences is indeed as effective as has been postulated for other disciplines has not yet been systematically examined. We thus administered a pre–post-test study to $N = 952$ students enrolled in 70 RBL courses at 10 German universities and examined potential changes in cognitive and affective-motivational research dispositions. Latent change score modelling indicated that students increased their cognitive research dispositions, whereas most affective-motivational research dispositions decreased. The instructors' interest in the students' work served as a significant predictor of changes in research interest and joy. Practical implications for designing RBL environments can be inferred from the results.

9.1 Introduction

Teaching and research can be linked through a variety of well-defined instructional formats. One of these is research-based learning (RBL), in which students conduct their own research with the help of a supervisor. RBL is currently seen as a panacea for addressing a range of demands within higher education, e.g. a lack of meaningful learning experiences and the need for stimulating instructional formats. Accordingly, several authors and institutions claim that RBL should be incorporated into the curriculum of many if not every academic study programme (e.g. Healey & Jenkins, 2009). Indeed, a growing number of programmes have attempted to implement RBL in a range of disciplines and forms, e.g. the REU programme by the US National Science Foundation. The main goal of these endeavours is to provide students with an opportunity to experience participation in research. In science, technology, engineering, and mathematics (STEM) disciplines, there is evidence that RBL does indeed live up to its promises and constitutes an effective learning experience (Linn et al., 2015). However, outside the STEM disciplines, it is still unclear which research dispositions RBL fosters. Thus, this study aims to examine whether RBL's effectiveness regarding the acquisition of various cognitive and affective-motivational research dispositions can be generalised to the social sciences.

9.2 Theoretical Background

9.2.1 Positioning Research-Based Learning in Relation to Other Forms of Research-Related Teaching

Teaching and research can be linked in different ways. In a popular model, Healey and Jenkins (2009) distinguish among different instructional formats for engaging students in research along two axes. The first axis describes whether the research results or the research process is emphasised. The other axis describes whether students take on an active role as participants or a passive role as audience. These two axes can be combined into four different formats: research-tutored, research-led, research-oriented and research-based learning. In RBL, teaching focuses on the research process, and students actively conduct research and inquiry. However, this description fails to describe the exact nature of students' involvement in research. Huber (2014) further defines RBL as an instructional format in which students work through the entire research process in a self-regulated manner, guided by their own research questions. The instructor takes on a facilitating role. This theoretically derived definition was replicated in an empirical classification of research-related formats (Rueß et al., 2016) and serves as the underlying definition of RBL in the current study.[9]

9.2.2 The Effectiveness of Research-Based Learning

Conducting one's own research project involves various cognitive, behavioural, and affective experiences (Lopatto, 2009, p. 29), which in turn lead to a wide range of benefits associated with RBL.

[9] What I call *RBL* has different names elsewhere, e.g. "undergraduate research experiences" (URE), "summer undergraduate research experiences" (SURE) or "course-based undergraduate research experiences" (CURE). Most of these terms describe the context ("during the summer") or the type of students ("undergraduates") rather than the instructional set-up per se. We chose the term RBL to denote a specific instructional approach independent of the exact duration or the participating students. I do, however, use evidence from studies examining "CURE" or "URE". I carefully checked that the students' research experiences aligned with our notion of RBL.

RBL is associated with long-term societal benefits because it can foster scientific careers: Students participating in RBL reported a greater interest in pursuing postgraduate education or PhDs (Lopatto, 2007; Russell et al., 2007) and were more likely to be engaged in scientific careers six years after graduation (Hernandez et al., 2018).

In addition, RBL fosters research skills that are also necessary for occupations outside academia (British Academy, 2012). RBL is said to facilitate the development of a 'researcher's mindset' – the ability to objectively examine data or a situation and finding enjoyment in solving problems (Wood, 2003). A researcher's mindset can be effective in a wide range of professional activities. For example, in the field of psychotherapy, therapists could draw upon their research knowledge to consult evidence on new therapeutic approaches (American Psychological Association, 2006). Hence, the acquisition of research-related knowledge and skills is a prerequisite for successfully engaging in both scientific and non-scientific careers – making it an appropriate focus for our article.

Successfully engaging in a task requires both cognitive dispositions, such as knowledge, and affective-motivational dispositions to put this knowledge into practice (Blömeke et al., 2015). *Disposition* serves as an umbrella term to denote a range of latent, personal resources (e.g. attitudes, traits and abilities) that determine how an individual will normally act in a certain situation (Schmidt-Atzert & Amelang, 2012, p. 63). Accordingly, competent performance in the research domain requires various cognitive (e.g. knowledge) and affective-motivational (e.g. interest) research dispositions. Whether RBL is effective at facilitating the development of different cognitive and affective-motivational research dispositions has been the focus of previous studies. The existing evidence will be introduced in the following sections.

9.2.2.1 Cognitive Gains

Most empirical studies on the effectiveness of RBL focus on cognitive research dispositions. However, the majority of these studies assessed STEM students (e.g. Linn et al., 2015; Seymour, Hunter, Laursen, & DeAntoni, 2004), with only a few studies investigating the effect of RBL in the social sciences. In a study from the field of social work, students gained domain-general research knowledge (Whipple et al., 2015). Taraban and Logue (2012) found evidence for a range of cognitive benefits of psychology students' participation in research, such as improved research methods skills. Participation in RBL can also lead to increased understanding of the scientific process as a whole (Lloyd et al., 2019).

Other researchers have examined specific skills pertaining to individual research steps, e.g. the ability to use statistics software (Whipple et al., 2015) and communicating and presenting one's research (Stanford et al., 2017). RBL also seems to facilitate more general cognitive dispositions like critical thinking (Hunter et al., 2007; Kilgo et al., 2015) and the ability to work independently (Stanford et al., 2017).

Thus, while RBL in the social sciences seems to be effective at facilitating a range of different cognitive dispositions, these results can only serve as preliminary evidence. A problem concerning the interpretability of these and other studies in the field lies in their methodological designs: Most existing studies focus on subjective ex-post assessments and self-evaluated skill gains (e.g. Stanford et al., 2017). However, self-assessments are often distorted by personality (O. P. John & Robins, 1994) or skill levels themselves (unskilled students overestimate their abilities, see Kruger & Dunning, 1999). Large-scale investigations using objective measures provide more substantial conclusions, but have so far only been completed for STEM students (e.g. Russell et al., 2007). Linn et al. (2015) note that the underlying problem is a lack of valid measures to objectively investigate the effectiveness of RBL. To

address this problem, the *Social-scientific Research Competency Test*, an objective measure of cognitive research dispositions in the social sciences, was developed by Gess et al. (2018, 2017). The instrument is based on a coherent model of different areas of research knowledge necessary to conduct critical steps in the research process (see Appendix 1, online supplemental data). In validation studies, the instrument has been shown to be suitable for evaluating social-scientific research education and could serve as an objective measure of the cognitive benefits of RBL.

9.2.2.2 Affective-Motivational Gains

Higher education research is increasingly acknowledging the importance of affective-motivational aspects for learning (e.g. Postareff & Lindblom-Ylänne, 2011). Reflecting this general trend, affective-motivational gains have also drawn increased attention in research on RBL.

Evidence on RBL's potential to alter affective-motivational research dispositions often stems from studies with multidisciplinary samples. Demonstrated benefits include higher research self-efficacy (Deicke et al., 2014; Whipple et al., 2015), increased intellectual curiosity (Bauer & Bennett, 2003) and a higher tolerance for obstacles in the research process (Lloyd et al., 2019). Furthermore, a study with STEM students demonstrated a greater desire to learn and an increased disposition towards working with ambiguity (Ward et al., 2003).

The few existing studies all examine individual affective-motivational research dispositions, often in an exploratory manner. However, conducting research is an especially demanding task that requires students to handle uncertainties and manifold frustrations (J. John & Creighton, 2011). Thus, it can be assumed that successfully conducting research requires a range of different affective-motivational dispositions to cope with the challenges of the research process. A coherent, empirically grounded model of the affective-motivational research dispositions necessary for student research in the social sciences has been recently developed (Wessels, Rueß, Jenßen, Gess, & Deicke, 2018). It encompasses dispositions that are necessary to begin and to sustain the research process: for example, research interest is needed to initiate a research process, while sustaining it requires frustration tolerance to cope with inevitable setbacks. It is unclear whether RBL is effective in developing these research dispositions.

Overall, studies on the nature and effectiveness of RBL in the social sciences are generally scarce and often based on weak methodological designs – in contrast to studies from other disciplines. However, one cannot assume that the evidence gained in studies with STEM students easily translates to the social sciences. First, research seems more important to university programmes in the natural sciences than in the social sciences (cf. Taraban & Logue, 2012). Second, most research experiences within STEM disciplines occur in structured lab environments that might have a different pedagogical culture (Rand, 2016). Third, if discipline-specific outcome variables are to be investigated, a study needs to be conducted in that specific discipline.

Another open question pertains to the processes by which RBL in the social sciences affects changes in different research dispositions. In studies with STEM students, the main predictors of learning gains are the duration and intensity of the research experience: longer-lasting and more intense research experiences lead to stronger increases in skill levels (Bauer & Bennett, 2003). Another study found that students with higher levels of autonomy in the research process, e.g. the autonomy to make their own methodological decisions, showed stronger learning gains (Gilmore et al., 2015). However, which characteristics of RBL courses

in the social sciences affect changes in different research dispositions has not been studied yet.

9.3 Research Questions and Hypotheses

The objective of this paper is to analyse the effectiveness of RBL courses in the social sciences. Two main research questions guided our work: (1) Does research-based learning have a positive effect on cognitive and affective-motivational research dispositions? (2) How do different course characteristics relate to changes in these research dispositions?

Pertaining to the first research question, the following hypotheses were tested:

Hypothesis 1a: As previous studies have found associations between student research experiences and self-evaluated knowledge gains (Taraban & Logue, 2012), we predict that students will have significantly higher post-test scores than pre-test scores for research knowledge (knowledge of methods, knowledge of methodologies and research process knowledge).

Hypothesis 1b: As previous studies have found associations between student research experiences and a higher tolerance for obstacles in the research process (Lloyd et al., 2019) as well as an increased ability to work with ambiguity (Ward et al., 2003), we predict that students will have significantly higher post-test scores than pre-test scores for affective-motivational research dispositions.

Pertaining to the second research question, the following hypotheses were tested:

Hypothesis 2a: Since studies in STEM disciplines have demonstrated that longer and more intense research experiences (Bauer & Bennett, 2003) have a positive influence on the effect of participation in RBL, we predict that the intensity of the research experience, i.e. the number of research steps performed, will influence changes in research knowledge.

Hypothesis 2b: Since studies in STEM disciplines have demonstrated that higher levels of autonomy in the research process (Gilmore et al., 2015) positively impact the effect of participation in RBL, we predict that students' autonomy, i.e. ability to freely choose a research question and a research method, will positively affect changes in affective-motivational research dispositions.

Hypothesis 2c: We predict that different motivating factors, e.g. students' self-efficacy, the perception that they are doing 'real research', perceived instructor interest in the students' work, and the perceived usefulness of RBL for their later career will positively affect changes in affective-motivational dispositions.

9.4 Methods

To answer our research questions, paper-based measurements were conducted at the beginning and the end of RBL courses offered in different social scientific disciplines at 10 different universities.

9.4.1 Procedure

As the objective was to study comparable RBL courses in the social sciences, only the curricula of study programmes employing empirical social science research methods were considered. These included sociology, political science, psychology, and education science (see also Gess et al., 2017).

Suitable RBL courses were identified via their course descriptions. Only courses that allowed students to experience a full research cycle in a self-regulated manner were considered, in

line with our definition of RBL. The instructors of 146 courses were contacted via email and asked to participate in the study; 65 agreed to participate, 50 did not wish to participate, mostly due to time constraints in the course, and the remaining 31 instructors did not respond. Pre-tests were scheduled for the first two weeks of the course, and post-tests for the last two weeks of the course.

Altogether, pre- and post-measurements were conducted in N=70 RBL courses at 10 universities across Germany. All universities included were state-funded public universities with 10,000-50,000 students offering degrees in a wide range of disciplines.

The testing itself was conducted during class time by one of the authors of this article, who explained the procedure and general purpose of the study. The questionnaires were administered in the form of printed booklets. A personal 6-digit code based on non-sensitive information, e.g. birthday month, was used to match pre- and post-test questionnaires while granting anonymity. Filling in the questionnaire took approximately 25 minutes. The post-test followed the same procedure. Additionally, a brief instructor survey on characteristics of the course instruction was administered.

9.4.2 Sample

The sample encompassed N=952 students (74.1% female, 23.5% male), of which 881 participated in the first measurement and 539 participated in the second measurement. Higher participation rates at the first measurement point were due to higher course attendance at the beginning of the semester.

The mean age of the participating students was M=24.38 years (SD=4.79). 61.6% of the students were enrolled in a bachelor's programme, while 29.5% were enrolled in a master's programme. Fifty students were enrolled in other study programmes, such as the traditional German university diploma, and were treated as either bachelor's or master's students depending on their study progress. Bachelor's students were near the end of their second year of study on average; the mean number of semesters completed was M=3.33 (SD=1.67). Master's students were at the beginning of their second year of master's studies on average, with M=2.57 (SD=1.63) semesters of the degree completed on average.

The students were enrolled in different fields of study, namely educational science (31.4% of the students), psychology (22.4%), sociology (10.3%), communication science (8.6%), and political science (5.5%) The remaining students were studying other, more specific social scientific subjects (i.e. media studies).

The students were enrolled in one of 70 RBL courses. Participation was often a mandatory part of the students' study programmes: 41.8% of the students were required to enrol in this specific course; an additional 35.7% could have chosen a different RBL course, while only 17.6% could have chosen a course not involving the instructional format of RBL. The average number of participants per course was M=13.54 (SD=12.62). The majority of students were enrolled in one-semester courses (77.7%); 22.3% of the students were enrolled in two-semester courses. The courses were led by 65 different instructors or co-teaching teams. 52 of these instructors participated in the instructors' survey at the end of the course.

9.4.3 Measures

9.4.3.1 Research Knowledge

A 9-item short version of the social-scientific research competence measure by Gess et al. (2017) was used to assess research knowledge in the social sciences. This test assesses knowledge of research methods, knowledge of methodologies and research process knowledge with items referring to both quantitative and qualitative research. The test uses short vignettes coupled with multiple choice questions on different research problems (see sample item in ESM 1). The instrument has gone through several validation studies and is suitable for the evaluation of research courses in the social sciences in both bachelor's and master's degree programmes (Gess et al., 2018, 2017). Since the full 27-item measure takes 35 minutes to complete and in-class time was sparse, a 9-item short version reflecting the full breadth of the original test in terms of content areas was developed based on the discrimination parameters, item difficulty, reliability and correlation with the long version. The correlation of the person scores for the short version and the person scores for the long version is $r = .86$, which indicates that the two versions measure a similar construct. However, it must be noted that the short version of the test has not undergone the same validation procedure as the long version. The students' answers were coded as either correct (1) or incorrect (0), such that the final data consisted of 9 dichotomous items. The reliability was acceptable, with weighted omega $h = .69$ (see Table 9).

9.4.3.2 Affective-Motivational Research Dispositions

The model of affective-motivational research dispositions (Wessels et al., 2018) encompasses nine necessary dispositions for pursuing research in the social sciences, of which four were selected to be investigated in the present study. (1) *Value-related interest in research* subsumes beliefs about the usefulness of research. (2) *Finding joy in conducting research* denotes the joy experienced with respect to different research activities. (3) Research-related *uncertainty tolerance* is the disposition to handle uncertainties in the research process. (4) Research-related *frustration tolerance* is the disposition to endure setbacks in the research process.

Self-assessment scales (sample items and basic descriptive data can be found in Table 9) were developed in a multistep process following deductive and inductive test construction procedures (Burisch, 1984). First, at least 20 items per disposition were constructed according to fixed theory-driven construction principles (Wilson, 2005). The items were selected and refined based on a pilot study with N=250 students from the social sciences. The final instruments encompass 4 or 5 items per disposition and exhibit acceptable or good reliabilities (weighted omega $h = 0.68$-0.82). The response format for all affective-motivational measures was a five-point Likert scale ranging from 1 (completely disagree) to 5 (completely agree).

Table 9: Overview of the dispositions with sample items, means, standard deviations and weighted omega h at both measurement points

	Disposition with sample item	Number of items	Mean (*SD*)	Weighted Omega *h*
1.	Research knowledge – t1 *Sample item see ESM 1*	9	0.46 (0.16)	.69
2.	Research knowledge – t2	9	0.50 (0.16)	.66
3.	Value-related interest in research – t1 *'Compared to other topics, I assign a high value to research.'*	5	3.96 (0.46)	.80
4.	Value-related interest in research– t2	5	3.86 (0.50)	.80
5.	Joy in working with scientific literature – t1 *'I enjoy reading the scientific literature on a topic.'*	4	3.20 (0.80)	.77
6.	Joy in working with scientific literature – t2	4	3.03 (0.85)	.82
7.	Joy in working with empirical data – t1 *'I enjoy analyzing data.'*	4	3.44 (0.47)	.68
8.	Joy in working with empirical data – t2	4	3.45 (0.57)	.74
9.	Uncertainty tolerance – t1 *'I find it disturbing that before I start my research project, I don't know whether everything will work out as I imagine it will.'*	4	2.71 (0.73)	.73
10.	Uncertainty tolerance – t2	4	2.83 (0.78)	.75
11.	Frustration tolerance – t1 *'If my data analysis turns out to be incorrect and I have to start all over again, I would probably despair.'*	4	2.57 (0.54)	.71
12.	Frustration tolerance – t2	4	2.55 (0.56)	.76

9.4.3.3 Instructor and Course Characteristics

Student survey: During the pre- and post-test, students were asked for additional information. At pre-test, this included their self-assessed research self-efficacy (6 items on a 5-point scale, e.g. 'I am sure I can find suitable assessment tools for a quantitative study, even if the main variable is difficult to operationalize'). At post-test, students were asked about the research steps (e.g. searching for relevant literature) they had completed so far, their perception of the instructor's interest in their research project, their perception of whether they were doing 'real' research, and the perceived usefulness of the course for their later career (all measured with one item each on a 5-point scale).

Instructor survey: The post-test was also used to gather information about the course's instructional concept from the instructor's perspective. A 5-minute questionnaire distributed to the instructors asked about students' autonomy in choosing their own research question and method (two items on a five-point scale).

9.4.4 Statistical Analysis

In a first step, students' pre- and post-test data were matched via their personal six-digit code. We used SPSS 23 to conduct data checks and descriptive analyses of the manifest variables. To investigate changes in the different variables over time, we employed latent change score

modelling (LCM; McArdle, 2009) and multiple regressions. LCM and all necessary preceding analyses were performed with Mplus version 8 (L. K. Muthén & Muthén, 2017). The following three steps were performed:

9.4.4.1 Dimensionality Tests

To confirm the assumed factor structures and allow for a meaningful interpretation of the data, we conducted confirmatory factor analyses on all variables (see ESM 2). For almost all variables, the unidimensional model exhibited better model fit. The only exception was the variable 'Finding joy in conducting research', which exhibited inadequate model fits in both the unidimensional and the three-dimensional solution. Hence, subsequent analyses were conducted with two separate factors for this construct to ensure a meaningful interpretation of the data. The first factor describes 'joy in working with scientific literature', while the second describes 'joy in working with empirical data'.

9.4.4.2 Measurement Invariance Tests

A prerequisite for latent change score modelling is strong factorial invariance (McArdle, 2009). Only if strong factorial invariance is given can all factor loadings and intercepts be fixed to the same values for all measurement points. Following Meredith and Horn (Meredith & Horn, 2001), the CFI values of increasingly constrained models were compared (see ESM 3). For all variables, either strong factorial invariance or partial measurement invariance was established, meaning that the subsequent analyses can be meaningfully interpreted.

9.4.4.3 Latent Change Score Modelling

We then employed LCMs to examine changes in our variables over time. In LCM, change is modelled with latent difference variables that express the change across two or more measurement points (see Figure 5). This approach enables us to observe interindividual differences in intraindividual change free from measurement error (McArdle, 2009).

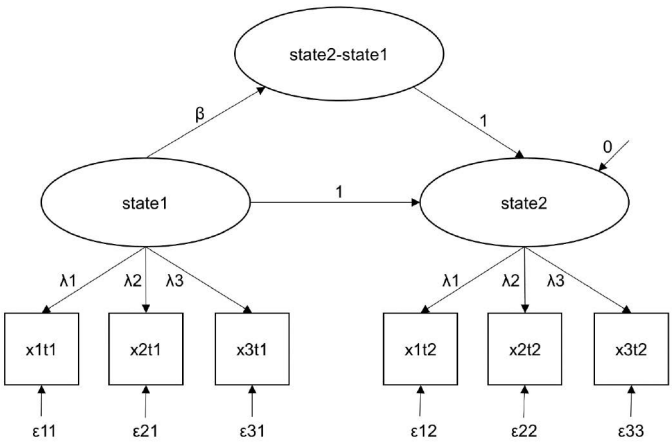


Figure 5: Latent change score model for two measurement points and three items

LCM analyses were performed in two steps: In the first step, we specified univariate LCMs (with two measurement points, T1 and T2) for each variable. The latent change variable indicates intraindividual changes from T1 to T2. Therefore, this variable was interpreted to

test Hypotheses H1a and H1b (effectiveness). The variance of the latent change variable indicates interindividual differences, i.e. whether students' research dispositions develop in different ways. When significant interindividual differences were found, in a second step, the latent change variable was regressed on six different course characteristics. The regression coefficients were then interpreted to test Hypotheses H2a, H2b and H2c (impact of course characteristics).

To account for the nested structure of the data (N=952 students nested in 70 courses), we used course as a cluster variable with the Mplus command TYPE = COMPLEX. Additionally, auto-correlated errors were included to account for method variance resulting from the use of the same items over the two measurement points. Missing data were handled using full-information maximum likelihood estimation (FIML). The criteria suggested by Hu and Bentler (1999) were used as a reference point for determining good model fit: models with a CFI>0.95 and a RMSEA <0.06 were considered to have adequate fit.

9.5 Results

9.5.1 Univariate Latent Change Score models: Changes in Individual Cognitive and Affective-Motivational Research Dispositions Over Time (Hypotheses H1a and H1b)

9.5.1.1 Research Knowledge

The LCM for research knowledge exhibited good model fit (see Table 10). The mean of the change variable was small but significant (ΔM =0.04, p<0.01), indicating a significant change from T1 to T2. This means that after taking the RBL course, students were able to correctly answer 0.45 questions more on average (out of nine questions) than at T1. Thus, the data supported hypothesis H1a. The variance of the change variable was very small and not significant (σ^2 = 0.001, p=0.8), indicating that there were no interindividual differences.

The univariate LCMs for all affective-motivational dispositions had very good model fits (see Table 10). The dispositions differed in their development from T1 to T2:

9.5.1.2 Value-Related Interest in Research

The results revealed a significant decrease from T1 to T2 (ΔM=-0.14, p<0.01). The significant variance of the change variable (σ^2 =0.33, p<0.01) indicates the presence of interindividual differences in changes in interest.

9.5.1.3 Joy With Respect to Research Activities

As described above, this variable consisted of two distinct factors whose development was examined individually. The results suggest a significant decrease in 'joy in working with scientific literature' from T1 to T2 (ΔM=-0.17, p<0.01). The significant variance of the change variable (σ^2=0.36, p<0.01) indicates that there were differences in students' trajectories. No significant change was observed for the second factor, 'joy in working with empirical data' (ΔM=-0.05, p=0.25). The significant variance indicates the presence of interindividual differences in students' trajectories (σ^2=0.15, p<0.01).

9.5.1.4 Uncertainty Tolerance

The results suggest a significant increase from T1 to T2 (ΔM=0.12, p<0.01). The significant variance (σ^2=0.38, p<0.01) indicates that there were substantial interindividual differences in students' trajectories.

9.5.1.5 Frustration Tolerance

The results show that frustration tolerance did not change significantly from T1 to T2 (ΔM=0.03, p=0.24). The significant variance was indicative of interindividual differences (σ^2=0.12, p<0.01).

Therefore, the data supports Hypothesis H1b only with respect to uncertainty tolerance. For value-related interest in research and joy in working with scientific literature, significant decreases were found.

Table 10: Model fits for all univariate latent change score models

Model	χ^2 (*df*)	*p*	RMSEA	CFI
1. Research knowledge	199.22 (141)	.001	0.02	0.93
2. Value-related interest in research	132.61 (37)	.001	0.05	0.95
3. Joy in working with scientific literature	62.18 (21)	.001	0.05	0.98
4. Joy in working with empirical data	91.69 (20)	.001	0.06	0.92
5. Uncertainty tolerance	39.29 (21)	.01	0.03	0.98
6. Frustration tolerance	38.37 (20)	.01	0.03	0.98

9.5.2 Influence of Other Variables on Changes in Different Research Dispositions Over Time (Hypotheses H2a, H2b and H2c)

Next, predictors of the change variable were analysed for the research dispositions for which the univariate LCMs showed evidence of interindividual differences. This was the case for value-related interest for research, joy in working with scientific literature and uncertainty tolerance.

9.5.2.1 Value-Related Interest for Research

The multiple regression revealed two significant and positive predictors of the latent change in value-related interest in research: the perceived usefulness of the course for one's later career and the instructor's perceived interest in the students' work. The overall variance explained by this regression model was 10% (see Table 11).

9.5.2.2 Joy in Working With Scientific Literature

The perceived usefulness of the course served as a significant predictor of the latent change in joy from T1 to T2. Students who perceived the course as useful for their later career experienced greater increases in joy in working with scientific literature. The full regression model explained 5% of the variance in the change in joy (see Table 11).

9.5.2.3 Uncertainty Tolerance

Uncertainty tolerance was significantly predicted by research self-efficacy at T1. Self-efficacy served as a negative predictor: the higher a student's self-efficacy, the more uncertainty tolerance decreased or the less it increased. The overall variance explained by this regression model was 6% (see Table 11).

These findings are in line with Hypothesis H2c, which examined the influence of additional motivating factors. Hypotheses H2a and H2b were not supported.

Table 11: Multiple regressions for affective-motivational research dispositions

	Change of value-related interest in research		Change of joy in working with scientific literature		Change of uncertainty tolerance	
Predictor variables (and time point of measurement)	***B (SE)***	**β**	***B (SE)***	**β**	***B (SE)***	**β**
Research self-efficacy (t1)	-0.01 (0.01)	-0.08	-0.01 (0.00)	-0.01	-0.03 (0.01)**	-0.22**
Number of research steps performed (t2)	-0.02 (0.03)	-0.04	<-0.01 (0.03)	<-0.01	0.02 (0.03)	0.04
Usefulness of the course for a later profession (t2)	0.10 (0.03)**	0.24**	0.10 (0.04)**	0.22**	-0.01 (0.04)	-0.03
Student autonomy (t2 – lecturer survey)	0.02 (0.02)	0.04	0.01 (0.04)	0.03	-0.04 (0.03)	-0.09
Lecturers interest in students' work (t2)	0.09 (0.04)*	0.16*	<-0.01 (0.05)	-0.01	0.03 (0.04)	0.05
Perception of conducting 'real' research (t2)	-0.04 (0.04)	-0.10	0.00 (0.04)	0.01	-0.01 (0.03)	-0.02
AIC	31,375		28,945		29,746	
R^2 (*SE*)	0.10 (0.04)		0.05 (0.03)		0.06 (0.04)	

Note. B = unstandardized coefficients, SE = standard error; β = standardized coefficients

** p<0.01; * p<0.01

9.6 Discussion and Implications

Our study examined the effectiveness of RBL in the social sciences. By applying pre-post measurements in 70 courses, we examined changes in different cognitive and affective-motivational research dispositions through participation in RBL. Research knowledge increased significantly, but no interindividual differences were observed that could be further investigated. Research-related uncertainty tolerance increased, whereas research interest and joy in working with scientific literature decreased over the course of RBL participation. Subsequent regression analyses showed that the change in uncertainty tolerance was significantly predicted by research self-efficacy. The changes in interest and joy were predicted by the perceived usefulness of the course for one's later profession, while the change in interest was also predicted by the instructor's perceived interest in the students' work.

Contrary to our expectations, the number of research steps performed and the autonomy students were given during the RBL experience did not have an effect on changes to any of the affective-motivational research dispositions.

9.6.1 Research Knowledge

Overall, research knowledge increased significantly over the course of RBL participation (see hypothesis 1a). Previous studies with students from individual social scientific disciplines have reported comparable results (e.g. Taraban & Logue, 2012). We were able to confirm these findings using an objective test instrument assessing three sub-areas of research knowledge: knowledge of methods, knowledge of methodologies and research process knowledge in the social sciences.

However, the students in our sample did not exhibit substantial interindividual differences in their improvement and no further analyses could be conducted to explain differences in the observed change with reference to other variables. This lack of interindividual differences might have been due to similar answering patterns on the knowledge items. We used a 9-item short version of a longer test, which might not have been sufficient to identify substantial differences between students. In future projects, we would recommend using the 27-item test form or another objective measurement that yields more variance in students' answers.

9.6.2 Affective-Motivational Research Dispositions

A significant change from the first to the second measurement point was found for three out of the four affective-motivational research dispositions examined.

In line with our expectations (see hypothesis 1b), uncertainty tolerance increased over the course of RBL participation. This change in uncertainty tolerance was significantly predicted by research self-efficacy (see hypothesis 2c). However, self-efficacy served as a negative predictor: the higher a student's self-efficacy, the smaller the positive change in uncertainty tolerance. Students with low levels of research self-efficacy might exhibit stronger increases in uncertainty tolerance because these students have less research experience and thus benefit more strongly from participation in RBL. A high level of uncertainty tolerance is important for coping with the unpredictable nature of the research process. Some claim that uncertainty tolerance is vital not only for conducting research but also for facing an increasingly complex world in general (Brew, 2010). In this sense, uncertainty tolerance not only assists students in pursuing scientific careers but also prepares students for other professions. How students' uncertainty tolerance can be changed is currently a subject of debate in several fields. In the health sciences, it has been suggested that medical students' uncertainty tolerance can be

enhanced by monitoring and controlling emotional processes related to uncertainty (Iannello, Mottini, Tirelli, Riva, & Antonietti, 2017). Translating this recommendation to research in the social sciences, we suggest integrating guided reflections on experienced emotions related to uncertainty in the research process. One way of doing so would be to use reflective learning diaries (Nevalainen et al., 2010). However, we did not test for reflective processes related to uncertainty in our sample. We can only assume that some instructors reflected on and discussed research-related uncertainties. Further research investigating the influence of guided reflection processes on the development of uncertainty tolerance in RBL courses would be necessary to come to a more comprehensive conclusion.

Interest and joy in research exhibited high mean values during both the pre- and post-test, indicating that the participating students are generally very fond of research and related activities. However, unlike uncertainty tolerance, interest and joy decreased over the course of RBL participation (see hypothesis 1b). There are several possible explanations for this. Perhaps students gain a more realistic idea of what research is during the course. At the beginning of their studies, students' conceptions of research might be influenced by the predominant view of research in their society: in Germany, the public perceives research as interesting and trustworthy (Wissenschaft im Dialog, 2018). Thus, realising how small the explanatory power of a single research project is might be frustrating or disillusioning. Gaining a more realistic understanding of the nature and practice of research might lead to decreased interest or joy in research, while simultaneously serves as an indication of what others have termed 'becoming a scientist' (Hunter et al., 2007).

The regression analyses showed that certain course variables served as significant predictors (see hypothesis 2c): changes in students' interest in research were significantly predicted by the instructor's perceived interest in the students' research and the perceived usefulness of the course for their later profession (both rated by the students). Perceiving that the instructor is interested in their work might be motivating for students and increase their own interest in research. As a practical implication, this does not mean that instructors should *pretend* to be interested in students' work. It could suffice for instructors to choose topics for RBL courses that are of genuine interest to them – for example, their own research topics. Bringing one's own research topics into the classroom, thereby combining one's teaching and research, has often been recommended as a useful practice for instructors (Vicens & Bourne, 2009). One of the main arguments for this is that it saves valuable time for instructors involved in both teaching and research. Our results additionally suggest that combining teaching and research comes with benefits for students, who feel more motivated by their instructors' interest in the topic.

Changes in joy were significantly predicted by the perceived usefulness of the course for students' later professions: those students who perceived the course as useful for their future career gained more joy in research. For students who do not aspire to academic careers, it might be beneficial to emphasize or enhance the course's usefulness for careers outside academia, e.g. by choosing research topics that are of interest in non-academic careers or applying service learning (Potter, Caffrey, & Plante, 2003). In this way, more students might perceive conducting their own research projects as useful for careers outside academia and therefore find greater joy in doing research.

Contrary to our expectations, the number of research steps performed and the autonomy students were given during the RBL experience did not have an effect on changes to any of the affective-motivational research dispositions (see hypothesis 2a and 2b). This indicates

that even working on pre-defined research problems or completing only a limited amount of research steps has a positive effect on students.

Overall, the regression models used to predict changes in different affective-motivational variables accounted for 5% (joy in working with scientific literature), 6% (uncertainty tolerance) and 10% (research interest) of the latent change variable's variance. While these effect sizes can be classified as small (J. Cohen, 1988), it is important to put these values into perspective: given that answering the questionnaires on the predictor variables took students only 1-2 minutes, the cost-value ratio of these regression analyses can be considered very positive. From a more fundamental perspective, it must be noted that affective-motivational dispositions are complex, multidimensional phenomena that are influenced by a range of external variables, such as current mood or personal life events. The variables examined in this study (e.g. student autonomy, instructors' interest) are not sufficient to accurately predict changes in different affective-motivational research dispositions over an entire course. However, they did partially serve as significant predictors and thus provide practical new ideas for designing RBL courses.

9.6.3 Limitations and Implications for Future Research

A problem with our and other studies in the field is the lack of a control group (cf. Lopatto, 2004). Without an adequate comparison group, it remains unclear whether the research experience itself is effective or whether it is the type of student who participates in RBL courses (Linn et al., 2015). Some authors claim that students who seek out RBL courses have higher academic abilities and are more motivated than other students in the first place (Carter, Ro, Alcott, & Lattuca, 2016). In our sample, participation in the RBL course was often a mandatory part of the students' study programme; thus, a strong self-selection bias in our sample can be ruled out. Nevertheless, a meaningful, matched control group is still necessary to draw final conclusions on the effectiveness of RBL, e.g. by examining study programs with a waiting list for RBL courses.

Another limitation concerns the testing time point. Since the post-measurement was conducted in the classroom towards the end of the course, our results do not reflect the effect of writing final papers or presenting research results. However, giving a public presentation on one's research has been described as particularly motivating by students (Cuthbert, Arunachalam, & Licina, 2012) and thus might influence the learning outcomes associated with RBL. Future research should incorporate the effects of final assignments by using later or follow-up measurements.

Our study's quantitative set-up meant that the students' personal perspectives on their research projects, individual reactions to challenges in the research process and additional thoughts on their instructors' behaviour could not be addressed. A future project could further explore and validate the preliminary findings of this study and the resulting implications by incorporating students' perspectives via in-depth interviews.

The aim of this study was to examine the effectiveness of RBL courses in the social sciences for enhancing cognitive and affective-motivational research dispositions. Based on the results, we can conclude that RBL is an effective instructional format for enhancing research knowledge and research-related uncertainty tolerance. RBL courses proved especially effective when students thought the RBL experience was useful for their later career.

The question of whether RBL is an effective instructional format has so far been dominated by studies from the field of STEM, while evidence from the social sciences remains scarce.

Our study sought to provide a systematic account of the effectiveness of RBL among students from different social scientific disciplines for enhancing discipline-specific measures using a pre-post design. While the chosen procedure was suitable for extending existing evidence in the field, a range of open questions remain that should be addressed in further research endeavours.

9.7 Acknowledgements

We would like to thank Christoph Geiger, Frederic Lenz and Luise Behm for their valuable help in conducting this study. We acknowledge support by the Open Access Publication Fund of Humboldt-Universität zu Berlin.

9.8 Declaration of Interest Statement

This research was supported by the German Federal Ministry for Education and Research under Grant No. 01PB14004B. The authors declare that this work was conducted in the absence of conflict of interests.

9.9 Electronic Supplementary Material

ESM 1 – Sample item for research knowledge

ESM 2 – Dimensionality tests

ESM 3 – Measurement invariance

10 Overall Discussion of the Results

The three central objectives of this dissertation were to identify relevant affective-motivational research dispositions, to develop scales for the assessment of these dispositions, and to investigate whether different cognitive and affective-motivational research dispositions can be fostered by participating in research-based learning in the social sciences. These three objectives were addressed in a sequential study design, using both qualitative and quantitative methodologies.

In the following section, I name and discuss the findings pertaining to these three central objectives. Findings on the model of affective-motivational research dispositions are discussed in section 10.1. The newly developed instruments to assess these affective-motivational dispositions are discussed in section 10.2. The effectiveness of RBL in the social sciences to foster different research dispositions, studied in a pre-post study, is discussed in section 10.3.

The methodological strengths and limitations of this dissertation are discussed (see section 10.4), before I provide an outlook on promising fields for further study and a concluding general remark (see section 10.5).

10.1 Affective-Motivational Research Dispositions

An aim of this dissertation project was to identify the affective-motivational dispositions necessary for students to conduct their own pieces of research. Based on expert interviews, a model consisting of six challenging research situations and nine affective-motivational research dispositions to handle these situations was identified (Publication I).

Since competence manifests in competent behaviour in specific situations (see section 2.2), interview participants were asked for challenging situations in the research process and how successful students overcome these challenges. Asked for challenging situations, the experts did usually not refer to the steps of a prototypical research cycle (e.g. "literature review phase", see section 5.4.2). Rather, the experts named challenges that spanned several steps or recurred throughout the research cycle. The first challenging situation of the research process is to develop a specific research interest. The other five challenging situations pertain to sustaining the research process. Among these are the difficulty to make decisions, to endure setbacks, to unravel irritations, making use of counselling and critique, and to present one's research in an audience-appropriate manner. These six situations shaped the identification of nine relevant affective-motivational research dispositions: Epistemic curiosity, research interest, joy towards undertaking research, uncertainty tolerance, acceptance to narrow down, complexity tolerance, frustration tolerance, willingness to seek feedback, and the acceptance of divergent perspectives. The expert rating deemed all of these dispositions relevant for student research processes, with frustration tolerance rated as the most relevant.

My prior assumptions about which affective-motivational dispositions are relevant to conducting research were derived from empirical studies from STEM disciplines and theoretical considerations (see section 3.3). Studies from the field of STEM mention e.g. research interest and the ability to manage uncertainty as important to conducting research (Ward et al., 2003). These two dispositions were also highlighted by the experts in our study. Based on thoughts on the nature of the research process, I additionally assumed that curiosity and research self-efficacy would be relevant. Indeed, the curiosity to find out more about a theme or a problem was frequently mentioned by our interview participants as important to com-

mence a research process. Contrary to my prior assumption, research self-efficacy or descriptions of self-efficacious behaviour were not mentioned by the interview participants as a relevant affective-motivational disposition. Other dispositions such as the acceptance to narrow down, i.e. the ability to narrow one's research focus both when defining the research question and terminating the project, were unforeseen. Apparently, the exploratory nature of the study captured more different constructs than literature-based procedures would have yielded. The experts' shared experience in supervising researching students provided a rich resource. Specifically asking these experts to consider students' emotional and motivational experiences was a new step and constituted a good way to go beyond the usual.

While the experts were free to elaborate on any affective-motivational aspects of students in research contexts, it was important that the extracted dispositions were compliant with the definition of competence (see section 2.2). Dispositions had to be context-specific (pertain to research situations in the social sciences), learnable (develop through growing experience with research), and express a capacity to act (be necessary to perform research actions). Respective in- and exclusion criteria were set. Based on these criteria, other dispositions mentioned as important abilities for conducting research in both our interviews and in the literature were excluded from the model. For instance, communication skills and team skills were frequently mentioned but do not have a research-specific nature. Rather, these skills are deemed relevant for working on any collaborative project.

After the dispositions were inductively extracted from the expert interviews they were refined and defined based on the existing literature. Searching the psychological-educational literature, it became apparent that for many of the identified dispositions there were related, domain-general concepts: For instance, based on the interviews "research-related uncertainty tolerance" was extracted whereas "general uncertainty tolerance" is an existing construct in the literature. The question arose whether the specific and research-related dispositions were indeed to be distinguished from the existing general dispositions. A validation study aimed at gaining insight on this question (see section 7.4) for the three dispositions uncertainty tolerance, frustration tolerance, and complexity tolerance. Based on the results, it can be inferred that these research-related dispositions can be distinguished from their general counterparts and add incremental validity to explaining other research-related variables. That situation-specific dispositions and their contextualised assessment add incremental validity in predicting performance has been shown for other dispositions, e.g. curiosity (Mussel et al., 2012). Thus, I proceeded to work with the research-related dispositions and the contextualized form of assessment.

Results from the pre-post study (see Publication II) additionally showed that most of the affective-motivational research dispositions changed significantly – some in a positive, some in a negative direction. These findings imply that the affective-motivational research dispositions identified fulfil the criteria of competence: The dispositions are related to research experiences, to research performance, and they are changeable. The observation that the affective-motivational dispositions are changeable over the course of a semester might also indicate that they are distinct from personality traits. In general, personality traits are regarded as rather fixed (B. W. Roberts, Wood, & Smith, 2005) and facilitating them through participation in a university course is unlikely. However, the finding that curiosity and openness are highly correlated (Mussel, 2010) shows that further evidence is needed to conclude with greater certainty how the affective-motivational dispositions are distinct from basic personality traits.

The desire to look at affective-motivational dispositions at all, arose from the observed discrepancy between definitions of competence and practical implementations of these definitions. Existing definitions of competence (see section 2.2) show that action within a domain is not only shaped by underlying cognitive dispositions but also affective-motivational dispositions (Blömeke et al., 2015). While there seems to be consent on this holistic view of competence, it is rarely turned into practice when it comes to defining or studying specific competencies. Especially for the field of higher education, there is a lack of competence models that include affective-motivational aspects. That affective-motivational dispositions are nevertheless relevant for social scientific research processes was quickly determined during the expert interviews: All interviewees deemed affective-motivational aspects highly relevant for conducting research and could provide lengthy accounts of very knowledgeable and intelligent students who failed to complete their research projects due to motivational issues.

With the resulting model I attempt to formulize the necessary affective-motivational research dispositions. I regard the model as the affective-motivational facet of research competence. A previous research project identified cognitive dispositions needed to conduct research. These can be regarded as the cognitive facet of research competence in the social sciences (e.g. Gess et al., 2017). However, while definitions of competence acknowledge its holistic nature, it remains unclear how cognitive and affective-motivational dispositions interact to enable competent performance. Do the affective-motivational dispositions merely serve auxiliary functions to enable the use of cognitive abilities? To answer this question for the domain of research dispositions became a secondary aim while working on the pre-post study. In general, research that looks at the interplay of noncognitive traits and cognitive abilities is rare (Ziegler, 2014a). One of the models that seeks to capture the interplay between the two is the Openness-Fluid-Crystallized-Intelligence (OFCI) model by Ziegler et al. (2018). It suggests that the personality trait openness motivates individuals to seek stimulating, or enriched, situations which helps to positively influence their fluid intelligence. This mechanism is called "environmental enrichment hypothesis". While openness is the general willingness to seek stimulating environments, interests work as an additional motivational force: They guide which situations are ultimately sought, can prolong the stay in these situations, and thus contribute to the overall development of fluid and crystallized intelligence. Transferred to student research processes and the affective-motivational dispositions I studied, this might imply the following: Since curiosity is similar to openness (see section 3.3.1), students with high levels of curiosity might be more likely to seek out enriching learning opportunities. Students with high research interest might choose more and longer research experiences and consequently acquire more research-related knowledge.

Unfortunately, since the cognitive research dispositions did not show enough interindividual variance during the pre-post study, its change could not be explained by any affective-motivational disposition. Thus, the development and interplay between cognitive and affective-motivational research dispositions could not be described further and remains an open question.

The developed model of affective-motivational research dispositions adds a new perspective by shedding light on affective-motivational learning outcomes that are normally ignored in higher education contexts (Zlatkin-Troitschanskaia et al., 2015). It is often claimed that expert educators in general need to address the emotional state of learners (Kort, Reilly, Picard, & Media, 2001) and instructors of research courses should not only pay attention to the methodological aspects of student research but also address the "affective domain" of their learners (Lei, 2010, p. 238). The work on this dissertation goal, in contrast, showed that the

educators were well-aware of affective-motivational aspects of learning: All professors and lecturers interviewed and surveyed were able to name a multitude of affective-motivational aspects of student research. They had all seen struggling students, could give detailed descriptions of these struggles, and had found their own way of addressing them as supervisors. Considering how common and well-known the affective-motivational aspects of student research are, it seems surprising that these aspects are not mentioned more explicitly in curricula or module descriptions. Possibly, this discrepancy is due to a lack of coherent descriptions of affective-motivational aspects of learning. The insight gained during this project can serve as an explicit account of the affective-motivational research dispositions that need to be systematically fostered and attained to during bachelor's and master's programmes.

On the level of the curricula, the model gives an idea of the competencies necessary to fulfil the demands of the framework for qualifications (HRK et al., 2017): Being able to participate in the production and evaluation of knowledge means e.g. to be able to tolerate uncertainties in the research process and to tolerate the complexity of large amounts of data. The identified research dispositions may serve as a catalogue of relevant research dispositions for students in the social sciences. As such, these dispositions can serve as learning outcomes for the research education.

Whether RBL served a suitable measure to attain these affective-motivational learning outcomes was another question of this dissertation. Its results will be discussed in section 10.3.

10.2 Instruments to Assess Affective-Motivational Dispositions

A second objective of this dissertation was to develop instruments to assess the affective-motivational research dispositions. The development of the instruments followed recommended standards from test construction. After an item generation phase, the final items were selected based on content and psychometric criteria from a pilot study. This procedure resulted in one self-assessment scale with 6-9 items for each of the dispositions (see Appendix B). In a subsequent validation study, I compared the measures for research-related uncertainty tolerance, complexity tolerance, and frustration tolerance with their general counterparts (e.g. general uncertainty tolerance). Additional variables were included to gain evidence on the incremental validity of the scales. The results provided evidence that the instruments assess research-related dispositions that increase with growing research experience and provide incremental validity over general measures in predicting research performance.

The instruments for the assessment of affective-motivational research dispositions were then used in the pre-post study on the effectiveness of RBL. However, an unforeseen problem for the three tolerance scales occurred: It became apparent that positive and negative item formulations seemed to function differently. For example, items expressing tolerance towards uncertainty and items expressing intolerance towards uncertainty did not show a high negative correlation but seemed to represent different dimensions of the disposition. Consequently, for the pre-post study it was worked with the positive items to ensure that one-dimensional constructs were used and a clear interpretation of the data was possible. The finding that tolerance and intolerance of uncertainty, frustration, or complexity are not extremities of one dimension but can only be expressed by two dimensions is however interesting. For further use of the instruments, it would be recommended to concentrate on either tolerance or intolerance and use the respective items.

Taking this restriction into account, the newly developed scales show good properties and are ready to be used to gain additional insight on their functioning. The instruments are already used by other universities which show the breadth of possible applications for these

instruments: In a research project at the University of Bielefeld, the scales on research-related joy and interest were used to assess motivational differences between two quasi-experimental groups that were both prepared for conducting research projects (Basten, Schumacher, & Mertens, 2019). At the University of Cologne, some of the instruments (e.g. epistemic curiosity and research interest) are used in an ongoing monitoring study to assess the overall quality of the bachelor's and master's teacher education programmes (ZuS, 2020). This collaboration indicates that the dispositions are not only central to students of the social sciences but also deemed relevant for teacher education students. At the University of Oldenburg, some of the scales are used in a longitudinal study across all disciplines to assess how research competence develops during different bachelor's and master's programmes (Thiem, Preetz, & Haberstroh, 2020). This panel study will provide evidence on how different curricular designs and differing forms of participation in RBL are linked to fostering affective-motivational research competencies in the long term. Here too, results are still pending.

These projects show that higher education research and practice have a growing demand in assessing affective-motivational research dispositions and deem the instruments suitable to be used in different contexts and for different purposes. While this serves as an additional external validation of the instruments, it must be noted that quantitative evidence on the validity of the instruments for different purposes is limited. Additional data was only collected for three of the affective-motivational dispositions: Uncertainty, frustration, and complexity tolerance. Further validation steps are still needed to guarantee a valid measurement of all affective-motivational dispositions, especially for the different intended uses like long-term applications.

10.3 Effectiveness of Research-Based Learning

The third research question aimed at investigating whether RBL is an effective instructional format to facilitate the development of different research dispositions in the social sciences. In a first step, to understand the existing evidence on the effectiveness of RBL, a systematic review was conducted (see section 6.1). Studies that assessed cognitive and affective-motivational learning outcomes of different forms of RBL across all disciplines were reviewed. The results of this work show that most studies so far were conducted in the field of STEM. These studies report a range of different, especially knowledge-related, learning outcomes associated with RBL. These results justify the wide-spread implementation of RBL in STEM disciplines. For the field of social sciences, I identified only a few studies on the effectiveness of RBL with predominantly weak methodological designs. Furthermore, in both STEM and the social sciences there were only a handful of studies mentioning affective-motivational learning outcomes. I could not find a single study where affective-motivational research dispositions as outcomes of RBL are in the centre of attention. This provided additional justification for conducting the pre-post study that examined the effect of participating in RBL on the development of different cognitive and affective-motivational research dispositions.

Based on pre-post-measurements in 70 RBL courses in different social scientific disciplines across ten German universities, the findings indicate that most of the research dispositions changed – however not always positively: While the cognitive facet of research competence and uncertainty tolerance increased, research interest and joy towards working with scientific literature decreased over the course. In light of the large number of studies on RBL that report very positive or even enthusiastic evaluations of RBL (e.g. Ward et al., 2003), this result comes as a surprise. Selected findings will be discussed in the following.

Cognitive research competence: The cognitive facet of research competence increased significantly over the course of RBL participation. This finding is in line with studies from the field of STEM (e.g. Linn et al., 2015) and social sciences (Taraban & Logue, 2012; Whipple et al., 2015) that report increased research knowledge through participation in RBL. However, these previous studies have often relied on self-assessment of knowledge gains which are prone to bias, e.g. a social desirability bias (Zlatkin-Troitschanskaia et al., 2015). By applying an objective test instrument with right and wrong answers, we hoped to provide a more valid assessment of students' research competence. The instrument assesses three sub-areas of research knowledge: Knowledge of methods, knowledge of methodologies, and research process knowledge in the social sciences. However, since the one-dimensional model of the data yielded a better model fit than the three-dimensional model, these three knowledge areas were interpreted as one construct. Thus, no detailed results on the individual knowledge areas were generated.

Additionally, the students in our sample did not exhibit substantial interindividual differences in their improvement and I could not conduct further analyses to explain differences in the observed change with reference to other variables. The lack of interindividual differences might stem from the low reliability of the test instrument. Due to time constraints in class, we did not apply the original 27-item test to assess research competence but developed a 9-item short version (see Appendix H). The short form only exhibited a reliability of weighted omega $h = 0.69$ in the pre-study. This might not have been sufficient to identify substantial differences between students. In future projects, I would recommend using the 27-item test form or another objective measurement that yields more variance in students' answers. This would also provide the opportunity to examine additional variables that might additionally explain changes in students' research competence.

Uncertainty tolerance: In the pre-post study, research-related uncertainty tolerance increased significantly during participation in RBL. Since there were no prior studies on the development of research-related uncertainty tolerance, I speculated on possible developments based on the characteristics of RBL. In RBL, the instructor provides guidance in difficult situations and can serve as a role model within a community of practice (see section 5.3.3). This might allow students to experience research-related uncertainties in a safe environment. I assume that learning from a more experienced researcher and his/her way of dealing with uncertainty enables students to develop uncertainty tolerance.

The increased uncertainty tolerance is important for both current and future research projects. When students start to enjoy the unknown, this might be a resource to motivate a range of subsequent research projects and ultimately lead to choosing this type of work professionally. Uncertainty tolerance is however not only seen as important for motivating research careers. Especially uncertainty tolerance can help to face the complexity of the modern world and prepare students for professions outside academia (Brew, 2010). By facilitating uncertainty tolerance, universities might fulfil an important function: They enable students to cope with the "supercomplexity" of the world that surrounds us (Barnett, 2000). However, it remains an open question whether research-related uncertainty tolerance looked at for the purpose of this dissertation indeed translates to professions outside academia, or even life in general.

Interest in research and joy towards research: In our study, interest and joy decreased significantly. For many of the students, the interest in research and the joy towards conducting research was lower at the end of the course than at the beginning. This is surprising since, in general, it is assumed that interest develops with increasing engagement with an object or a task (Hidi

& Renninger, 2006). For instance, a study with students from educational sciences showed that engaging in research led to increased enthusiasm towards research (Hosein & Rao, 2017). Based on these readings, I assumed that working on research projects would also lead to students' increased research interests in the pre-post-study.

Why exactly the students in our sample show negative developments of joy and interest remained unclear. One of the reasons could lie in what I call the "overload hypothesis": Conducting one's own piece of research in the context of RBL is very demanding since the student-centred format places a lot of responsibility on the students (see section 5.3.1). For inquiry-based learning and other student-centred formats Kirschner et al. (Kirschner, Sweller, & Clark, 2006) claim that students are unable to simultaneously accomplish all subtasks involved in these types of learning. Being overloaded with the task of conducting one's own piece of research could lead to negative affects towards research.

Another explanation is provided by what I call the "frustration hypothesis": In informal conversations with students of RBL courses – often after completing my questionnaires – many students expressed their disappointment about the limited explanatory power of their projects. It felt frustrating to them to invest so much time and energy while receiving rather meaningless results. During the post-measurement students were near the end of their projects and realised how much work and how little effect research often provides. This might have lowered their interest and joy towards research.

Another explanation would be the "group dynamic hypothesis": Most of the research work is done in teams. Groups normally underly similar changes until they reach their full productive power. One of the models that describes these group developments is "forming-storming-norming-performing" by Tuckman (1965). The model postulates that work teams go through comparable phases. Possibly, during the post-measurement many of the groups were at similar, conflictual stages. These conflicts might have led to an overall lowered affect towards research.

To find out why joy and interest decrease towards the end of the course is important to counteract these developments. Since interest is regarded as a central variable in motivating and sustaining learning processes (Schiefele, 1991), a decrease of research interest poses a threat to taking up further research experiences. In this case, RBL would fail as a learning experience that sparks further interest in research among students and leads to an increased number of scientific careers. Whether the decreased research interest of the students in our study indeed constitutes a long-term problem for the research education in the social sciences cannot be answered based on our data and remains an open question.

Using multiple regressions, I gained further insight on the developments of research interest and joy. The instructors' interest in students' research work was a significant predictor of the change of research interest and joy. The instructor's interest served as a compensating factor: If the instructor's interest in students' work was high, the change in research interest and joy was not as negative as for other students. This finding emphasizes the importance of the instructor for RBL learning settings. Even though RBL can be considered a student-centred format which relies heavily on students' self-regulated work (see section 5.3), this does not mean that the instructor is superfluous. Instead, supervision has been shown to be a crucial factor in student research processes (Howitt et al., 2010). The instructor takes on the role of a guide or expert who provides insight into his or her own research approach within a community of practice and enables students to implicitly and explicitly learn the practices of research (Hunter et al., 2007). This includes not only conveying methodical knowledge but

also sharing the enthusiasm and interest for research. That the enthusiasm of university instructors affects students' motivation has been shown in other academic learning contexts (Frenzel, Taxer, Schwab, & Kuhbandner, 2019). Likewise, the students in our sample seem to benefit from their instructors' interest in their work by an increased research interest themselves.

The finding that the instructor is an important figure in higher education learning settings is not new. In a systematic review of meta-analyses looking at a broad range of variables related to achievement in higher education, Schneider and Preckel (2017) found that instructors that asked open questions and encouraged classroom discussions were most strongly associated with student achievement. Possibly, when students in our sample had the impression that their lecturer was interested in their work, this impression was given by the instructors' questions and discussions on the research projects. Thus – if this far-reaching conclusion is allowed – instructors' questions on the course content are not only related to achievement as suggested by Schneider and Preckel but additionally seem to enhance students' interest and enjoyment of the course content.

Altogether, RBL seems to be an effective learning format for the development of different cognitive and affective-motivational research dispositions – especially if the instructor takes an interest in his or her students' work. This study thus provides preliminary evidence for the effectiveness of RBL in the social sciences. However, its findings also indicate that participating in research is not effective per se to spark an interest in research. Instead, the results call for instructors to pay more attention to the affective-motivational learning areas of their students. Instructors seem to have the power to counteract negative developments in this realm and should be ready to use it. Surely, only when instructors are aware of necessary affective-motivational research dispositions and possible difficulties in the research process such a call can be put into practice.

10.4 Strengths and Limitations of the Research Design

This dissertation employed a sequential mixed method design, beginning with an explorative interview study with experts for student research and concluding with a pre-post study in RBL courses across different social scientific disciplines and universities. While such a design has several advantages, namely a broad and deep insight into the practice of research education and its challenges within the social sciences, there are also several weaknesses that limit the explanatory power of this dissertation project. The strengths and limitations of the chosen methodological procedure will be discussed in the following section.

10.4.1 Strengths

A strength of this dissertation lies in the rigid application of test construction standards for the modelling and assessment of affective-motivational research dispositions. While competence is theoretically regarded as a multidimensional construct that encompasses cognitive, affective, and motivational aspects (see section 2.2), empirical projects usually concentrate on the cognitive facet "due to pragmatic reasons" (own translation, Fleischer et al., 2013, p. 7). In the field of higher education, research on competence modelling and assessment has predominately focused on cognitive outcomes like knowledge and analytical reasoning skills. The modelling and assessment of non-cognitive outcomes is still under-researched (Zlatkin-Troitschanskaia et al., 2015). This means there is also a lack of exemplary procedures on how to map affective-motivational facets of competence. In this dissertation, I chose a methodically rigid procedure that allowed for modelling and operationalising affective-motivational

research dispositions. The expert-based approach meant that the dispositions were generated and explored from the perspective of higher educational practice and based on decades of experience. A subsequent online expert rating further supported the relevance of the dispositions identified and provided the baseline for defining the different dispositions. These definitions were used to develop self-assessment scales employing a deductive-inductive approach. As a result, the identified dispositions are well-defined, deemed relevant by experts, and were operationalised by carefully designed and empirically tested instruments. Completing all these steps necessarily required more time and financial resources than other, simpler approaches. If time and resources allow, the methodological steps employed in this dissertation can be regarded as a suitable procedure to modelling affective-motivational dispositions in the context of higher education. The procedure chosen for this dissertation may serve as a guideline for others who seek to model affective-motivational dispositions.

The chosen approach met the call for evidence-based competence models. Zlatkin-Troitschanskaia et al. stress that "evidence-based competence models in higher education are still an exception" (Zlatkin-Troitschanskaia et al., 2015, p. 394). Most models are based on theoretical or political considerations, such as qualification frameworks. The work on this dissertation sought to be one of those exceptions by choosing an explorative and empirical approach to modelling research competence and thereby reflect the actual practice of higher education.

Another advantage of the research design was the personal administration of the questionnaires in class within course-time. In-class testing for the pilot study, the validation study and the pre-post study meant that 15 different German universities were visited. While this procedure required a substantial amount of time and travelling funds, the personal introduction and explanation of the projects' purpose guaranteed that almost all students asked for participation did indeed participate. During the testing appointments none of the students left the lecture hall or seminar room before or after the study was explained. This means that a strong self-selection bias can be ruled out. Since affective-motivational variables were in the focus of assessment this is of special importance. In most existing studies of RBL, online questionnaires are used and participation is assumingly distorted by motivational factors (Taraban & Logue, 2012). In contrast, our sample consists of very different students and probably depicts the broad "motivational landscape" of students in the social sciences. In addition, the administrator of the questionnaires was present during the full assessment and ensured a concentrated and supervised working atmosphere in class. This led to a high quality of the data reflected in a low percentage of incomplete questionnaires (e.g. 1.9 % missing values in the validation study) and no non-sense data entries. Administering the questionnaires in class also meant that I could informally converse with students, instructors, and university staff. These conversations confirmed the practical relevance of my questions and I gained additional insight on the broad variety of RBL practices at different universities.

10.4.2 Limitations

There are several limitations of the chosen research design which are important to note – on the one hand to further frame the interpretation of the results; on the other hand, to inspire future research.

A limitation for the interview study and thus of the whole subsequent project was that I only interviewed professors and lecturers as experts of student research. These persons and their accumulated experience with student research are suitable to provide insight into student

research processes and the associated observable affective-motivational challenges. However, a reviewer later rightly remarked that the expert interviews should have been coupled with student interviews. Especially affective-motivational dispositions are based on internal and personal processes which only the students themselves can fully express. Thus, the model of affective-motivational research dispositions might have been more complete if I complemented the expert study by a study with students to validate the identified dispositions from the internal perspectives of the persons concerned.

Another limitation lies in the lack of a good measure of research performance. Competence is a latent trait that is said to underly competent performance in a given field (see section 2.2). While I aimed to assess relevant research dispositions by using an expert-based approach, it is unclear whether the affective-motivational research dispositions identified do indeed predict better research performance. I can only assume so for two reasons: First, the participants of our expert interviews stated which specific affective-motivational dispositions were necessary for successful student research and their expertise validates these claims. Second, in the validation study (see section 7.4), the affective-motivational research dispositions of master's students (uncertainty tolerance, frustration tolerance, and complexity tolerance) showed high correlations with bachelor thesis grades which served as a preliminary measure of research performance. However, a clear and valid measure of research performance is still missing and constitutes one of the open questions of the field in general. I will therefore discuss this demand in greater depths in the subsequent section (see section 10.5.1).

The pre-post study has additional limitations that should be noted. The first limitation concerns the time point of testing. Since the post-measurement was conducted in class and before the start of the semester break, the effect of writing final papers or presenting and discussing research results are not reflected in the findings. According to the instructors in our study, 60.6 % of the students had to hand in a course paper, an additional 25 % of the students had to present a poster. Most of these assignments were not yet completed at the time point of testing since these tasks were often completed in the semester break after our assessment. However, especially giving a public presentation on one's research was described as particularly exciting and motivating by students (Cuthbert et al., 2012) and thus might influence the learning outcomes associated with RBL. Our findings on the effectiveness of RBL pertain only to its potential during the semester. Future research should incorporate the effects of assignments by using later or follow-up measurements. This would also allow for comparing the effect of different assignments.

Another problem of the pre-post study and other studies in the field is the lack of a control group (cf. Lopatto, 2004). Creating a meaningful control group was unfortunately impossible for our sample: The different disciplines and universities involved meant there was no possibility to find students who studied the same content but within different instructional formats. Without an adequate comparison group however, it remains open whether the research experience itself is effective or whether it is the type of student who participates in RBL courses (Linn et al., 2015). Some authors claim that students who seek out RBL courses are those that have higher academic abilities and are more motivated than other students in the first place (Carter et al., 2016). In our sample, the participation in the RBL course was often a mandatory part of study programmes, a strong self-selection bias of our sample can thus be ruled out. A meaningful, matched control group is however still necessary to draw final conclusions on the effectiveness of RBL in both social sciences and other disciplines.

Additionally, I want to acknowledge possible confounding variables. Since the pre-post study was conducted in real courses, the research and learning experiences made by students could

not be controlled. By using a criteria-based approach to choosing the RBL courses under study and by assessing additional surface criteria (e.g. number and type of research activity, role of the instructor) it was sought to minimize differences between the learning experiences of participating students, or at least to make them transparent. However, the RBL courses remained very diverse on various factors, e.g. the number of participants, the topics covered, the assignments and the supervisor's style of instruction. In addition to these course-related variables, there are additional sources of confounding in the individual learning experiences outside the RBL course. For instance, some students simultaneously took additional methods courses that might have impacted their score on the cognitive research competence test. These course-related and external variables probably all influenced the success of the RBL experience. While the external additional learning experiences are hard to control, a laboratory-like setting could minimize the course-related differences in future studies.

Furthermore, I want to comment on the generalisability of the results. For all empirical studies of this dissertation project, I sought to create diverse and meaningful samples: The interview partners were from three universities and represented different disciplines and research methodologies, the pilot and the validation study were conducted with students from different disciplines and universities, the pre-post study was conducted in 70 RBL courses at ten German universities with both master's and bachelor's students. However, Stanford (2017) criticised that previous studies (e.g. Russell et al., 2007) have evaluated the benefits of student research with samples from multiple institutions and recommends to study student outcomes on a single campus as it removes institutional variability. In contrast, by choosing heterogenous samples we aimed to represent the full breadth of social scientific research practices. Because of these diverse samples, it is plausible to assume that the results of our studies are generalisable for the field of the social sciences. An open question pertains to the generalisability of the results to other disciplines or university systems. Since teaching and learning are never isolated from their respective context, e.g. the disciplines or the institution, a similar study in a different discipline or country would probably render different results. Especially the differing historical and political roots of RBL across countries (see section 5.1) should be considered. While in Germany all students are required to acquire competencies to participate in the evaluation and production of new knowledge (HRK et al., 2017) and mandatory participation in RBL is common, students in the US often seek RBL experiences as additional learning experiences. These cultural differences might lead to different results when it comes to the effectiveness of RBL and thus limit the generalisability of my studies to other higher education settings.

10.5 Open Questions and Concluding Remarks

Just like any other research project, this dissertation project raised more questions than it could answer. A few of these open questions will be outlined in the following before a concluding remark brings this dissertation to an end.

10.5.1 Open Questions

Some of the open questions are informed by the limitations of the project (see section 10.4). One of these is the question whether the affective-motivational research dispositions identified are indeed related to an improved research performance. To assess this question, one needs to determine what research performance is and how it can be assessed. In the validation study (see section 7.4) I chose empirical bachelor's thesis grades as an indicator of research performance – knowing that these can be highly distorted by a faculty's and supervisor's grading policy. In the empirical literature, thesis grades are also used as measure of

research performance. Some authors additionally evaluate different research artefacts such as students' research papers or posters based on grading rubrics (Robbins, Kinney, & Kart, 2008). While these approaches provide information on the written outcome of a research process, it does not give any information on students' performance during individual research phases. Future studies should use a more insightful indicator of research performance, e.g. by observing students' research behaviour. Observations of actual research work are very time-consuming but served as a valuable method to accumulate insight on the practice of professional researchers (Klahr & Simon, 1999). In comparison with professional researchers, observations of students' research could provide a valid measure of research performance. Such measure is necessary to further validate the cognitive and affective-motivational research dispositions as latent traits underlying competent performance in conducting research.

Another open question concerns possible ways of facilitating affective-motivational dispositions. The predominant focus on knowledge and skills in academic learning settings means that a large amount of evidence exists on how to foster the acquisition of knowledge. The question how affective-motivational dispositions can be fostered is in contrast a fairly new question. The results from the pre-post study hint at the importance of the instructor for the development of affective-motivational research dispositions: The instructor's interest in student work was related to students' increased research interest. For other affective-motivational dispositions, the situation is less clear. In the health sciences it has been suggested that medical students' uncertainty tolerance can be enhanced by monitoring and controlling emotional processes related to medical uncertainty (Iannello et al., 2017). Translating this recommendation to RBL in the social sciences, uncertainty tolerance could be addressed by instructors who offer guided reflections on experienced emotions related to uncertainty in the research process. It remains an open question whether this or another instructional measure is suitable to foster affective-motivational research dispositions during RBL experiences. Based on the result from the pre-post study it seems promising to focus on the behaviour of the instructor to deduct possible ways of facilitating different research dispositions.

Another field of open questions pertains to the long-term benefits of RBL. To assess the existing literature on the effectiveness of RBL, a systematic review was conducted. When evaluating the results of this review three different areas of benefits that are associated with participation in RBL emerged. Apart from individual research competencies, RBL is thought to serve a societal function by increasing retention and PhD rates and to facilitate the development of skills that are relevant for professions outside of academia (see section 6.1). Interestingly, most studies – my pre-post study included – focus on the first, evidence on the latter two areas remains scarce. There is, to my knowledge, no study that looks at the long-term effects of participating in RBL in the social sciences. Does it indeed affect students' career choices and is it, for example, related to higher PhD beginning rates, like shown for STEM students (Hernandez et al., 2018)? Likewise, the claim that the competencies acquired during RBL in the social sciences translate to non-scientific professions remains purely anecdotal or speculative. A future study should thus look at how different research dispositions one acquires during participation in RBL are used in non-scientific fields outside academia. For example, do students with RBL experiences and advanced levels of research competence indeed make greater use of evidence when working as a psychotherapist or teacher? A positive answer to these questions could further justify why students need to acquire research competence as part of their studies even though they do not intend to stay in academia.

10.5.2 Concluding Remarks

Throughout working on this dissertation, it became apparent that there is no shared idea on the terminology and form of research-based and other forms of research-related learning. This held true for both the international literature and the German context. The identification of courses suitable for studying the effectiveness of RBL showed that the term RBL is not yet comprehensively established across higher education in Germany. Depending on the discipline, university, and the positioning of the course in the curriculum, there existed a range of different terms that sometimes denoted the same underlying instructional format and sometimes completely different things. Among these were, for example, "Lehrforschung", "Forschungswerkstatt", "Projektseminar", "Experimentalpraktikum", "Forschungsseminar", "Studentische Forschung", and "Studienprojekt". Even though these terms might all have a meaningful historical background, their heterogeneity makes it difficult to compare different curricular foci and developments. To establish a discourse on teaching research in different disciplines, clear terms and concepts are needed. This also includes a debate on the roots and underlying didactical principles and learning theories of different research-related teaching and learning formats (see section 5.3). Only if there is a shared idea of different instructional formats and their underlying principles, these formats can be meaningfully discussed, planned, or applied.

These unclear terms and formats are also an expression of the fact that higher education didactics and its research in general is a comparably new field. It is a specialised area between educational sciences, sociology, and psychology. As a new discipline its degree of professionalisation sometimes seems to remain somehow limited. Often, studies in the field do not follow scientific rigour but remain anecdotal and highly interpretative. Other studies do not explain their samples and interventions in detail and make it impossible to replicate the findings. By making use of the standards of psychological assessment, e.g. with respect to test construction, study set-up and data analysis, I sought to use established procedures of neighbouring disciplines to come to more robust evidence in the field of higher education research. It is admittedly difficult to negotiate the rigid criteria of test construction and psychological research with the complexity of real-world learning environments. While educational research in primary and secondary education is facing this difficulty since decades, the field of higher education research has only just started to develop procedures to overcome these difficulties. The different approaches used as part of this dissertation, e.g. the expert interviews to derive an evidence-based competence model or the latent change models used to analyse the pre-post data, can be seen as starting points. Additionally, different study set-ups, e.g. control groups, waiting lists, or observations of actual teaching practice, are needed to come to more comprehensive evidence.

High-quality studies are necessary to make evidence-based suggestions for learning and instruction in the field of higher education (Blömeke & Zlatkin-Troitschanskaia, 2013). So far, most changes of curricular or teaching methods are policy-driven changes (Zlatkin-Troitschanskaia et al., 2015). By working on this dissertation, I sought to address a small corner of this gap and provide empirical evidence for the field of research education in the social sciences.

As a result of this dissertation, I established a model of affective-motivational research dispositions for student research in the social sciences. The procedure developed to model and assess these affective-motivational dispositions may serve as an exemplary procedure and is ready to be applied to other disciplines or competence fields. The result of these efforts was the development of self-assessment scales that are suitable to assess the status of different

affective-motivational research dispositions. I used the instruments to assess the effectiveness RBL courses: Based on a pre-post-study of over 900 students, RBL seems to be an instructional format that is suitable to elicit changes in student cognitive and affective-motivational research dispositions – both negative and positive changes. The findings of this study provide implications for the teaching of RBL and especially shed light on the importance of the instructor.

11 References

Adedokun, O. A., Bessenbacher, A. B., Parker, L. C., Kirkham, L. L., & Burgess, W. D. (2013). Research skills and STEM undergraduate research students' aspirations for research careers: Mediating effects of research self-efficacy. *Journal of Research in Science Teaching*, *50*(8), 940–951. https://doi.org/10.1002/tea.21102

Aditomo, A., Goodyear, P., Bliuc, A. M., & Ellis, R. A. (2013). Inquiry-based learning in higher education: Principal forms, educational objectives, and disciplinary variations. Studies in Higher Education, 38(9), 1239–1258. https://doi.org/10.1080/03075079.2011.616584

Alasuutari, P., Bickman, L., & Brannen, J. (2008). The SAGE handbook of social research methods. London: Sage. https://doi.org/10.4135/9781446212165

Alon, U. (2009). How to choose a good scientific problem. Molecular Cell, 35(6), 726–728. https://doi.org/10.1016/j.molcel.2009.09.013

American Psychological Association. (2006). Evidence-based practice in psychology. American Psychologist, 61(4), 271–285. https://doi.org/10.1037/0003-066X.61.4.271

Auchincloss, L. C., Laursen, S. L., Branchaw, J. L., Eagan, K., Graham, M., Hanauer, D. I., … Dolan, E. L. (2014). Assessment of course-based undergraduate research experiences: A meeting report. CBE Life Sciences Education, 13(1), 29–40. https://doi.org/10.1187/cbe.14-01-0004

Baker, R. S., D'Mello, S. K., Rodrigo, M. M. T., & Graesser, A. C. (2010). Better to be frustrated than bored: The incidence, persistence, and impact of learners' cognitive-affective states during interactions with three different computer-based learning environments. International Journal of Human-Computer Studies, 68(4), 223–241. https://doi.org/10.1016/j.ijhcs.2009.12.003

Bandura, A. (2006). Guide for constructing self-efficacy scales. In T. Urdan & F. Pajares (Eds.), Self-efficacy beliefs of adolescents (pp. 307–337). Greenwich, CT: Information Age Publishing.

Barnett, R. (2000). University knowledge in an age of supercomplexity. Higher Education, 40(4), 409–422. https://doi.org/10.1023/A:1004159513741

Barr, R., & Tagg, J. (1995). From teaching to learning: A new paradigm for undergraduate education. Change: The Magazine of Higher Learning, 27(6), 12–26.

Basten, M., Schumacher, F., & Mertens, C. (2019). Methodische Vorbereitung auf das Studienprojekt im Praxissemester – Vergleich eines Inverted-Classroom-Ansatzes mit Präsenzlehre. In J. Košinár, A. Gröschner, & U. Weyland (Eds.), Langzeitpraktika als Lernräume - Historische Bezüge, Konzeptionen und Forschungsbefunde (pp. 175–188). Münster: Waxmann Verlag.

Bauer, K. W., & Bennett, J. S. (2003). Alumni perceptions used to assess undergraduate research experience. The Journal of Higher Education, 74(2), 210–230.

Beard, C., Clegg, S., & Smith, K. (2007). Acknowledging the affective in higher education. British Educational Research Journal, 33(2), 235–252.

Ben-Zvi, D., & Garfield, J. (2004). Statistical literacy, reasoning, and thinking: Goals, definitions, and challenges. In D. Ben-Zvi & J. Garfield (Eds.), The challenge of developing statistical literacy, reasoning and thinking (Vol. 66, pp. 3–15). Dordrecht: Springer-Science+Business Media.

Bieschke, K. J. (2006). Research self-efficacy beliefs and research outcome expectations: Implications for developing scientifically minded psychologists. Journal of Career Assessment, 14(1), 77–91. https://doi.org/10.1177/1069072705281366

Bishop, R. M., & Bieschke, K. J. (1998). Applying social cognitive theory to interest in research among counseling psychology doctoral students: A path analysis. Journal of Counseling Psychology, 45(2), 182–188.

Blömeke, S., Gustafsson, J.-E. E., & Shavelson, R. J. (2015). Beyond dichotomies: Competence viewed as a continuum. Zeitschrift Für Psychologie, 223(1), 3–13. https://doi.org/10.1027/2151-2604/a000194

Blömeke, S., & Zlatkin-Troitschanskaia, O. (2013). Kompetenzmodellierung und Kompetenzerfassung im Hochschulsektor: Ziele, theoretischer Rahmen, Design und Herausforderungen des BMBF-Forschungsprogramms KoKoHs (KoKoHs Working Paper 1). Berlin & Mainz.

Blumer, H. (1969). Symbolic interactionism: Perspective and method. Berkeley, CA: California University Press.

Bogner, A., Littig, B., & Menz, W. (2009). Introduction: Expert interviews – An introduction to a new methodological debate. In A. Bogner, B. Littig, & W. Menz (Eds.), Interviewing Experts (pp. 1–13). Basingstoke: Palgrave Macmillan.

Bolin, A. U., Khramtsova, I., & Saarnio, D. (2005). Using student journals to stimulate authentic learning: Balancing Bloom's cognitive and affective domains. Teaching of Psychology, 32(3), 154–159. https://doi.org/10.1207/s15328023top3203_3

Bologna Process Committee. (1999). Joint declaration of the European ministers of education convened in Bologna on 19 June 1999 (Bologna Declaration).

Borg, S. (2007). Research engagement in English language teaching. Teaching and Teacher Education, 23(5), 731–747. https://doi.org/10.1016/j.tate.2006.03.012

Böttcher, F., & Thiel, F. (2018). Evaluating research-oriented teaching: A new instrument to assess university students' research competences. Higher Education, 75, 91–110. https://doi.org/10.1007/s10734-017-0128-y

Bourgeois, E. (2002). Zukunftsforschung zur Entwicklung der Beziehungen zwischen Hochschulausbildung und Forschung mit Blick auf den Europäischen Forschungsraum. Luxemburg: Europäische Kommission/Generaldirektion Forschung.

Boyer Commission on Educating Undergraduates in the Research University. (1998). Reinventing undergraduate education: A blueprint for America's research universities. New York: Stony Brook.

Boyer, E. L. (1990). Scholarship reconsidered: Priorities of the professoriate. New Jersey: The Carnegie Foundation for the Advancement of Teaching.

Bradley, M. M., Greenwald, M. K., Petry, M. C., & Lang, P. J. (1992). Remembering pictures: Pleasure and arousal in memory. Journal of Experimental Psychology: Learning, Memory, and Cognition, 18(2), 379–390. https://doi.org/10.1037/0278-7393.18.2.379

Brew, A. (2001). The nature of research: Inquiry in academic contexts. London: Routledge-Falmer.

Brew, A. (2010). Imperatives and challenges in integrating teaching and research. Higher Education Research & Development, 29(2), 139–150. https://doi.org/10.1080/07294360903552451

Brew, A., & Jewell, E. (2012). Enhancing quality learning through experiences of research-based learning: implications for academic development. International Journal for Academic Development, 17(1), 47–58. https://doi.org/10.1080/1360144X.2011.586461

British Academy. (2012). Society counts: Quantitative skills in the social sciences. London. Retrieved from http://www.britac.ac.uk/policy/Society_Counts.cfm

Bromme, R., & Goldman, S. R. (2014). The public's bounded understanding of science. Educational Psychologist, 49(2), 59–69. https://doi.org/10.1080/00461520.2014.921572

Broussine, M., Watts, L., & Clarke, C. (2014). Why should researchers be interested in their feelings? In C. Clarke, M. Broussine, & L. Watts (Eds.), Researching with feeling. The emotional aspects of social and organizational research (pp. 1–16). London: Routledge.

Brun, G., & Kuenzle, D. (2008). Introduction: A new role for emotions in epistemology? In G. Brun, U. Doguoglu, & D. Kuenzle (Eds.), Epistemology and emotions (pp. 1–31). Aldershot: Ashgate.

Bruner, J. (1990). The Jerusalem-Harvard lectures. Acts of meaning. Cambridge, MA: Harvard University Press.

Bryman, A. (2012). Social research methods (4th ed.). Oxford: Oxford University Press.

Bühner, M. (2011). Einführung in die Test- und Fragebogenkonstruktion (3rd ed.). München: Pearson Studium.

Bundesassistentenkonferenz. (1970). Forschendes Lernen - Wissenschaftliches Prüfen (Schriften der Bundesassistentenkonferenz 5). Bielefeld: Universitätsverlag Webler (Neudruck 2009).

Burisch, M. (1984). Approaches to personality inventory construction. American Psychologist, 39(3), 214–227. https://doi.org/10.1037/0003-066X.39.3.214

Butcher, J., & Maunder, R. (2014). Going URB@N: Exploring the impact of undergraduate students as pedagogic researchers. Innovations in Education and Teaching International, 51(2), 142–152. https://doi.org/10.1080/14703297.2013.771967

Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. Psychological Bulletin, 56(2), 81–105. https://doi.org/10.1037/h0046016

Carter, D. F., Ro, H. K., Alcott, B., & Lattuca, L. R. (2016). Co-curricular connections: The role of undergraduate research experiences in promoting engineering skills. Research in Higher Education, 57(3), 363–393. https://doi.org/10.1007/s11162-015-9386-7

Cerasoli, C. P., Nicklin, J. M., & Ford, M. T. (2014). Intrinsic motivation and extrinsic incentives jointly predict performance: A 40-year meta-analysis. Psychological Bulletin, 140(4), 980–1008. https://doi.org/10.1037/a0035661

Chawla, N. V., Bowyer, K. W., Hall, L. O., & Kegelmeyer, W. P. (2002). SMOTE: Synthetic minority over-sampling technique. Journal of Artificial Intelligence Research, 16, 321–357. https://doi.org/10.1613/jair.953

Chi, M. T. H., & Wylie, R. (2014). The ICAP framework: Linking cognitive engagement to active learning outcomes. Educational Psychologist, 49(4), 219–243. https://doi.org/10.1080/00461520.2014.965823

Chomsky, N. (1968). Language and Mind. New York: Harcourt, Brace & World.

Christou, C., & Papageorgiou, E. (2007). A framework of mathematics inductive reasoning. Learning and Instruction, 17(1), 55–66. https://doi.org/10.1016/j.learninstruc.2006.11.009

Cohen, J. (1988). Statistical power analysis for the behavioral sciences. Hillsdale, NJ: L. Erlbaum Associates.

Cohen, S. A., & MacVicar, M. L. A. (1976). Establishing an undergraduate research program in physics: How it was done. American Journal of Physics, 44(3), 199–203. https://doi.org/10.1119/1.10456

Cortes, C., & Vapnik, V. (1995). Support-vector networks. Machine Learning, 20(3), 273–297. https://doi.org/10.1007/bf00994018

Council on Undergraduate Research. (2020). Mission. Retrieved from https://www.cur.org/who/organization/mission/

Creswell, J. W., & Plano Clark, V. L. (2011). Designing and conducting mixed methods research. (2nd ed.). Los Angeles: SAGE Publications.

Cronbach, L. J. (1990). Essentials of psychological testing (5th ed.). New York: Harper & Row.

Cuthbert, D., Arunachalam, D., & Licina, D. (2012). "It feels more important than other classes I have done": An "authentic" undergraduate research experience in sociology. Studies in Higher Education, 37(2), 129–142. https://doi.org/10.1080/03075079.2010.538473

D'Mello, S., Lehman, B., Pekrun, R., & Graesser, A. (2014). Confusion can be beneficial for learning. Learning and Instruction, 29, 153–170. https://doi.org/10.1016/j.learninstruc.2012.05.003

Dalbert, C. (1999). Die Ungewißheitstoleranzskala: Skaleneigenschaften und Validierungsbefunde. In Hallesche Berichte zur Pädagogischen Psychologie. Retrieved from http://hdl.handle.net/20.500.11780/927

Dalbert, C. (2003). Ungewissheitstoleranzskala (UGTS). In J. Hoyer & J. Margraf (Eds.), Angstdiagnostik – Grundlagen und Testverfahren (pp. 172–175). Heidelberg: Springer.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. Psychological Inquiry, 11(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01

Deicke, W., Gess, C., & Rueß, J. (2014). Increasing students' research interest through research-based learning at Humboldt University. Council on Undergraduate Research Quarterly, 35(1), 27–33.

Deicke, W., & Mieg, H. (2020). Undergraduate research in German higher education: Tradition, policy, and innovation. In N. Hensel & P. Blessinger (Eds.), International Perspectives on Teaching Excellence in Higher Education (pp. 219–236). Cham: Palgrave Macmillan. https://doi.org/10.1007/978-3-030-53559-9

Delamont, S., & Atkinson, P. (2001). Doctoring uncertainty: Mastering craft knowledge. Social Studies of Science, 31(1), 87–107. Retrieved from https://www.jstor.org/stable/285819

Diekmann, A. (2007). Empirische Sozialforschung: Grundlagen, Methoden, Anwendungen. Reinbek bei Hamburg: Rowohlt Taschenbuch Verlag.

Donche, V., De Maeyer, S., Coertjens, L., Van Daal, T., & Van Petegem, P. (2013). Differential use of learning strategies in first-year higher education: The impact of personality, academic motivation, and teaching strategies. British Journal of Educational Psychology, 83(2), 238–251. https://doi.org/10.1111/bjep.12016

Durrheim, K., & Foster, D. (1997). Tolerance of ambiguity as a content specific construct. Personality and Individual Differences, 22(5), 741–750. https://doi.org/10.1016/S0191-8869(96)00207-3

Dweck, C. S., Mangels, J. A., & Good, C. (2004). Motivational effects on attention, cognition, and performance. In D. Y. Dai & R. J. Sternberg (Eds.), Motivation, Emotion, and Cognition (pp. 41–55). Mahwah, NJ: Lawrence Erlbaum Associates.

Earley, M. A. (2014). A synthesis of the literature on research methods education. Teaching in Higher Education, 19(3), 242–253. https://doi.org/10.1080/13562517.2013.860105

Engel, U. (2002). Praxisrelevanz der Methodenausbildung (Sozialwissenschaftliche Tagungsberichte, 5). Bonn: Informationszentrum Sozialwissenschaften. Retrieved from https://nbn-resolving.org/urn:nbn:de:0168-ssoar-2634

Fichten, W. (2010). Forschendes Lernen in der Lehrerbildung. In U. Eberhardt (Ed.), Neue Impulse in der Hochschuldidaktik - Sprach- und Literaturwissenschaften (pp. 127–182). Wiesbaden: VS Verlag für Sozialwissenschaften.

Fichten, W. (2013). Über die Umsetzung und Gestaltung Forschenden Lernens im Lehramtsstudium. Verschriftlichung eines Vortrags auf der Veranstaltung "Modelle Forschenden Lernens." Oldenburg: Didaktisches Zentrum der Universität Oldenburg.

Fischer, F., Kollar, I., Ufer, S., Sodian, B., Hussmann, H., Pekrun, R., … Eberle, J. (2014). Scientific reasoning and argumentation: Advancing an interdisciplinary research agenda in education. Frontline Learning Research. https://doi.org/10.14786/flr.v2i3.96

Flanagan, J. C. (1954). The critical incident technique. Psychological Bulletin, 51(4), 327–358.

Fleischer, J., Koeppen, K., Kenk, M., Klieme, E., & Leutner, D. (2013). Kompetenzmodellierung: Struktur, Konzepte und Forschungszugänge des DFG- Schwerpunktprogramms. Zeitschrift Für Erziehungswissenschaft, 16(5), 5–22.

Forester, M., Kahn, J. H., & Hesson-McInnis, M. S. (2004). Factor structures of three measures of research self-efficacy. Journal of Career Assessment, 12(1), 3–16. https://doi.org/10.1177/1069072703257719

Fredrickson, B. L., & Branigan, C. (2005). Positive emotions broaden the scope of attention and thought-action repertoires. Cognition & Emotion, 19(3), 313–332. https://doi.org/10.1080/02699930441000238

Freeston, M. H., Rhéaume, J., Letarte, H., Dugas, M. J., & Ladouceur, R. (1994). Why do people worry? Personality and Individual Differences. https://doi.org/10.1016/0191-8869(94)90048-5

Frenzel, A. C., Taxer, J. L., Schwab, C., & Kuhbandner, C. (2019). Independent and joint effects of teacher enthusiasm and motivation on student motivation and experiences: A field experiment. Motivation and Emotion, 43(2), 255–265. https://doi.org/10.1007/s11031-018-9738-7

Friedman, J., Hastie, T., & Tibshirani, R. (2000). Additive logistic regression: A statistical view of boosting. Annals of Statistics. https://doi.org/10.1214/aos/1016218223

Fröhlich-Gildhoff, K., Nentwig-Gesemann, I., & Pietsch, S. (2011). Kompetenzorientierung in der Qualifizierung frühpädagogischer Fachkräfte. (Deutsches Jugendinstitut e.V. (DJI), Ed.). München.

Gal, I. (2002). Adults' statistical literacy: Meanings, components, responsibilities. International Statistical Review, 70(1), 1–25. https://doi.org/10.1111/j.1751-5823.2002.tb00336.x

Gasper, K., & Clore, G. L. (2002). Attending to the big picture: Mood and global versus local processing of visual information. Psychological Science, 13(1), 34–40. https://doi.org/10.1111/1467-9280.00406

Gess, C., Geiger, C., & Ziegler, M. (2018). Social-scientific research competency: Validation of test score interpretations for evaluative purposes in higher education. European Journal of Psychological Assessment, 35(5), 737–750. https://doi.org/10.1027/1015-5759/a000451

Gess, C., Wessels, I., & Blömeke, S. (2017). Domain-specificity of research competencies in the social sciences: Evidence from differential item functioning. Journal for Educational Research Online, 9(2), 11–36. Retrieved from https://www.waxmann.com/artikelART102899

Gilardi, S., & Lozza, E. (2009). Inquiry-based learning and undergraduates' professional identity development: Assessment of a field research-based course. Innovative Higher Education, 34, 245–256. https://doi.org/10.1007/s10755-009-9109-0

Gilmore, J., Vieyra, M., Timmerman, B., Feldon, D., & Maher, M. (2015). The relationship between undergraduate research participation and subsequent research performance of early career STEM graduate students. The Journal of Higher Education, 86(6), 834–863. https://doi.org/10.1353/jhe.2015.0031

Groß Ophoff, J., Schladitz, S., Leuders, J., Leuders, T., & Wirtz, M. A. (2015). Assessing the development of educational research literacy: The effect of courses on research methods in studies of educational science. Peabody Journal of Education, 90(4), 560–573. https://doi.org/10.1080/0161956X.2015.1068085

Haeger, H., & Fresquez, C. (2016). Mentoring for inclusion: The impact of mentoring on undergraduate researchers in the sciences. CBE Life Sciences Education, 15(3). https://doi.org/10.1187/cbe.16-01-0016

Hagenauer, G., & Volet, S. (2014). "I don't think I could, you know, just teach without any emotion": Exploring the nature and origin of university teachers' emotions. Research Papers in Education, 29(2), 240–262. https://doi.org/10.1080/02671522.2012.754929

Healey, M., & Jenkins, A. (2009). Developing undergraduate research and inquiry. Innovations in Education and Teaching International. York: The Higher Education Academy.

Heggestad, E. D., & Gordon, H. L. (2008). An argument for context-specific personality assessments. Industrial and Organizational Psychology, 1(2008), 320–322. https://doi.org/10.1111/j.1754-9434.2008.00056.x

Herman, J. L., Stevens, M. J., Bird, A., Mendenhall, M., & Oddou, G. (2010). The tolerance for ambiguity scale: Towards a more refined measure for international management research. International Journal of Intercultural Relations, 34(1), 58–65. https://doi.org/10.1016/j.ijintrel.2009.09.004

Hernandez, P. R., Woodcock, A., Estrada, M., & Schultz, P. W. (2018). Undergraduate research experiences broaden diversity in the scientific workforce. BioScience, 68(3), 204–211. https://doi.org/10.1093/biosci/bix163

Hidi, S., & Renninger, K. A. (2006). The four-phase model of interest development. Educational Psychologist, 41(2), 111–127. https://doi.org/10.1207/s15326985ep4102_4

Hidi, S., Renninger, K. A., & Krapp, A. (2004). Interest, a motivational variable that combines affective and cognitive functioning. In D. Y. Dai & R. J. Sternberg (Eds.), Motivation, Emotion, and Cognition (pp. 89–115). Mahwah, NJ: Lawrence Erlbaum Associates.

Hillen, M. A., Gutheil, C. M., Strout, T. D., Smets, E. M. A., & Han, P. K. J. (2017). Tolerance of uncertainty: Conceptual analysis, integrative model, and implications for healthcare. Social Science & Medicine, 180, 62–75. https://doi.org/10.1016/j.socscimed.2017.03.024

Holland, J. L. (1997). Making vocational choices: A theory of vocational personalities and work environments (3rd ed.). Odessa, FL: Psychological Assessment Resources. Retrieved from https://psycnet.apa.org/record/1997-08980-000

Hosein, A., & Rao, N. (2017). Students' reflective essays as insights into student centred-pedagogies within the undergraduate research methods curriculum. Teaching in Higher Education, 22(1), 109–125. https://doi.org/10.1080/13562517.2016.1221804

Howitt, S., Wilson, A., Wilson, K., & Roberts, P. (2010). "Please remember we are not all brilliant": Undergraduates' experiences of an elite, research-intensive degree at a research-intensive university. Higher Education Research and Development, 29(4), 405–420. https://doi.org/10.1080/07294361003601883

HRK, KMK, & BMBF. (2017). Qualifikationsrahmen für Deutsche Hochschulabschlüsse (beschlossen am 16.02.2017). Retrieved September 16, 2020, from https://www.hrk.de/fileadmin/redaktion/hrk/02-Dokumente/02-03-Studium/02-03-02-Qualifikationsrahmen/2017_Qualifikationsrahmen_HQR.pdf

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling: A Multidisciplinary Journal, 6(1), 1–55. https://doi.org/10.1080/10705519909540118

Hu, S., Kuh, G. D., & Gayles, J. G. (2007). Engaging undergraduate students in research activities: Are research universities doing a better job? Innovative Higher Education, 32(3), 167–177. https://doi.org/10.1007/s10755-007-9043-y

Huber, L. (2003). Forschendes Lernen in Deutschen Hochschulen. Zum Stand der Diskussion. In A. Obolenski & H. Meyer (Eds.), Forschendes Lernen - Theorie und Praxis einer professionellen LehrerInnenausbildung (pp. 15–36). Rieden: Klinkhardt.

Huber, L. (2009). Warum Forschendes Lernen nötig und möglich ist. In L. Huber, J. Hellmer, & F. Schneider (Eds.), Forschendes Lernen im Studium. Aktuelle Konzepte und Erfahrungen (pp. 9–35). Bielefeld: UniversitätsVerlagWebler.

Huber, L. (2014). Forschungsbasiertes, Forschungsorientiertes, Forschendes Lernen: Alles dasselbe? Das Hochschulwesen, 62(1+2), 32–39.

Hui, F., & Koplin, M. (2011). The implementation of authentic activities for learning: A case study in finance education. E-Journal of Business Education Scholarship of Teaching, 5(1), 59–72.

Humboldt, W. von. (n.d.). Über die innere und äussere Organisation der höheren wissenschaftlichen Anstalten in Berlin. In Der Präsident der Humboldt-Universität zu Berlin (Ed.), Gründungstexte (pp. 229–241). Humboldt-Universität zu Berlin. https://doi.org/10.18452/17880

Hunter, A.-B., Laursen, S. L., & Seymour, E. (2007). Becoming a scientist: The role of undergraduate research in students' cognitive, personal, and professional development. Science Education, 91(1), 36–74. https://doi.org/10.1002/sce.20173

Iannello, P., Mottini, A., Tirelli, S., Riva, S., & Antonietti, A. (2017). Ambiguity and uncertainty tolerance, need for cognition, and their association with stress. A study among Italian practicing physicians. Medical Education Online, 22(1), 1–10. https://doi.org/10.1080/10872981.2016.1270009

Jenßen, L., Dunekacke, S., & Blömeke, S. (2015). Qualitätssicherung in der Kompetenzforschung: Standards für den Nachweis von Validität in Testentwicklung und Veröffentlichungspraxis. Zeitschrift Für Pädagogik (Beiheft), 61, 11–30. Retrieved from http://nbn-resolving.de/urn:nbn:de:0111-pedocs-155018

Jenßen, L., Dunekacke, S., Eid, M., & Blömeke, S. (2015). The relationship of mathematical competence and mathematics anxiety: An application of latent state-trait theory. Zeitschrift Für Psychiatrie, Psychologie Und Psychotherapie, 223(1), 31–38. https://doi.org/10.1027/2151-2604/a000197

John, J., & Creighton, J. (2011). Researcher development: the impact of undergraduate research opportunity programmes on students in the UK. Studies in Higher Education, 36(7), 781–797. https://doi.org/10.1080/03075071003777708

John, O. P., & Robins, R. W. (1994). Accuracy and bias in self-perception: Individual differences in self-enhancement and the role of narcissism. Journal of Personality and Social Psychology, 66(1), 206–219. https://doi.org/10.1037/0022-3514.66.1.206

Jones, M. T., Barlow, A. E. L., & Villarejo, M. (2010). Importance of undergraduate research for minority persistence and achievement in biology. The Journal of Higher Education, 81(1), 82–115. https://doi.org/10.1353/jhe.0.0082

Junge, B., Quiñones, C., Kakietek, J., Teodorescu, D., & Marsteller, P. (2010). Promoting undergraduate interest, preparedness, and professional pursuit in the sciences: An outcomes evaluation of the SURE program at Emory University. CBE—Life Sciences Education, 9(2), 119–132. https://doi.org/10.1187/cbe.09-08-0057

Kang, S., Scharmann, L. C., & Noh, T. (2004). Reexamining the role of cognitive conflict in science concept learning. Research in Science Education, 34(1), 71–96. https://doi.org/10.1023/B:RISE.0000021001.77568.b3

Kardash, C. A. M. (2000). Evaluation of undergraduate research experience: Perceptions of undergraduate interns and their faculty mentors. Journal of Educational Psychology, 92(1), 191–201. https://doi.org/10.1037/0022-0663.92.1.191

Kazura, K., & Tuttle, H. (2010). Research based learning approach: Students perspective of skills obtained. Journal of Instructional Psychology, 37(3), 210–215.

Keller, M. M., Goetz, T., Becker, E. S., Morger, V., & Hensley, L. (2014). Feeling and showing: A new conceptualization of dispositional teacher enthusiasm and its relation to students' interest. Learning and Instruction, 33, 29–38. https://doi.org/10.1016/j.learninstruc.2014.03.001

Kember, D. (1997). A reconceptualisation of the research into university academics' conceptions of teaching. Learning and Instruction, 7(3), 255–275. https://doi.org/10.1016/S0959-4752(96)00028-X

Kilgo, C. A., Ezell Sheets, J. K., & Pascarella, E. T. (2015). The link between high-impact practices and student learning: Some longitudinal evidence. Higher Education, 69(4), 509–525. https://doi.org/10.1007/s10734-014-9788-z

Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiental, and inquiry-based teaching. Educational Psychologist, 41(2), 75–86. https://doi.org/10.1207/s15326985ep4102

Klahr, D., & Simon, H. A. (1999). Studies of scientific discovery: Complementary approaches and convergent findings. Psychological Bulletin, 125(5), 524–543. https://doi.org/10.1037/0033-2909.125.5.524

Klieme, E., Artelt, C., Hartig, J., Jude, N., Köller, O., Prenzel, M., … Stanat, P. (2010). PISA 2009. Bilanz nach einem Jahrzehnt. Münster: Waxmann. Retrieved from http://nbn-resolving.de/urn:nbn:de:0111-opus-35265

Klieme, E., & Hartig, J. (2008). Kompetenzkonzepte in den Sozialwissenschaften und im erziehungswissenschaftlichen Diskurs. In M. Prenzel, I. Gogolin, & H. H. Krüger (Eds.), Kompetenzdiagnostik (pp. 11–29). VS Verlag für Sozialwissenschaften.

Kobelt, K. (2008). Ideengeschichtliche Entwicklung des pädagogischen Kompetenzkonzepts. In M. Koch & P. Straßer (Eds.), In der Tat kompetent. Zum Verständnis von Kompetenz und Tätigkeit in der beruflichen Benachteiligtenförderung. (pp. 9–23). Bielefeld: Bertelsmann.

Koeppen, K., Hartig, J., Klieme, E., & Leutner, D. (2008). Current issues in competence modeling and assessment. Zeitschrift Für Psychologie, 216(2), 61–73. https://doi.org/10.1027/0044-3409.216.2.61

Kordts-Freudinger, R. (2017). Feel, think, teach – Emotional underpinnings of approaches to teaching in higher education. International Journal of Higher Education, 6(1), 217–229. https://doi.org/10.5430/ijhe.v6n1p217

Kort, B., Reilly, R., Picard, R. W., & Media, M. I. T. (2001). An affective model of interplay between emotions and learning: Reengineering educational pedagogy — building a learning companion. In Proceedings of the IEEE International Conference on Advanced Learning Techniques (pp. 43–46). Madison, WI. https://doi.org/10.1109/ICALT.2001.943850

Krapp, A., & Prenzel, M. (2011). Research on interest in science: Theories, methods, and findings. International Journal on Science Education, 33(1), 27–50. https://doi.org/10.1080/09500693.2010.518645

Kruger, J., & Dunning, D. (1999). Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. Journal of Personality and Social Psychology, 77(6), 1121–1134. https://doi.org/10.1037/0022-3514.77.6.1121

Kühl, S. (2012). Der Sudoku-Effekt. Hochschulen im Teufelskreis der Bürokratie. Eine Streitschrift. Bielefeld: transcript Verlag.

Kuhlmann, S., Piel, M., & Wolf, O. T. (2005). Impaired memory retrieval after psychosocial stress in healthy young men. The Journal of Neuroscience, 25(11), 2977–2982. https://doi.org/10.1523/JNEUROSCI.5139-04.2005

Künzli, R. (2010). Lehrpläne, Bildungsstandards und Kompetenzmodelle. Eine problematische Vermischung von Funktionen. Beiträge Zur Lehrerinnen- Und Lehrerbildung, 28(3), 440–452. Retrieved from urn:nbn:de:0111-pedocs-13761

Lambert, C. (2009). Pedagogies of participation in higher education: A case for research-bas-ed learning. Pedagogy, Culture and Society, 17(3), 295–309. https://doi.org/10.1080/14681360903194327

Lau, S., & Roeser, R. W. (2002). Cognitive abilities and motivational processes in high school students' situational engagement and achievement in science. Educational Assessment, 8(2), 139–162. https://doi.org/10.1207/S15326977EA0802_04

Lave, J., & Wenger, E. (1991). Situated learning: Legitimate peripheral participation. Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9780511815355

Layder, D. (1993). New strategies in social research: An introduction and guide. Cambridge: Polity Press.

Lei, S. A. (2010). College research methodology courses: Revisiting general instructional goals and objectives. Journal of Instructional Psychology, 37(3), 236–241.

Leiner, D. J. (2015). SoSci Survey. Retrieved from www.soscisurvey.de

Levin, D. Z., Kurtzberg, T. R., Phillips, K. W., & Lount, R. B. (2010). The role of affect in knowledge transfer. Group Dynamics: Theory, Research, and Practice, 14(2), 123–142. https://doi.org/10.1037/a0017317

Lewthwaite, S., & Nind, M. (2016). Teaching research methods in the social sciences: Expert perspectives on pedagogy and practice. British Journal of Educational Studies, 64(4), 413–430. https://doi.org/10.1080/00071005.2016.1197882

Linn, M. C., Palmer, E., Baranger, A., Gerard, E., & Stone, E. (2015). Undergraduate research experiences: Impacts and opportunities. Science, 347(6222), 1261756–1261757. https://doi.org/10.1126/science.1261757

Litman, J. A. (2008). Interest and deprivation factors of epistemic curiosity. Personality and Individual Differences, 44(7), 1585–1595. https://doi.org/10.1016/j.paid.2008.01.014

Litman, J. A., & Mussel, P. (2013). Validity of the interest-and deprivation-type epistemic curiosity model in Germany. Journal of Individual Differences, 34(2), 59–68. https://doi.org/10.1027/1614-0001/a000100

Litman, J. A., & Spielberger, C. D. (2003). Measuring epistemic curiosity and its diversive and specific components. Journal of Personality Assessment, 80(1), 75–86. https://doi.org/10.1207/S15327752JPA8001_16

Lloyd, S. A., Shanks, R. A., & Lopatto, D. (2019). Perceived student benefits of an undergraduate physiological psychology laboratory course. Teaching of Psychology, 46(3), 215–222. https://doi.org/10.1177/0098628319853935

Lopatto, D. (2004). Survey of undergraduate research experiences (SURE): First findings. Cell Biology Education, 3(4), 270–277. https://doi.org/10.1187/cbe.04-07-0045

Lopatto, D. (2007). Undergraduate research experiences support science career decisions and active learning. CBE Life Sciences Education, 6(4), 297–306. https://doi.org/10.1187/cbe.07-06-0039

Lopatto, D. (2009). Science in solution: The impact of undergraduate research on student learning. Tucson, AZ: Research Corporation for Science Advancement.

Love, K. M., Bahner, A. D., Jones, L. N., & Nilsson, J. E. (2007). An investigation of early research experience and research self-efficacy. Professional Psychology: Research and Practice, 38(3), 314–320. https://doi.org/10.1037/0735-7028.38.3.314

Marsh, H. W., Trautwein, U., Lüdtke, O., Köller, O., & Baumert, J. (2005). Academic self-concept, interest, grades, and standardized test scores: Reciprocal effects models of causal ordering. Child Development, 76(2), 397–416. https://doi.org/10.1111/j.1467-8624.2005.00853.x

Maschi, T., Probst, B., & Bradley, C. (2009). Mapping social work students' perceptions of the research process: A qualitative follow-up study. Journal of Baccalaureate Social Work, 14(2), 63–78.

Mayer, J., & Wellnitz, N. (2013). Die Entwicklung von Kompetenzstrukturmodellen. In D. Krüger, I. Parchmann, & H. Schecker (Eds.), Methoden in der naturwissenschaftsdidaktischen Forschung (pp. 19–29). Berlin Heidelberg: Springer Spektrum. https://doi.org/https://doi.org/10.1007/978-3-642-37827-0_2

McArdle, J. J. (2009). Latent mariable Modeling of differences and changes with longitudinal data. Annual Review of Psychology, 60(1), 577–605. https://doi.org/10.1146/annurev.psych.60.110707.163612

McKinney, K., & Busher, M. (2011). The sociology research experience capstone course at three institutions. Teaching Sociology, 39(3), 290–302. https://doi.org/10.1177/0092055X11407349

Mello-Goldner, D. (2019). Community-based research as an alternative to traditional research courses as a method of promoting undergraduate publication. Frontiers in Psychology, 10, 1012. https://doi.org/10.3389/fpsyg.2019.01012

Meredith, W., & Horn, J. (2001). The role of factorial invariance in modeling growth and change. In L. M. Collins & A. G. Sayer (Eds.), Decade of behavior. New methods for the analysis of change (pp. 203–240). Washington, DC: American Psychological Association.

Merton, R. K. (1973). The Sociology of science. Chicago, IL: The University of Chicago Press.

Meuser, M., & Nagel, U. (2002). ExpertInneninterviews – Vielfach erprobt, wenig bedacht. In A. Bogner, B. Littig, & W. Menz (Eds.), Das Experteninterview: Theorie, Methode, Anwendung (pp. 71–93). Wiesbaden: VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-322-93270-9_3

Meuser, M., & Nagel, U. (2009). The expert interview and changes in knowledge production. In A. Bogner, B. Littig, & W. Menz (Eds.), Interviewing Experts. Research Methods Series (pp. 17–42). Basingstoke: Palgrave Macmillan. https://doi.org/10.1057/9780230244276_2

Moosbrugger, H., & Kelava, A. (2012). Testtheorie und Fragebogenkonstruktion (2nd ed.). Heidelberg: Springer.

Mussel, P. (2010). Epistemic curiosity and related constructs: Lacking evidence of discriminant validity. Personality and Individual Differences, 49(5), 506–510. https://doi.org/10.1016/j.paid.2010.05.014

Mussel, P., Spengler, M., Litman, J. A., & Schuler, H. (2012). Development and validation of the German work-related curiosity scale. European Journal of Psychological Assessment, 28(2), 109–117. https://doi.org/10.1027/1015-5759/a000098

Muthén, L. K., & Muthén, B. O. (2017). Mplus User's Guide. (M. & Muthén, Ed.) (8th ed.). Los Angeles, CA: Muthén & Muthén.

Nevalainen, M. K., Mantyranta, T., & Pitkala, K. H. (2010). Facing uncertainty as a medical student - A qualitative study of their reflective learning diaries and writings on specific themes during the first clinical year. Patient Education and Counseling, 78(2), 218–223. https://doi.org/10.1016/j.pec.2009.07.011

OECD. (2015). Frascati Manual 2015: Guidelines for collecting and reporting data on research and experimental development. The measurement of scientific, technological and innovation activities. Paris: OECD Publishing. https://doi.org/10.1787/9789264239012-en

Oliver, R. (2008). Engaging first year students using a web-supported inquiry-based learning setting. Higher Education, 55(3), 285–301. https://doi.org/10.1007/s10734-007-9055-7

Onwuegbuzie, A. J., & Leech, N. L. (2005). On becoming a pragmatic researcher: The importance of combining quantitative and qualitative research methodologies. International Journal of Social Research Methodology, 8(5), 375–387. https://doi.org/10.1080/13645570500402447

Onwuegbuzie, A. J., & Wilson, V. a. (2003). Statistics anxiety: Nature, etiology, antecedents, effects, and treatments – A comprehensive review of the literature. Teaching in Higher Education, 8(2), 195–209. https://doi.org/10.1080/1356251032000052447

Ostendorf, F., & Angleitner, A. (2004). NEO-PI-R: NEO-Persönlichkeitsinventar nach Costa und McCrae. Revidierte Fassung. Göttingen: Hogrefe Verlag.

Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. Educational Psychology Review, 18(4), 315–341. https://doi.org/10.1007/s10648-006-9029-9

Pekrun, R., & Linnenbrink-Garcia, L. (2012). Academic emotions and student engagement. In S. L. Christenson, A. L. Reschly, & C. Wylie (Eds.), Handbook of Research on Student Engagement (pp. 259–282). New York: Springer.

Pekrun, R., & Linnenbrink-Garcia, L. (2014). International handbook of emotions and education. New York: Routledge. https://doi.org/10.4324/9780203148211

Pekrun, R., & Stephens, E. J. (2012). Academic Emotions. In K. R. Harris, S. Graham, T. Urdan, S. Graham, J. M. Royer, & M. Zeidner (Eds.), APA educational psychology handbook, Vol 2: Individual differences and cultural and contextual factors. (pp. 3–31). Washington: American Psychological Association. https://doi.org/10.1037/13274-001

Phillips, J. C., & Russel, R. K. (1994). Research self-efficacy, the research training environment, and research productivity among graduate students in counseling psychology. The Counseling Psychologist, 22(4), 628–641. https://doi.org/10.1177/0011000094224008

Piaget, J. (1972). The Psychology of the Child. New York: Basic Books.

Postareff, L., & Lindblom-Ylänne, S. (2011). Emotions and confidence within teaching in higher education. Studies in Higher Education, 36(7), 799–813. https://doi.org/10.1080/03075079.2010.483279

Potter, S. J., Caffrey, E. M., & Plante, E. G. (2003). Integrating service learning into the research methods course. Teaching Sociology, 31(1), 38. https://doi.org/10.2307/3211423

Radant, M., & Dalbert, C. (2006). Dimensionen der Komplexitätstoleranz: Ergebnisse einer Synopse von Persönlichkeitskonstrukten. In Vortrag für den 45. Kongress der Deutschen Gesellschaft für Psychologie in Nürnberg, 2005.

Ragin, C. (1994). Constructing social research: The unity and diversity of method. Thousand Oaks, CA: Pine Forge Press.

Rand, J. (2016). Researching undergraduate social science research. Teaching in Higher Education, 21(7), 773–789. https://doi.org/10.1080/13562517.2016.1183621

Reinmann, G., & Mandl, H. (2006). Unterrichten und Lernumgebungen gestalten. In A. Krapp & B. Weidenmann (Eds.), Pädagogische Psychologie (5th ed., pp. 613–658). Weinheim: Beltz Verlag.

Rettberg, G. (2017). Forschendes Lernen entlang fachdidaktischer Prinzipien im Fach Sozialwissenschaften. In R. Schüssler & A. Schöning (Eds.), Forschendes Lernen im Praxissemester. Zugänge Konzepte Erfahrungen (pp. 310–315). Heilbrunn: Julius Klinkhardt.

Revelle, W. (2016). psych: Procedures for psychological, psychometric, and personality research. Retrieved September 16, 2020, from https://cran.r-project.org/package=psych

Rinker, T. (2017). textstem: Tools for stemming and lemmatizing text (Version 0.0.1). Retrieved September 14, 2020, from https://cran.r-project.org/web/packages/textstem/index.html

Robbins, E. J., Kinney, J. M., & Kart, C. S. (2008). Promoting active engagement in health research: Lessons from an undergraduate gerontology capstone course. Gerontology and Geriatrics Education, 29(2), 105–123. https://doi.org/10.1080/02701960802223159

Roberts, B. W., Wood, D., & Smith, J. L. (2005). Evaluating Five Factor Theory and social investment perspectives on personality trait development. Journal of Research in Personality, 39(1), 166–184. https://doi.org/10.1016/j.jrp.2004.08.002

Roberts, L. D. (2016). Editorial: Research methods pedagogy: Engaging psychology students in research methods and statistics. Frontiers in Psychology, 7, 1430. https://doi.org/10.3389/fpsyg.2016.01430

Romney, A. K., Weller, S. C., & Batchelder, W. H. (1986). Culture as consensus: A theory of culture and informant accuracy. American Anthropologist, 88(2), 313–338. https://doi.org/10.1525/aa.1986.88.2.02a00020

Rosen, N. O., Ivanova, E., & Knäuper, B. (2014). Differentiating intolerance of uncertainty from three related but distinct constructs. Anxiety, Stress, and Coping, 27(1), 55–73. https://doi.org/10.1080/10615806.2013.815743

Rueß, J., Gess, C., & Deicke, W. (2016). Forschendes Lernen und forschungsbezogene Lehre: Empirisch gestützte Systematisierung des Forschungsbezugs hochschulischer Lehre. Zeitschrift Für Hochschulentwicklung, 11(2), 23–44.

Russ-Eft, D., & Preskill, H. (2009). Evaluation in organizations: A systematic approach to enhancing learning, performance, and change (2nd ed.). New York: Basic Books.

Russell, S. H., Hancock, M. P., & McCullough, J. (2007). Benefits of undergraduate research experiences. Science, 316(5824), 548–549. https://doi.org/10.1126/science.1140384

Rychen, D. S., & Salganik, L. H. (2003). A holistic model of competence. In D. S. Rychen & L. H. Salganik (Eds.), Key competencies for a successful life and a well-functioning society (pp. 63–108). Cambridge, MA: Hogrefe Huber Publishers.

Scherer, K. R. (2009). The dynamic architecture of emotion: Evidence for the component process model. Cognition & Emotion, 23(7), 1307–1351. https://doi.org/10.1080/02699930902928969

Schiefele, U. (1991). Interest, learning, and motivation. Educational Psychologist, 26(3&4), 299–323. https://doi.org/10.1080/00461520.1991.9653136

Schiefele, U., Köller, O., & Schaffner, E. (2018). Intrinsische und extrinsische Motivation. In D. H. Rost, J. R. Sparfeldt, & S. R. Buch (Eds.), Handwörterbuch Pädagogische Psychologie (5th ed., pp. 309–319). Weinheim/Basel: Beltz.

Schladitz, S., Groß Ophoff, J., & Wirtz, M. (2015). Konstruktvalidierung eines Tests zur Messung bildungswissenschaftlicher Forschungskompetenz. Zeitschrift Für Pädagogik, 61. Beihef, 167–184. Retrieved from rn:nbn:de:0111-pedocs-155098

Schmidt-Atzert, L., & Amelang, M. (2012). Psychologische Diagnostik (5th ed.). Berlin Heidelberg: Springer.

Schneider, M., & Preckel, F. (2017). Variables associated with achievement in higher education: A systematic review of meta-analyses. Psychological Bulletin, 143(6), 565–600. https://doi.org/10.1037/bul0000098

Schön, D. A. (1983). The reflective practitioner - how professionals think in action. New York: Basic Books.

Schorn, A. (2000). The "theme-centered interview". A method to decode manifest and latent aspects of subjective realities. Forum Qualitative Social Research, 1(2). Retrieved from urn:nbn:de:0114-fqs0002236

Schreier, M. (2012). Qualitative content analysis in practice. London: SAGE Publications.

Seymour, E., Hunter, A.-B., Laursen, S. L., & DeAntoni, T. (2004). Establishing the benefits of research experiences for undergraduates in the sciences: First findings from a three-year study. Science Education, 88(4), 493–534. https://doi.org/10.1002/sce.10131

Shank, G., & Brown, L. (2007). Exploring Educational Research Literacy. New York: Routledge.

Sharot, T., Delgado, M. R., & Phelps, E. A. (2004). How emotion enhances the feeling of remembering. Nature Neuroscience, 7, 1376–1380. https://doi.org/10.1038/nn1353

Silén, C., & Uhlin, L. (2008). Self-directed learning – a learning issue for students and faculty! Teaching in Higher Education, 13(4), 461–475. https://doi.org/10.1080/13562510802169756

Silvia, P. J. (2006). Exploring the Psychology of Interest. Oxford: Oxford University Press.

Silvia, P. J. (2008). Interest – the curious Emotion. Current Directions in Psychological Science, 17(1), 57–60. https://doi.org/10.1111/j.1467-8721.2008.00548.x

Sinatra, G. M., Broughton, S. H., & Lombardi, D. (2014). Emotions in science education. In R. Pekrun & L. Linnenbrink-Garcia (Eds.), International Handbook of Emotions in Education (pp. 415–436). New York: Routledge.

Siriseriwan, W. (2017). smotefamily: A collection of oversampling techniques for class imbalance problem based on SMOTE (Version 1.1). Retrieved September 14, 2020, from https://cran.r-project.org/web/packages/smotefamily/index.html

Slavin, R. E. (2008). Perspectives on evidence-based research in education. What works? Issues in synthesizing educational program evaluations. Educational Researcher, 37(1), 5–14. https://doi.org/10.3102/0013189X08314117

Slavin, R. E. (2009). Educational psychology – Theory and practice (9th ed.). New Jersey: Pearson Education.

Snellman, C. L. (2015). University in knowledge society: Role and challenges. Journal of System and Management Sciences, 5(4), 84–113.

Snow, R. E. (1994). Abilities in academic tasks. In R. J. Sternberg & R. K. Wagner (Eds.), Mind in context: Interactionist perspectives on human intelligence (pp. 3–37). Cambridge, MA: Cambridge University Press.

Sorić, I., & Palekčić, M. (2009). The role of students' interests in self-regulated learning: The relationship between students' interests, learning strategies and causal attributions. European Journal of Psychology of Education, 24(4), 545–565. https://doi.org/10.1007/BF03178767

Spronken-Smith, R. (2010). Undergraduate research and inquiry-based learning: Is there a difference? Insights from research in New Zealand. CUR, Quarterly SUMMER 2010, 30(4), 28–35.

Spronken-Smith, R. (2012). Experiencing the process of knowledge creation: The nature and use of inquiry-based learning in higher education. International Colloquium on Practices for Academic Inquiry. University of Otago, 1–17. Retrieved from https://ako.ac.nz/assets/Knowledge-centre/inquiry-based-learning/SUMMARY-REPORT-Inquiry-based-Learning.pdf

Spronken-Smith, R., Walker, R., Batchelor, J., O'Steen, B., & Angelo, T. (2012). Evaluating student perceptions of learning processes and intended learning outcomes under inquiry approaches. Assessment & Evaluation in Higher Education, 37(1), 57–72. https://doi.org/10.1080/02602938.2010.496531

Stanford, J. S., Rocheleau, S. E., Smith, K. P. W., & Mohan, J. (2017). Early undergraduate research experiences lead to similar learning gains for STEM and Non-STEM undergraduates. Studies in Higher Education, 42(1), 115–129. https://doi.org/10.1080/03075079.2015.1035248

Stark, R., & Mandl, H. (2000). Training in empirical research methods: Analysis of problems and intervention from a motivational perspective. In J. Heckhausen (Ed.), Motivational Psychology of Human Development (pp. 165–183). Amsterdam: Elsevier. https://doi.org/10.1016/S0166-4115(00)80011-4

Stark, R., Puhl, T., & Krause, U.-M. (2009). Improving scientific argumentation skills by a problem-based learning environment: Effects of an elaboration tool and relevance of student characteristics. Evaluation & Research in Education, 22(1), 51–68. https://doi.org/10.1080/09500790903082362

Stark, R., Tyroller, M., Krause, U.-M., & Mandl, H. (2008). Effekte einer metakognitiven Promptingmaßnahme beim situierten, beispielbasierten Lernen im Bereich Korrelationsrechnung. Zeitschrift Für Pädagogische Psychologie, 22(1), 59–71. https://doi.org/10.1024/1010-0652.22.1.59

Statistisches Bundesamt. (2019). Bildung und Kultur - Prüfung an Hochschulen 2018. Fachserie 11 Reihe 4.2. https://doi.org/10.30965/9783657781065_008

Stavemann, H. H., & Yvonne, H. (2016). Integrative KVT bei Frustrationsintoleranz. Weinheim Basel: Beltz Verlag. Retrieved from https://docplayer.org/70679200-Leseprobe-aus-stavemann-huelsner-integrative-kvt-bei-frustrationsintoleranz-isbn-beltz-verlag-weinheim-basel.html

Stecher, B. M., & Hamilton, L. S. (2014). Measuring hard-to-measure student Competencies: A research and development plan. Santa Monica, CA: Rand Corporation.

Stupnisky, R. H., Pekrun, R., & Lichtenfeld, S. (2016). New faculty members' emotions: A mixed-method study. Studies in Higher Education, 41(7), 1167–1188. https://doi.org/10.1080/03075079.2014.968546

Subramaniam, K., Kounios, J., Parrish, T. B., & Jung-Beeman, M. (2009). A brain mechanism for facilitation of insight by positive affect. Journal of Cognitive Neuroscience, 21(3), 415–432. https://doi.org/10.1162/jocn.2009.21057

Taraban, R., & Logue, E. (2012). Academic factors that affect undergraduate research experiences. Journal of Educational Psychology, 104(2), 499–514. https://doi.org/10.1037/a0026851

Terzer, E., Hartig, J., & zu Belzen, A. (2013). Systematische Konstruktion eines Tests zu Modellkompetenz im Biologieunterricht unter Berücksichtigung von Gütekriterien. Zeitschrift Für Didaktik Der Naturwissenschaften, 19, 51–76.

Thiel, F., & Böttcher, F. (2014). Modellierung fächerübergreifender Forschungskompetenzen: Das RMKR-W-Modell als Grundlage der Planung und Evaluation von Formaten forschungsorientierter Lehre. In B. Berendt, A. Fleischmann, N. Schaper, B. Szczyrba, & J. Wildt (Eds.), Neues Handbuch Hochschullehre (pp. 109–125). Berlin: Raabe.

Thiem, J., Preetz, R., & Haberstroh, S. (2020). Forschendes Lernen im Student Life-cycle – Eine Panelstudie zur Weiterentwicklung des Lehrprofils der Universität Oldenburg. In P. Pohlenz, L. Mitterauer, & S. Harris-Huemmert (Eds.), Der Student Life-cycle als Gegenstand von Studierendenbefragungen - Funktionen, Chancen & Perspektiven für das Hochschulqualitätsmanagement (pp. 83–96). Berlin: Waxmann.

Townsend, M. (2011). Motivation, learning and instruction. In C. M. Rubie-Davies (Ed.), Educational psychology: Concepts, research and challenges (pp. 118–133). New York: Routledge.

Trigwell, K., Ellis, R. A., & Han, F. (2012). Relations between students' approaches to learning, experienced emotions and outcomes of learning. Studies in Higher Education, 37(7), 811–824. https://doi.org/10.1080/03075079.2010.549220

Tuckman, B. W. (1965). Developmental sequence in small groups. Psychological Bulletin, 63(6), 384–399. https://doi.org/10.1037/h0022100

Tuszynski, J. (2014). caTools: Tools: Moving window statistics, GIF, Base64, ROC AUC, etc (Version 1.17.1). Retrieved September 14, 2020, from https://cran.r-project.org/web/packages/caTools/index.html

Välimaa, J., & Hoffman, D. (2008). Knowledge society discourse and higher education. Higher Education, 56(3), 265–285. https://doi.org/10.1007/s10734-008-9123-7

Vicens, Q., & Bourne, P. E. (2009). Ten simple rules to combine teaching and research. PLoS Computational Biology, 5(4), 4–5. https://doi.org/10.1371/journal.pcbi.1000358

Vieyra, M., Gilmore, J., & Timmerman, B. (2011). Requiring research may improve retention in STEM fields for underrepresented women. Council on Undergraduate Research Quarterly, 32(1), 13–19.

Vittengl, J. R., Bosley, C. Y., Brescia, S. A., Eckardt, E. A., Neidig, J. M., Shelver, K. S., & Sapenoff, L. A. (2004). Why are some undergraduates more (and others less) interested in psychological research? Teaching of Psychology, 31(2), 91–97. https://doi.org/10.1207/s15328023top3102

Wallerstein, N., & Duran, B. (2017). The theoretical, historical, and practice roots of CBPR. In N. Wallerstein, B. Duran, J. G. Oetzel, & M. Minkler (Eds.), Community-based participatory research for health: Advancing social and health equity (pp. 17–29). San Francisco: Jossey-Bass.

Ward, C., Bennett, J. S., & Bauer, K. W. (2003). Content analysis of undergraduate research student evaluation. Retrieved September 18, 2020, from http://www1.udel.edu/RAIRE/Content.pdf

Weinert, F. E. (2001). Concept of competence: A conceptual clarification. In D. S. Rychen & L. H. Salganik (Eds.), Defining and Selecting Key Competencies (pp. 45–66). Seattle: Hogrefe & Huber Publishers.

Wellington, J. (2015). Educational research: Contemporary issues and practical approaches. (2nd ed.). London: Bloomsbury Publishing.

Wessels, I., Rueß, J., Jenßen, L., Gess, C., & Deicke, W. (2018). Beyond cognition: Experts' views on affective-motivational research dispositions in the social sciences. Frontiers in Psychology, 9, 1300. https://doi.org/10.3389/fpsyg.2018.01300

Whipple, E. E., Hughes, A., & Bowden, S. (2015). Evaluation of a BSW research experience: Improving student research competency. Journal of Teaching in Social Work, 35(4), 397–409. https://doi.org/10.1080/08841233.2015.1063568

Widdowfield, R. (2000). The place of emotions in academic research. Area, 322, 199–208. https://doi.org/10.1111/j.1475-4762.2000.tb00130.x

Wild, F. (2015). lsa: Latent Semantic Analysis (Version 0.73.1). Retrieved September 14, 2020, from https://cran.r-project.org/web/packages/lsa/index.html

Wildt, J. (2006). Kompetenzen als „Learning Outcome". Journal Hochschuldidaktik, 17(1), 6–9.

Wildt, J. (2009). Forschendes Lernen: Lernen im „Format" der Forschung. Journal Hochschuldidaktik, 20(2), 4–6.

Williams, M., Payne, G., Hodgkinson, L., & Poade, D. (2008). Does British sociology count?: Sociology students' attitudes toward quantitative methods. Sociology, 42(5), 1003–1021. https://doi.org/10.1177/0038038508094576

Willison, J., & O'Regan, K. (2007). Commonly known, commonly not known, totally unknown: A framework for students becoming researchers. Higher Education Research & Development, 26(4), 393–409. https://doi.org/10.1080/07294360701658609

Wilson, M. (2005). Constructing measures: An item response modeling approach. Mahwah, NJ: Lawrence Erlbaum.

Wissenschaft im Dialog. (2018). Wissenschaftsbarometer 2018. Berlin: WiD. Retrieved from https://www.wissenschaft-im-dialog.de/fileadmin/user_upload/Projekte/Wissenschaftsbarometer/Dokumente_18/Downloads_allgemein/Broschuere_Wissenschaftsbarometer2018_Web.pdf

Wissenschaftsrat. (2006). Empfehlungen zur künftigen Rolle der Universitäten im Wissenschaftssystem. Berlin. Retrieved from https://www.wissenschaftsrat.de/download/archiv/7067-06.pdf

Wood, W. B. (2003). Inquiry-based undergraduate teaching in the life sciences at large research universities: A perspective on the Boyer Commission Report. Cell Biology Education, 2(2), 112–116. https://doi.org/10.1187/cbe.03-02-0004

Woodzicka, J. A., Ford, T. E., Caudill, A., & Ohanmamooreni, A. (2015). A successful model of collaborative undergraduate research: A multi-faculty, multi-project, multi-institution team approach. Teaching of Psychology, 42(1), 60–63.

Zeidner, M. (2007). Test anxiety in educational contexts: Concepts, findings, and future directions. In P. A. Schutz & R. Pekrun (Eds.), Emotion in Education (pp. 165–184). San Diego, CA: Elsevier Academic Press.

Ziegler, M. (2014a). Looking at intelligence from so-called noncognitive traits: Be open to change. Journal of Intelligence, 2(1), 1–3. https://doi.org/10.3390/jintelligence2010001

Ziegler, M. (2014b). Stop and state your Intentions! Let's not forget the ABC of test construction. European Journal of Psychological Assessment, 30(4), 239–242. https://doi.org/10.1027/1015-5759/a000228

Ziegler, M., Schroeter, T. A., Lüdtke, O., & Roemer, L. (2018). The enriching interplay between openness and interest: A theoretical elaboration of the OFCI model and a first empirical test. Journal of Intelligence, 6(3), 1–22. https://doi.org/10.3390/jintelligence6030035

Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. Contemporary Educational Psychology, 25, 82–91. https://doi.org/10.1006/ceps.1999.1016

Zlatkin-Troitschanskaia, O., Pant, H. A., & Greiff, S. (2019). Assessing generic and domain-specific academic competencies in higher education. Zeitschrift Für Pädagogische Psychologie, 33(2), 91–93. https://doi.org/10.1024/1010-0652/a000236

Zlatkin-Troitschanskaia, O., & Seidel, J. (2011). Kompetenz und ihre Erfassung – Das neue "Theorie-Empirie-Problem" der empirischen Bildungsforschung? In O. Zlatkin-Troitschanskaia (Ed.), Stationen Empirischer Bildungsforschung (pp. 218–233). Wiesbaden: VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-531-94025-0

Zlatkin-Troitschanskaia, O., Shavelson, R. J., & Kuhn, C. (2015). The international state of research on measurement of competency in higher education. Studies in Higher Education, 40(3), 393–411.

ZuS. (2020). Lehrer*Innen-Bildungsmonitorung. Retrieved September 16, 2020, from https://zus.uni-koeln.de/qs-makro.html

Zylka, J., Christoph, G., Kroehne, U., Hartig, J., & Goldhammer, F. (2015). Moving beyond cognitive elements of ICT literacy: First evidence on the structure of ICT engagement. Computers in Human Behavior, 53, 149–160.

Appendix

Appendix A Interview Guide for the Expert Interviews

Ziel: Identifikation affektiv-motivationaler Forschungsdispositionen

Methode: Kombination narrativer und themenzentrierter Interviewfragen; leitfadengestützt

Gesprächspartner_innen: Erfahrene Hochschullehrer und Leiter_innen von studentischen Forschungsprojekten, aus den Sozialwissenschaften

Dauer: ca. 45 Minuten

Instruktion zum Verlauf des Interviews

Dieses Interview wird zur späteren Datenauswertung aufgezeichnet. Sollten Sie damit nicht einverstanden sein, so sagen Sie das bitte. Zugriff zu den Aufnahmen dieses Interviews haben nur die unmittelbar an diesem Projekt beteiligten Personen; mit jeglichen Informationen gehen wir selbstverständlich vertraulich um. Eine Verwertung der von Ihnen genannten Inhalte erfolgt anonymisiert.

Die Dauer dieses Interviews beträgt etwa 45 Minuten. In einem ersten Teil möchte ich vor allem über Ihre persönlichen Erfahrungen mit forschenden Studierenden sprechen. Mich interessiert dabei besonders, wie sich unterschiedliche Studierende in Forschungswerkstätten und im Verlauf der Erstellung von Forschungsarbeiten verhalten. Erzählen Sie ruhig frei heraus und berichten Sie von bestimmten Situationen oder Studierenden, die Ihnen besonders in Erinnerung geblieben sind.

Im zweiten Teil dieses Interviews möchte ich konkret über die Motivationsstrukturen Ihrer Studierenden reden. Es sollen Kompetenzen beleuchtet werden, die über das reine Wissen um Methoden und Forschungsprozess hinausgehen.

Abschnitt 1: Einstieg

Sie haben viele Erfahrungen mit forschenden Studierenden. Sie betreuen Abschlussarbeiten, bieten eine Forschungswerkstatt/ ein Forschungskolloquium an und haben vielleicht auch in Forschungsprojekten mit studentischen Hilfskräften zusammengearbeitet.

1. Wie viele Abschlussarbeiten haben Sie in etwa schon betreut (ggf. pro Jahr schätzen lassen)?
2. Wie viele Forschungsseminare bzw. -kolloquien haben Sie schon durchgeführt?

Abschnitt 2 – narrativ: Forschungskompetenzen allgemein

Erzählen Sie mir bitte – zunächst ganz offen – von Ihren Erfahrungen mit forschenden Studierenden.

1. Ist Ihnen dabei ein/e Student/in im Gedächtnis geblieben oder besonders aufgefallen?
2. Fällt Ihnen ein/e bestimmte/r Student/in ein, die/ der besonders gut forschen konnte? Was zeichnete diese/n Student/in aus?
3. Fällt Ihnen ein/e bestimmte/r Student/in ein, die/ der weniger gut forschen konnte? Was fehlte dieser/ diesem Student/in im Vergleich zu anderen Studierenden?
4. Können Sie sich an eine/n Student/in erinnern, die/ der freiwillig mehr an ihrer/ seiner Forschungsarbeit gearbeitet hat, als gefragt oder verpflichtend war? Warum glauben Sie, dass die/ der Student/in mehr gearbeitet hat?

Überleitung: Motivationale Aspekte aus der letzten Antwort des Interviewpartners aufgreifen; vom Anekdotischen zum Abstrakten

Abschnitt 3 – themenzentriert: Motivationale, affektive und soziale Kompetenzen in der Forschung

Motivationales

1. Welche Rolle spielt die Motivation von Studierenden, wenn sie eine Forschungsfrage bearbeiten oder ein Forschungsprojekt durchführen? Woran machen Sie das fest?
2. Woran erkennen Sie einen besonders motivierten Studierenden?
3. Was motiviert Studierende überhaupt zum Forschen?
4. Was demotiviert Studierende im Forschungsprozess?
5. Warum gelingt es teilweise nicht, die Studierenden zum Forschen zu motivieren? Ist es Ihnen schon einmal gelungen Studierende ganz besonders zu motivieren?

Affektives

1. Zeigen Studierende beim Forschen Emotionen? Welche?
2. An welchen Stellen des Forschungsprozesses spielen Emotionen von Studierenden überhaupt eine Rolle?
3. Welche Emotionen der Studierenden sind wichtig für das Gelingen von Forschungsvorhaben?
4. Haben Sie schon einmal erlebt, dass (evtl. fehlende) Emotionen die Forschung von Studierenden behindert haben?
5. (Wie kann ich als Lehrender mit den Emotionen meiner Studierenden im Forschungsprozess umgehen?)

Soziales

1. Welche sozialen Fähigkeiten brauchen Studierende beim Forschen?
2. An welchen Stellen im Forschungsprozess sind soziale Fähigkeiten für Studierende besonders wichtig?

Abschnitt 4: Bilanzierungsphase

1. Wenn Sie das mal zusammenfassen würden, worüber wir in der letzten (halben) Stunde gesprochen haben, was zeichnet dann eine forschende Haltung aus? Gibt es einen forschenden Habitus?
2. Hätten Sie im Rahmen dieses Interviews eine bestimmte Frage erwartet, die ich nicht gestellt habe?
3. Können Sie uns andere Gesprächspartner nennen/empfehlen?
4. Haben Sie Interesse an den Ergebnissen der Interview-Studie?
5. Hätten Sie Interesse den Test zu diskutieren, den wir basierend auf der Interview-Studie entwickeln werden?
6. Haben Sie noch eine Frage?

Abschnitt 5: Ausstieg

Für Teilnahme am Interview danken

Verabschiedung

Appendix B Scales and Item Values After the Pilot Study

B.1 Development and general properties of the instruments

All instruments to assess the affective-motivational research dispositions were developed by following the principles of test construction. For each disposition, a large number of items was constructed out of which 20 were chosen to be studied empirically in a pilot study. Based on the pilot study with *N*=248 students from different bachelor's and master's programmes in the social sciences (educational sciences, psychology, political sciences, communication sciences), the final items for each disposition were selected. The final scales for each disposition are given in the following. Any psychometric criteria reported here are based on data from the pilot study.

All items are rated on a 5-point scale from 1 = *trifft nicht zu* ("is not true"); 5 = *trifft zu* ("is true"). There are both positive and negative items. Thus, inverting some of the items (indicated by an asterisk) is necessary before analyzing the scales as a whole. For each disposition, the construct's description, the original German instructions, and items are given.

B.2 Frustration tolerance

Frustration tolerance in the research process means not allowing setbacks to inhibit action or impair the self-concept as a researcher. This means that the emotions triggered by setbacks are regulated in such a way that productive further work is possible.

The 8 items of the scale address the phases of the research process that are central to this construct: literature research, data collection and analysis, and interaction with the supervisor. The items reflect the productive (positive items) and inhibitory (negative items) handling of setbacks in the research process.

Positive items: 1, 5, 6, 8

Negative items: 2, 3, 4, 7

Negative items must be recoded accordingly before analysis. Cronbach's Alpha for the pilot sample is $\alpha = 0.77$.

Im Folgenden schildern wir Ihnen herausfordernde Situationen, die im Laufe eines Forschungsprozesses auftreten können. Wie reagieren Sie in solchen Situationen? Falls Sie einige der Situationen selbst noch nicht erlebt haben, versuchen Sie bitte, sich dennoch in diese Situationen hineinzuversetzen.

		Item in der Pilotstudie	*N*	*M*	*SD*	Trennschärfe
1.	*Wenn ich einen komplizierten Text, den mir meine Betreuerin empfohlen hat, auch nach mehrmaligem Lesen nicht verstehe, bleibe ich ruhig und versuche es noch einmal.*	FT_02	163	3.42	0.98	.381
2.	*Wenn ich Daten, die ich selbst erhoben habe, durch ein Computerproblem verlieren würde, hätte ich keine Lust mehr, weiterzuarbeiten.*	FT_06*	153	2.88	1.19	.427
3.	*Wenn mein Betreuer ständig Kritik an meinen Analysen übt, könnte ich verzweifeln.*	FT_12*	157	2.66	1.11	.532
4.	*Wenn sich meine Datenauswertung als fehlerhaft erweist und ich noch einmal von vorne anfangen muss, würde ich wahrscheinlich verzweifeln.*	FT_16*	159	2.94	1.13	.652
5.	*Wenn ich Probleme habe, Leute für meine Datenerhebung zu gewinnen, gebe ich trotzdem nicht auf.*	FT_18	160	4.00	0.81	.369
6.	*Wenn ich am Ende meiner Datenauswertung bemerke, dass ich einen groben Fehler gemacht habe, behalte ich einen kühlen Kopf und suche nach Lösungen für mein Problem.*	FT_21	156	3.52	0.926	.567
7.	*Wenn ich einen komplizierten Text einfach nicht verstehen kann, fühle ich mich unfähig.*	FT_23*	162	2.85	1.25	.360
8.	*Wenn meine Betreuerin anmerkt, dass ich viel zu viel in meine Forschungsergebnisse reininterpretiert habe, überarbeite ich das entsprechende Kapitel in aller Ruhe.*	FT_24	159	3.76	0.87	.494

B.3 Complexity tolerance

Complexity tolerance describes the extent to which complex situations in the research process are perceived as interesting or stressful. The assessment of complexity influences the subsequent handling; complexity is either specifically sought out and analysed or avoided.

The 8 items of the scale address the phases of the research process that are central to this construct: the literature research and the evaluation of the data. The items reflect complexity-tolerant (positive items) and complexity-intolerant (negative items) behaviour in the research process.

Positive Items: 1, 3, 5, 6, 8

Negative Items: 2, 4, 7

Negative items must be recoded accordingly before analysis. Cronbach's Alpha for the pilot sample is $\alpha = 0.75$.

Im Folgenden schildern wir Ihnen herausfordernde Situationen, die im Laufe eines Forschungsprozesses auftreten können. Wie reagieren Sie in solchen Situationen? Falls Sie einige der Situationen selbst noch nicht erlebt haben, versuchen Sie bitte, sich dennoch in diese Situationen hineinzuversetzen.

		Item in der Pilotstudie	*N*	*M*	*SD*	Trennschärfe
1.	*Wenn ich bei der Literarturrecherche merke, dass der Forschungsstand zu meinem Thema widersprüchlich ist, spornt mich das an, mehr über die Hintergründe zu erfahren.*	KTi_04	158	3.77	0.95	.505
2.	*Wenn ich beim Aufarbeiten der Hintergrundliteratur merke, dass die Kernaussagen der Autor_innen nicht zusammenpassen, finde ich das belastend.*	KTi_05*[10]	--	--	--	--
3.	*Wenn meine Datenauswertung zu überraschenden Zwischenergebnissen führt, untersuche ich diese Unregelmäßigkeiten im Detail.*	KTi_07	143	3.90	0.87	.335
4.	*Wenn sich durch eine forschungsmethodische Empfehlung meiner Betreuerin plötzlich viele neue Möglichkeiten auftun, fühle ich mich durch die entstehende Komplexität stark beunruhigt.*	KTi_10*	154	3.13	0.93	.433
5.	*Wenn ich bei der Suche nach einer Forschungslücke auf eine komplizierte Literaturlage mit vielen abweichenden Perspektiven treffe, reizt es mich, die Hintergründe zu durchdringen.*	KTi_11	150	3.57	0.90	.618
6.	*Wenn ich bei meiner Datenauswertung merke, dass die Ergebnisse nicht erwartungskonform sind, will ich gleich herausfinden, woran das liegt.*	KTi_13	158	4.03	0.79	.357
7.	*Wenn sich bei der Auswertung von Daten plötzlich neue Aspekte auftun, befürchte ich ein großes Durcheinander.*	KTi_14*	156	3.22	1.00	.400
8.	*Wenn beim Aufarbeiten der Literatur die bisherigen Ergebnisse überhaupt nicht zusammenpassen, will ich durchschauen, woran das liegt.*	KTi_16	154	4.06	0.76	.613

[10] The original item Kti_05 was positive. To establish a balance between positive and negative items for the final scale, it was reformulated to be negative. Thus, there is no data available for this new item.

B.4 Uncertainty tolerance

Uncertainty tolerance in the research process refers to the ability to endure and accept uncertainties inherent in research. These uncertainties arise because research processes are largely unpredictable. In particular, the uncertainty resulting from the absence of definitive truths must be tolerated.

The 8 items of the scale address the central phases of the research process, from starting the research process by finding a question to collecting and evaluating the data. The items reflect the toleration (positive items) and rejection (negative items) of uncertainty in the research process.

Positive Items: 1, 4, 6, 8

Negative Items: 2, 3, 5, 7

Negative items must be recoded accordingly before analysis. Cronbach's Alpha for the pilot sample is $\alpha = 0.81$.

Im Folgenden schildern wir Ihnen herausfordernde Situationen, die im Laufe eines Forschungsprozesses auftreten können. Wie reagieren Sie in solchen Situationen? Falls Sie einige der Situationen selbst noch nicht erlebt haben, versuchen Sie bitte, sich dennoch in diese Situationen hineinzuversetzen.

		Item in der Pilotstudie	***N***	***M***	***SD***	**Trennschärfe**
1.	*Mich motiviert es, dass in meiner Forschung nicht immer alles planbar ist.*	UnT_01	159	3.30	1.11	.553
2.	*Ich finde es beunruhigend, dass ich vor Beginn meines Forschungsprojekts nicht weiß, ob alles klappt, wie ich mir das vorstelle.*	UnT_05*	160	3.11	1.15	.635
3.	*Wenn ich mir nicht sicher bin, welche Methoden ich zur Auswertung meiner Daten anwenden sollte, dann belastet mich das.*	UnT_07*	157	2.408	0.97	.427
4.	*Ich finde es unglaublich motivierend, dass ich bei meinen Erhebungen im Feld nicht immer alles genau planen kann.*	UnT_10	157	3.19	1.09	.549
5.	*Wenn ich die Wahl hätte, würde ich lieber vorher wissen, ob meine Erhebung funktioniert, als mich überraschen zu lassen.*	UnT_18*	158	2.50	1.30	.504
6.	*Ich finde es spannend, wenn ich vor Beginn meines Forschungsvorhabens nicht abschätzen kann, was am Ende eigentlich rauskommen wird.*	UnT_19	157	3.45	1.05	.493
7.	*Wenn ich nicht weiß, welche Forschungsfrage ich wählen soll, weil ich die Ergebnisse kaum absehen kann, fühle ich mich unwohl.*	UnT_20*	153	3.00	1.15	.530
8.	*Wenn ich für die Datenauswertung eine Methode benötige, von der ich noch nie gehört habe, empfinde ich das als eine schöne Herausforderung.*	UnT_21	157	3.39	1.09	.473

B.5 Finding joy in conducting research

The disposition joy in conducting research describes the positive affect experienced from engaging in different research activities.

The 10 items on the scale represent the entire research process, from generating a research question to communicating the results in verbal of written forms of presentation. The items on this scale were rated differently from all other scales with 1 = *macht mir überhaupt keinen Spaß* ("I do not enjoy this at all"); 5 = *macht mir sehr viel Spaß* (" I enjoy this very much").

Since all items are formulated positively, no recoding is necessary. Cronbach's Alpha for the pilot sample is $\alpha = 0.75$.

Im Folgenden schildern wir Ihnen verschiedene Forschungstätigkeiten, die einem mehr oder auch weniger Spaß machen können. Falls Sie manche Tätigkeiten selbst noch nicht durchgeführt haben, versuchen Sie bitte sich dennoch in diese Tätigkeiten hineinzuversetzen.

		Item in der Pilotstudie	*N*	*M*	*SD*	Trenn-schärfe
1.	*eine eigene Forschungsfrage entwickeln*	Freu_01	160	3.67	1.049	.582
2.	*Literatur zu einem Forschungsfeld recherchieren*	Freu_02	161	3.36	1.099	.362
3.	*wissenschaftliche Artikel zu einem Forschungsfeld lesen*	Freu_03	160	3.63	.937	.412
4.	*ein Forschungsdesign/ einen Untersuchungsplan entwickeln*	Freu_04	158	3.32	1.072	.465
5.	*Daten empirisch erheben (z.B. messen, befragen, interviewen, testen)*	Freu_05	160	3.56	1.109	.186
6.	*Daten auswerten*	Freu_06	161	3.13	1.266	.395
7.	*aus neuen Erkenntnissen Schlussfolgerungen ziehen*	Freu_07	161	4.30	.723	.520
8.	*bestehende Theorien meines Faches weiterentwickeln*	Freu_08	155	3.97	.848	.486
9.	*neue Erkenntnisse vor einer Gruppe präsentieren*	Freu_09	160	3.36	1.276	.341
10.	*wissenschaftliche Texte schreiben*	Freu_10	159	3.07	1.186	.497

B.6 Research interest

Research interest includes beliefs about the value and benefits of research. Research is seen as suitable for generating knowledge for the discipline, finding personal explanations, or solving problems relevant to social practice.

The scale has 6 items that equally reflect three different contexts of research that can spark an interest.

Research produces findings in its discipline: 2, 4

Research has personal significance: 3, 5

Research in one's own discipline has social relevance: 1, 6

Since all items are formulated positively, no recoding is necessary. Cronbach's Alpha for the pilot sample is $\alpha = 0.76$.

Zur Frage, für wie wichtig man Forschung hält, kann man ganz unterschiedlicher Auffassung sein. Uns interessiert nun, was Sie darüber denken.

		Item in der Pilotstudie	*N*	*M*	*SD*	Trennschärfe
1.	*Forschung in meinem Fach hilft dabei, gesellschaftliche Probleme der Gegenwart zu lösen.*	Wert_02	159	4.01	.889	.634
2.	*Nur durch Forschung kann in meinem Fach das bestehende Wissen erweitert werden.*	Wert_03	159	3.96	1.099	.493
3.	*Im Vergleich zu anderen Themen messe ich der Forschung eine große Bedeutung bei.*	Wert_04	156	3.29	1.011	.577
4.	*Die Forschung in meinem Fach ist nützlich, weil man durch Forschung interessante Erkenntnisse erzielen kann.*	Wert_07	162	4.32	.736	.531
5.	*Mir ist Forschung wichtiger als anderen Leuten.*	Wert_10	150	2.57	1.271	.369
6.	*Wenn es in meinem Fach keine Forschung geben würde, könnten viele gesellschaftliche Probleme nicht gelöst werden.*	Wert_12	157	3.38	1.101	.528

B.7 Specific epistemic curiosity

Specific epistemic curiosity describes the motivational state of wanting to find answers to open questions. This state expresses itself in the urge to learn more about a topic, which is satisfied by finding knowledge. Successfully generated insights create positive affect. This is the basic motivational prerequisite for starting a research activity.

The origin of the open questions that trigger curiosity can be the subject, society, or the student him- or herself. The items are constructed according to these dimensions.

Science: items 1, 4, 6

Society: items 3, 5, 8

Own questions: items 2, 7, 9

Since all items are formulated positively, no recoding is necessary. Cronbach's Alpha for the pilot sample is $\alpha = 0.83$.

Im Folgenden schildern wir Ihnen verschiedene Situationen, in denen Sie Neugier für bestimmte Fragen entwickeln können. Falls Sie manche Situationen selbst noch nicht erlebt haben, versuchen Sie bitte sich dennoch in diese Situationen hineinzuversetzen.

		Item in der Pilot-studie	*N*	*M*	*SD*	Trenn-schärfe
1.	*Wenn ich einen Widerspruch in der Forschungsliteratur entdecke, muss ich unbedingt mehr darüber erfahren.*	Neug_01	166	3.65	0.97	.552
2.	*Durch das Lesen von Artikeln oder Lehrbüchern meines Fachs entstehen bei mir oft eigene Fragen, zu denen ich dann unbedingt mehr lesen muss.*	Neug_02	165	3.62	1.00	.673
3.	*Über gesellschaftliche Probleme, die die Wissenschaft noch nicht zufriedenstellend gelöst hat, will ich unbedingt mehr erfahren.*	Neug_03	165	4.07	0.92	.530
4.	*Wenn ich mit der Erklärung für ein Problem in meinem Fach nicht zufrieden bin, halte ich nicht still, bis ich mehr darüber erfahren habe.*	Neug_04	164	3.31	0.98	.557
5.	*Praktische Probleme, für die die Wissenschaft noch keine Antwort hat, lassen bei mir den Wunsch entstehen, mich da tiefer reinzudenken.*	Neug_11	162	3.62	1.00	.447
6.	*Wenn ich auf eine offene Fragestellung in meinem Fach stoße, entsteht bei mir der Drang, sofort mehr darüber erfahren zu wollen.*	Neug_12	162	3.36	0.94	.640
7.	*Bei Diskussionen in Uni-Seminaren entstehen bei mir oft Fragen, zu denen ich auf jeden Fall mehr erfahren möchte.*	Neug_13	164	3.45	0.94	.407
8.	*Wenn mir ein gesellschaftliches Problem auffällt, zu dem ich bisher nichts wusste, möchte ich mich unbedingt dazu informieren.*	Neug_14	165	4.05	0.83	.499
9.	*Wenn mir in einer Vorlesung neue Ideen zum Thema kommen, die nicht ausreichend besprochen werden, kann ich nicht anders als mehr darüber zu lesen.*	Neug_15	163	3.28	0.95	.548

B.8 Acceptance of divergent perspectives

The disposition acceptance of divergent perspectives denotes the ability to respect and consider perspectives that do not conform to a student's own point of view. This also includes the ability to adapt the contents of one's research to different audiences and present one's findings in a factual way without suppressing one's genuine enthusiasm for the project.

The 8 items of the scale express either the acceptance or the rejection of divergent perspectives.

Positive Items: 2, 4, 6, 8

Negative Items: 1, 3, 5, 7

Negative items must be recoded accordingly before analysis. Cronbach's Alpha for the pilot sample is $\alpha = 0.77$.

Im Folgenden schildern wir Ihnen verschiedene Situationen, in denen Ihr Forschungsprojekt von Mitstudierenden oder Fachfremden aus ihren jeweiligen Blickwinkeln betrachtet und bewertet wird. Falls Sie manche Situationen selbst noch nicht erlebt haben, versuchen Sie bitte sich dennoch in diese Situationen hineinzuversetzen.

		Item in der Pilot-studie	*N*	*M*	*SD*	Trenn-schärfe
1.	*Fachfremde können die Sinnhaftigkeit meines Forschungsvorhabens nicht beurteilen.*	Pers_02*	146	3.55	1.00	.453
2.	*Fruchtbare Diskussionen zu meinem Forschungsthema können vor allem dann entstehen, wenn Studierende aus unterschiedlichen Disziplinen daran teilnehmen.*	Pers_04	155	3.74	1.08	.361
3.	*Wenn Berufspraktiker mir Anregungen für mein Forschungsprojekt geben, kann ich nichts damit anfangen, solange diese Anregungen nicht wissenschaftlich fundiert sind.*	Pers_05*	148	4.11	0.86	.528
4.	*Das eigene Vorhaben auch mal aus der Perspektive der beruflichen Praxis zu betrachten, kann interessante Impulse bieten.*	Pers_06	153	4.41	0.85	.425
5.	*Mein Forschungsthema mit Laien zu diskutieren, bringt mir nichts.*	Pers_07*	151	4.11	0.91	.529
6.	*Empfehlungen von Forschern anderer Disziplinen sind eine große Hilfe für die eigene Forschung.*	Pers_09	148	3.95	0.98	.485
7.	*Mit Studierenden anderer Fächer über meine Abschlussarbeit zu diskutieren ist reine Zeitverschwendung, da sie ganz andere Herangehensweisen haben.*	Pers_10*	149	4.21	0.99	.415
8.	*Die Perspektive eines Laien kann manchmal helfen, ein tieferes Verständnis für das eigene Forschungsthema zu entwickeln.*	Pers_12	148	4.05	0.95	.539

B.9 Acceptance of narrowing down

The disposition acceptance of narrowing down describes the ability to set boundaries for one's own work within the given context, both when defining the research question and terminating the project.

The 8 items of the scale describe the ability to narrow oneself down in different phases of the research project, by setting boundaries or terminating individual research steps:

Research topic: 1, 3, 5, 6

Literature phase: 2, 8

Research design and analysis: 4, 7

Since all items are formulated negatively, no recoding is necessary. Cronbach's Alpha for the pilot sample is $\alpha = 0.87$.

Im Folgenden schildern wir Ihnen Situationen, in denen die eigene Forschungsarbeit eingegrenzt werden muss. Falls Sie manche Situationen selbst noch nicht erlebt haben, versuchen Sie bitte sich dennoch in diese Situationen hineinzuversetzen.

		Item in der Pilot-studie	***N***	***M***	***SD***	**Trenn-schärfe**
1.	*Oft fallen mir während des Forschungsprozesses thematisch angrenzende Fragen auf, die ich dann auch unbedingt bearbeiten möchte.*	Ein_02	153	3.69	0.94	.623
2.	*Meine Literaturrecherche abzuschließen, obwohl ich noch viel mehr lesen könnte, bereitet mir Schwierigkeiten.*	Ein_04	153	3.16	1.27	.586
3.	*Wenn mich bei meinem Forschungsthema viele Aspekte interessieren, finde ich es schwierig, mich auf nur einen einzelnen Aspekt festzulegen.*	Ein_07	155	3.70	1.18	.747
4.	*Es fällt mir schwer, mich für eine Forschungsmethode zu entscheiden, wenn alle infrage kommenden Methoden jeweils spezifische Nachteile aufweisen und es keine perfekte Methode gibt.*	Ein_08	147	3.44	1.07	.521
5.	*Wenn ich merke, dass mein Forschungsthema eigentlich zu breit ist, um gut bearbeitet werden zu können, fällt es mir trotzdem schwer, mich von einzelnen Aspekten zu verabschieden.*	Ein_09	153	3.31	1.20	.706
6.	*Mir fällt es schwer, mein Forschungsthema einzugrenzen, weil mich so vieles daran interessiert.*	Ein_10	151	3.48	1.09	.740
7.	*Solange ich das Gefühl habe, dass da noch mehr in den Daten steckt, habe ich Schwierigkeiten meine Datenauswertung zu beenden.*	Ein_11	148	3.14	1.15	.611
8.	*Wenn ich merke, dass ich mich bei meiner Literaturaufbereitung verliere, habe ich Probleme, wieder zum Wesentlichen zurückzukommen.*	Ein_14	153	2.99	1.14	.544

B.10 Willingness to seek feedback

The willingness to seek feedback describes a student's readiness to actively ask for feedback on his or her research work. This implies to re-question the answers one has found by seeking the opinions of others, e.g. the supervisor or fellow students. This also requires the courage to put even unfinished research projects up for discussion.

The 8 items of the scale describe different feedback situations and two perceived threats that might impede the willingness to seek feedback: a perceived threat to the researcher's self-concept or to own's autonomy in the research process.

Perception of a threat to researcher's self-concept: 1, 3, 5, 7

Perception of a threat to autonomy in research: 2, 4, 6, 8

Since all items are formulated negatively, no recoding is necessary. Cronbach's Alpha for the pilot sample is $\alpha = 0.82$.

Im Forschungsprozess gibt es immer wieder Situationen, in denen man selbst nicht weiterkommt und deshalb Beratung von anderen braucht. Falls Sie manche Situationen selbst noch nicht erlebt haben, versuchen Sie bitte sich dennoch in diese Situationen hineinzuversetzen.

		Item in der Pilot-studie	*N*	*M*	*SD*	Trenn-schärfe
1.	*Wenn ich meine Betreuerin bitten muss, mir dabei zu helfen, eine gute Forschungsfrage für meine Abschlussarbeit zu finden, würde ich mir total unfähig vorkommen.*	Ber_01	159	2.53	1.23	.420
2.	*Wenn ich den Zwischenstand meiner Abschlussarbeit im Kolloquium vorstellen soll, befürchte ich, dass sich Kommiliton_innen in Dinge einmischen, die sie gar nichts angehen.*	Ber_02	157	2.15	1.08	.516
3.	*Meinem Betreuer würde ich noch keine unfertigen Überlegungen zu meinem Forschungsdesign darlegen, weil er denken könnte, ich wäre nicht im Stande, einen vernünftigen Plan zu entwickeln.*	Ber_07	162	2.40	1.16	.592
4.	*Bei der Suche nach einer Forschungsfrage für meine Bachelorarbeit, würde ich meine ersten Ideen auf keinen Fall mit Kommiliton_innen besprechen, weil ich nicht will, dass mir jemand bei einer so wichtigen Entscheidung reinredet.*	Ber_08	163	1.82	1.00	.506
5.	*Wenn ich mir bei Kommiliton_innen Hilfe für meine Abschlussarbeit holen muss, wäre mir das unangenehm, weil sie mich für inkompetent halten könnten.*	Ber_09	163	1.92	1.03	.617
6.	*Wenn ich bei der Planung meiner Untersuchung Hilfe benötige, ist mir das unangenehm, weil ich dann nicht mehr selbst in der Hand habe, was geschieht.*	Ber_10	160	2.06	1.02	.611
7.	*Wenn ich weiß, dass mein Forschungsdesign noch einige Haken hat, ich es aber trotzdem präsentieren müsste, hätte ich Angst, dass mich mein Betreuer für nicht gut genug hält.*	Ber_15	162	2.75	1.24	.529
8.	*Wenn ich meine Betreuerin darum bitten müsste, mir ein Auswertungsverfahren zu empfehlen, hätte ich das Gefühl, damit zu viel Selbstbestimmtheit aufzugeben.*	Ber_18	159	1.70	0.89	.541

Appendix C Systematic Review on the Effects of Research-Based Learning

C.1 Goal

The aim of the systematic review was to view and evaluate existing publications on the effectiveness of research-based learning (RBL) in higher education. It was examined which learning outcomes have already been considered empirically and which effects have been observed. The study was carried out across all disciplines. A first concern of the study was thus to find a definition of research-based learning that fitted the different subjects equally and enabled a meaningful selection of studies.

C.2 Literature search

The literature search aimed at finding empirical papers that investigate the effect of research-based learning. Thus, the search string consisted of three thematical complexes that were operationalized with a range of different alternative terms.

RBL and **Effect** and **Skill**

(1) Research-based learning: RBL has various different terms in different countries and study programmes. Thus, many alternative terms like "research-led teaching", "inquiry-based learning" or "undergraduate research" were used.
(2) Effect: There exists a range of position papers on RBL which were not in the focus of this review. This thematic complex thus aimed at finding mainly empirical papers which would have any mention of an empirical investigation by the help of terms like "outcome", "benefit" or "change".
(3) Skill: This thematic complex aimed at finding studies that looked at an outcome variable of RBL, e.g. "knowledge", "attitude", "ability", "belief", or "skill".

The overall structure of the search string was thus a combination of alternative terms (connected with OR) connected with AND: ("research based learning" OR "…" OR "…" OR "inquiry based learning") AND ("effect" OR "…" OR "…" OR "gain") AND ("competence" OR "…" OR "…" OR "knowledge").

Three different data bases were searched: Web of Science, ERIC and PsycInfo. The search was limited to peer-reviewed articles published between 2007-2017 in English. As a result, there were 1,539 articles found in Web of Science, 735 articles found in ERIC, and 710 articles in PsycInfo, which were all exported to EndNote. In a next step, the database was screened for duplicates. Of the 2,804 articles, 589 duplicates (452 found automatically, 138 identified manually) were found. The final database thus consists of 2,214 abstracts (see Figure 3 in section 6.1).

C.3 Classification of the abstracts

The abstracts of the 2214 studies were screened for in- and exclusion. The classification was performed in three phases: first, a manual classification of 745 abstracts was performed based on several in- and exclusion criteria. Second, the codings from the manual classification were used to perform an automatic classification using machine learning algorithms on the remaining 1469 abstracts. Third, the remaining 573 abstracts that could not be in- or excluded with a high certainty based on the algorithm, were classified in a second manual classification phase.

C.3.1 Manual classification I

The abstracts were sorted by alphabet. I coded the first 745 abstracts of the 2,214 studies manually. As a result of the screening, 599 studies were excluded and 146 were included. Based on the abstracts, the following criteria had to be fulfilled for a study to be further considered:

- **Sample**
  - Students of higher education institutions (universities, or universities of applied sciences)
  - All disciplines were considered
  - Any study progress was considered
  - Excluded: school students, PhD students, professionals (e.g. residents, teachers), patients, citizens
- **Instructional format**
  - Instructional format studied needs a focus on students performing research
  - The focus on research can be manifested in the content and/or activities of the course (e.g. students had to develop a research design)
  - Possible formats include research-based learning, summer research courses, community-research courses, short in-class projects, problem-based learning
- **Empirical analysis of outcomes**
  - The study needs to investigate the effect of the instructional format empirically
  - Target variables need to be any research-related dispositions (e.g. research knowledge, research interest, data analysis skills)
  - Excluded: evaluation studies, that do not assess learning outcomes, but only "satisfaction with a programme"
- **Study design**
  - Both qualitative and quantitative study designs were included
  - Review studies were included
  - Book chapters were not included

In addition to these criteria, it was controlled, that the criteria set for the search of the databases were met as well (e.g. English language, double-blind peer review). The screening was performed conservatively: In cases where the abstract did not provide enough information to fully decide whether all criteria were fulfilled, I included the abstract, nevertheless. A second coder, unfamiliar with RBL, coded 100 randomly selected abstracts of these 745 abstracts. The second coder received a brief introduction and the coding scheme. The inter-rater agreement rate for the classification was 86%.

C.3.2 Automatic classification

The remaining 1,469 abstracts were screened automatically by the help of an algorithm. The concept, the implementation and the classification results of this algorithm are described in the following.

Please note: the automatic classification was implemented by Dr. Richard Kunert. Refer to the Disclaimer (see C.6) for additional information.

Concept and procedure

Like the manual classification, the automatic classification algorithm only uses the article abstracts. The automatic classification was performed using an algorithm that learned on the basis of 745 manually coded articles, i.e. the 745 manually coded abstracts serve as a training set. The algorithm uses a "bag of words model". This means that all words in the abstract are considered, but syntax and word order are ignored. The algorithm was written in the programming language R (version 3.4.0). Each abstract is classified 16 times and the agreement of all classification models is taken as the final classification. Classification took place in three steps:

Data Cleaning

Characters that do not meet the ASCII standard or are not alpha-numeric, are replaced by spaces. Then all abstracts are lemmatized (Rinker, 2017), which means that all words were reduced to their dictionary entry. For example, the words "learned" and "learning" are both reduced to their lemma "learn". As a result, different word versions, e.g. due to conjugations, are recognized as one word in the following steps.

Text abstraction

All 2,214 abstracts were analysed using Latent Semantic Analysis (LSA; Wild, 2015). LSA assumes that words (or other text elements) that appear together in an abstract have a similar meaning. Thus, LSA can represent words and abstracts in an n-dimensional semantic space. Abstracts that are closer on one dimension are also more semantically similar on that dimension.

Here, both words and 2-word sequences (bigrams) are selected as input for the LSA. In both cases, abstracts are presented with varying amounts of semantic details, i.e. with 10, 20, 200 or 2000 dimensions. All in all, each abstract is abstracted in eight different ways. Thus, the following classification algorithms are focused on rough (few dimensions) and less rough (many dimensions) semantic differences between abstracts.

Sample balancing

Machine learning algorithms classify new cases better if inclusion and exclusion cases are approximately equally represented in the training sample by which the algorithm learns classifications. In the training sample used here, exclusion cases (N = 599) outweigh inclusion cases (N = 146). Therefore, the Synthetic Minority Over-sampling Technique (SMOTE) is used (Chawla, Bowyer, Hall, & Kegelmeyer, 2002; Siriseriwan, 2017). SMOTE creates artificial cases in the semantic space between two real abstracts. As a result, the proportion of included abstracts was artificially increased from 18% to 46% of the manually coded sample.

Classification

Two typical machine learning algorithms were used: support vector machines (SVM; Cortes & Vapnik, 1995) and LogitBoost (Friedman, Hastie, & Tibshirani, 2000; Tuszynski, 2014). SVM with a radial kernel ($C = 10$, $\gamma = 1$) find borderline cases of the two classes (inclusion versus exclusion), so-called support vectors, which lead to an optimal differentiation between the classes in semantic

space. LogitBoost's classification is based on a series of logistic regression models that give previously misclassified cases more weight than previously correctly classified cases. Both algorithms, SVM and LogitBoost, each classify all eight versions of an abstract. Thus, each abstract is classified 16 times and the match between the classifications were used as decision criteria.

Performance

To assess the performance of this approach, seven-fold cross-validation is performed with 100 repetitions. For each repetition, the training set (N = 745) is divided into seven random parts (folds). Six parts are used as a training set and the seventh part as a test set to evaluate the classification performance. Thus, each part acts once as a test set and six times as part of the training set. The classification performance is averaged over the seven parts. This process is repeated 100 times.

The performance of the classification algorithm for automatically excluded cases is shown in Figure 1. The figure clearly shows that with more agreement between the classification models, accuracy increases to an average of 98.2% with total agreement. The average accuracy is only 55.7% with the lowest model agreement. The 895 articles for which at least 14 out of 16 algorithms suggest exclusion are therefore likely to contain only 16 (1.8%) false decisions, thus, articles that should be included.

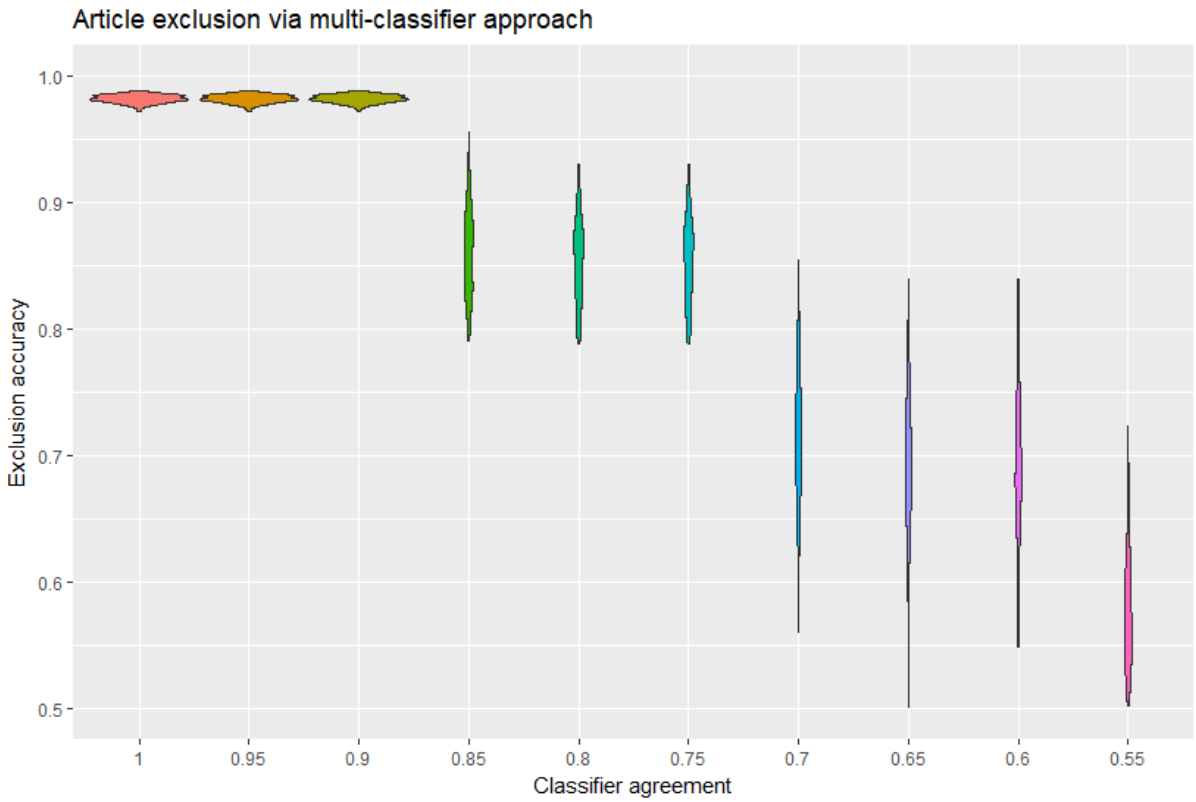


Figure 6: Classification accuracy at different levels of agreement between classification models for cases excluded from the algorithm.

Note. Violin graphs show vertically mirrored density. Wider areas therefore represent more data points. The value of the match on the x-axis is the minimum of a 14%-wide span.

The performance of the classification algorithm for automatically included cases is shown in Figure 7. The comparison with Figure 6 shows that the performance for included cases is worse and less clear than for excluded cases. Model agreement rates over 85% were hardly achieved and are not presented. If 85% or more models match in an inclusion classification, this is correct on average in 88.7% of the abstracts. The 23 articles that have not been manually classified and are included by the classification algorithm with at least 85% model agreement are therefore likely to contain only 3 (11.3%) false decisions; thus, articles that should be excluded.

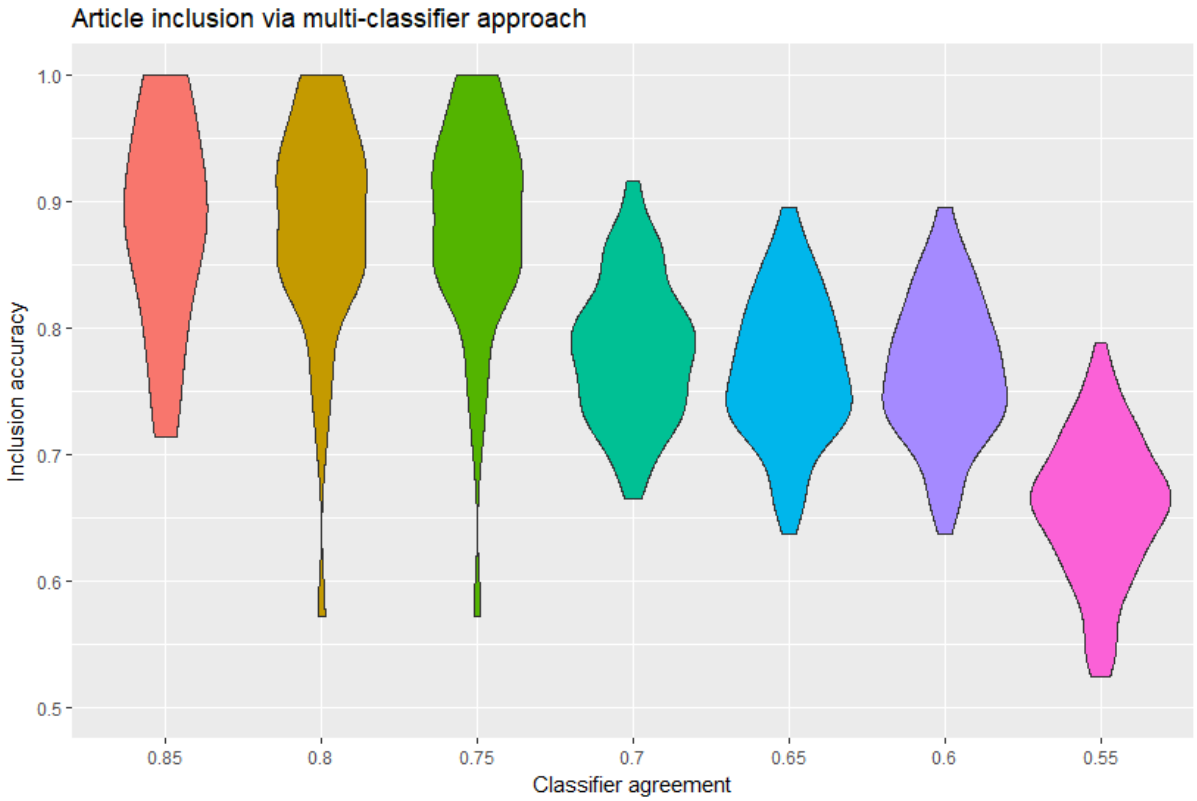


Figure 7: Classification accuracy at different levels of agreement between classification models for cases included by the algorithm

Note. Violin graphs show vertically mirrored density. Wider areas therefore represent more data points. The value of the match on the x-axis is the minimum of a 14%- wide span

Figure 8 shows the number of 1,468 abstracts not previously manually classified according to model agreement of the classification algorithm. The high number (*N*=808) of excluded abstracts with total model agreement stands out. No abstract was included with the same model agreement.

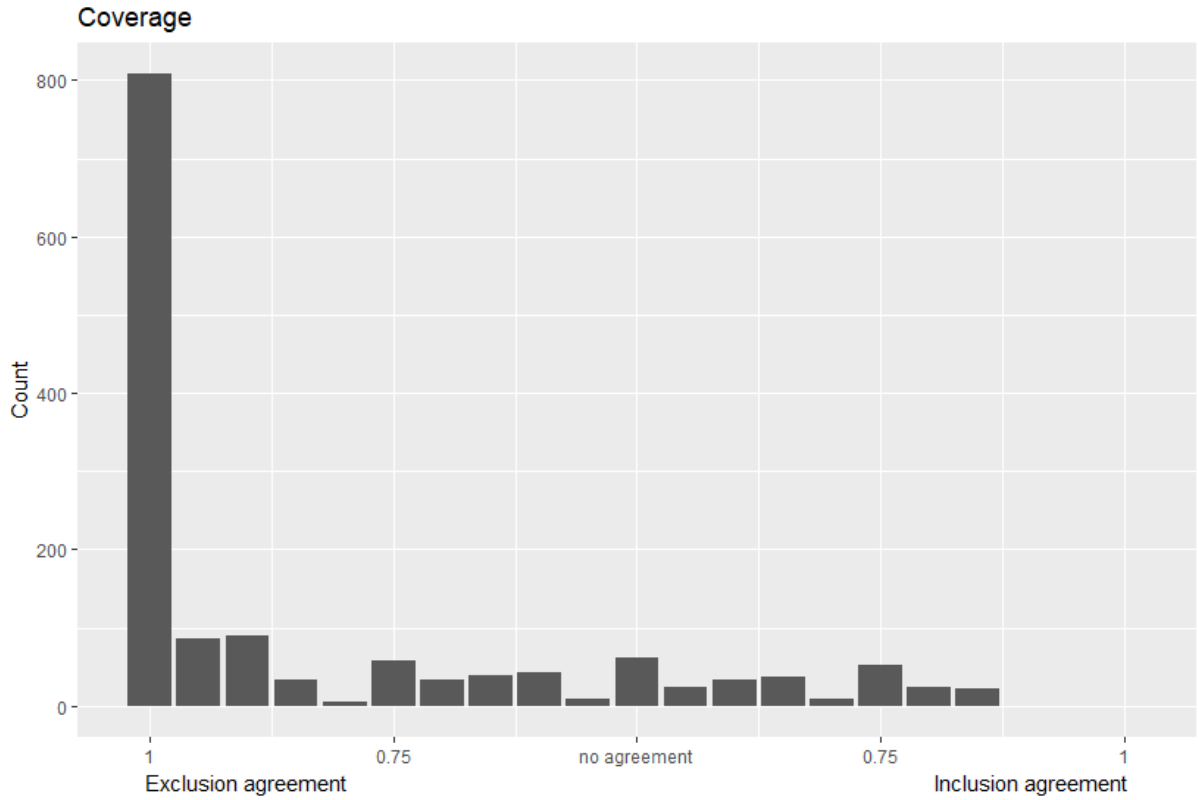


Figure 8: Histogram of the automatically classified abstracts according to model agreement.

Note. Unlike in Figure 6 and Figure 7, the value of the match on the x-axis reflects the minimum of a 4.9%-wide range.

Result

It is decided to trust the algorithm when at least 14 out of the 16 models match. The accuracy of this classification is estimated at over 98%. On this basis, 895 abstracts are excluded, and no abstract is included. The remaining 573 articles have to be classified manually.

Limitations

The classification approach chosen here is based on a number of assumptions. One of the most important assumptions is that the manually classified abstracts were correctly classified. 100 of the 745 manually classified abstracts were classified by a second rater to guarantee some validity of the coding. The remaining 645 abstracts were not cross-checked by a second rater.

A second important assumption is that the manually classified abstracts are representative for the whole sample. The 745 manually classified abstracts were not randomly chosen out of the 2,214 abstracts. Instead, the first 745 abstracts based on the first author's surname were chosen for manual classification which can be seen as near random. The automatic classification assumes that a selection based on the authors' surnames does not distort the sample.

C.3.3 Manual classification II

After the automatic classification, 573 studies remained that could not be in- or excluded with a high certainty. These abstracts were screened manually, following the procedure explained above (see section C.3.1). 180 of these studies were included.

After screening the abstracts both manually and automatically, there were thus 326 studies (146 from the first manual classification, 180 from the second manual classification) included in the sample.

C.4 Classification of the full texts

Afterwards, the full texts of the 326 studies included were searched. Based on *Google Scholar*, the library network of the different universities in Berlin, the social research network *ResearchGate* and the webpages of the respective journals, 277 full texts could be found.

These 277 full texts were coded manually based on a coding scheme.

C.4.1 Coding scheme

The coding scheme helped to extract the relevant information from the full texts.[11] For each full text, information on six different categories was entered in an Excel sheet:

Sample (3 variables): In this category, discipline, disciplinary group, and final degree of the sample were entered.

Intervention (5 variables): In this category, the nature and context of the instructional format were described. E.g. it was coded, how long and when the intervention took place, what students were asked to do and whether the intervention classified as RBL.

Study Design (4 variables): Here, more information on the study design was extracted, e.g. the underlying methodology (qualitative, quantitative, mixed methods), the time point of testing, and any instruments used.

Outcomes (4 variables): In this category, it was coded which type of outcomes were examined in a study. These outcomes were grouped into cognitive (e.g. knowledge), affective-motivational (e.g. interest), social (e.g. communication skills), and other non-classifiable outcomes.

Moderators (2 variables): In this category, it was coded if any moderator variables by which the outcomes differed were reported. These were grouped into either individual (e.g. previous knowledge, gender) or context variables (e.g. instructor's role, number of research activities performed).

Rating (3 variables): In this final category, the overall quality of the study was rated and the decision on in- vs. exclusion was made. Additional comments on the study were entered in a last step.

Based on the study design and the variables looked at in the study, it was assessed whether the study was suitable for inclusion. The same criteria as for the inclusion of the abstracts (see section C.3.1) were set. The codings were performed by me and two colleagues. We discussed any critical cases until consensus was reached.

[11] Since the coding scheme comprises another 12 pages and the systematic review is not the central focus of my dissertation, the coding scheme is not attached. The full coding scheme can of course be provided to any interested reader.

C.5 Results

Out of the 277 full texts, 71 studies were included based on the coding. The majority of these studies looked at students from STEM disciplines (see Table 12). Only 9 of the 71 studies looked at students from the social sciences. Among these were students from psychology, sociology, social work, pedagogy and educational sciences (see

Table 13).

Table 12: Number of identified studies for each disciplinary group

Disciplinary groups	Number of Studies
STEM	45
Medicine & Health	12
Social Sciences	9
Arts and Humanities	3
Multiple disciplinary groups	2
All	**71**

The majority of the nine studies assess course-based RBL experiences with a duration of 1 or 2 semesters. In terms of study design, most of the studies employ ex-post ratings of any learning outcomes with questionnaires. The focus of assessment lies on cognitive learning outcomes such as knowledge and writing skills. The details on the studies' results are described as part of the dissertation (see section 6).

Table 13: Overview of the included studies with students from social scientific disciplines

Study	Discipline	Degree	Course form	Duration	Study design	(Quasi) Experimental	Time point of testing	Instruments	Cognitive outcomes	Affective-motivational outcomes	Social outcomes
Butcher and Maunder (2014)	Pedagogy	Bachelor	Research internship	More than 2 semesters	mm	no	ex-post	questionnaire, interviews, written and oral feedback	research methods knowledge, literacy skills, research skills	--	teamwork skills, communication skills, feedback skills
Gilardi and Lozza (2009)	Psychology	Bachelor	Course-based	8 months	mm	no	ex-post	questionnaire qualitative content analysis of comments	research methods knowledge, scientific writing, etc.	uncertainty tolerance	teamwork skills
Hosein and Rao (2017)	Educational Sciences	Bachelor	Course-based	1 year	qual	no	ex-post	essay analysis	--	enthusiasm of the research idea	
Kazura and Tuttle (2010)	Child Development/Psychology	Bachelor	Course-based	1 semester	mm	no	ex-post	questionnaire	writing skills, presentation skills	--	--
Maschi, Probst and Bradley (2009)	Social work	Bachelor and Master	Course-based	1 semester	qual	no	follow-up	questionnaire	content knowledge, (research) skills	research confidence	--
McKinney Busher (2011)	Sociology	Bachelor and Master	Course-based	1 semester	mm	no	pre-post, ex-post	questionnaire	writing skills, literacy skills, presentation skills	--	teamwork skills, communication skills
Robbins, Kinney and Kart (2008)	Gerontology	Bachelor	Course-based	1 semester	quant	no	pre-post, ex-post	questionnaire	writing skills, presentation skills	--	--
Whipple, Hughes and Bowden (2015)	Social Work	Bachelor	Students working with professor	2 semesters	mm	no	pre-post	questionnaire, group interview	research methods knowledge, attitudes towards research, understanding of the research environment	research confidence	--
Woodzicka, Ford, Caudill and Ohanmamooreni (2015)	Psychology	Bachelor and Master	Students participating in professional research project	Not mentioned	quant	quasi-experimental	ex-post	questionnaire	research methods knowledge, understanding of research process, understanding of the research environment	--	communication skills

C.6 Disclaimer

The work on this systematic review was not performed by me alone. My colleague Julia Rueß was involved in all stages of this work; our student assistant Luise Behm helped to search the literature and supported the manual coding of the studies.

The automatic classification of the abstracts was performed by Dr. Richard Kunert. He wrote and optimized the algorithm, analysed the results and made a recommendation on how to use the results of the automatic classification. Dr. Kunert also wrote the German draft for section C.3.2 ("Automatic classification") and produced the figures in this section. Dr. Kunert describes the work on this project and publicly shares the algorithm he developed on his personal github-homepage: https://github.com/rikunert/HU_text_classification (accessed on September 14th, 2020).

Appendix D Questionnaire Pilot Study

ZU IHRER PERSON

1. Welches Studienfach (Hauptfach) studieren Sie?

2. In welchem Semester studieren Sie in Ihrem derzeitigen Studiengang?

im _____. Fachsemester ❍ Bachelor ❍ Master ❍ Dipl./ Mag. ❍ Promotion

3. Haben Sie vor Ihrem derzeitigen Studiengang bereits ein anderes Fach studiert? Wenn ja, welches?

❍	Ja, und zwar: _____
❍	Nein

4. Haben Sie in Ihrem gesamten Studium schon an Veranstaltungen zu Forschungsmethoden teilgenommen?
Bitte denken Sie neben Ihrem derzeitigen Studium auch an alle vorangegangenen Studiengänge, die Sie studiert heben.

	Veranstaltungsart	**Anzahl Studienpunkte**
❑	Veranstaltung(en) zu quantitativen Forschungsmethoden	_____ Studienpunkte
❑	Veranstaltung(en) zu qualitativen Forschungsmethoden	_____ Studienpunkte
❑	Veranstaltung(en) zu anderen Forschungsmethoden	_____ Studienpunkte
❑	keine Veranstaltung(en) zu Forschungsmethoden	

5. Haben Sie während Ihres Studiums an Forschungsprojekten mitgearbeitet?

	Mitarbeit an …	**Anzahl Projekte**
❑	studentischen Forschungsprojekten (z.B. Studienprojekt im Seminar)	_____ Projekte
❑	realen Forschungsprojekten (z.B. im Rahmen einer Hilfskraft-Tätigkeit)	_____ Projekte
❑	keine Mitarbeit an Forschungsprojekten	

6. Viele Studierende konzentrieren sich im Studium auf bestimmte Methodentraditionen. Sehen Sie sich eher in der quantitativen oder qualitativen Forschungstradition?

❍	quantitative Forschungstradition (z.B. Fragebögen, statistische Auswertung)
❍	qualitative Forschungstradition (z.B. Interviews, teilnehmende Beobachtung)
❍	sowohl quantitativ als auch qualitativ
❍	weder qualitativ noch quantitativ
❍	keine Angabe / weiß ich nicht

KOMPLIZIERTE SITUATIONEN

Im Folgenden schildern wir Ihnen komplizierte Forschungssituationen. Falls Sie manche Situationen selbst noch nicht erlebt haben, versuchen Sie bitte, sich dennoch in diese Situationen hineinzuversetzen. Gelingt dies nicht, so haben Sie die Möglichkeit „nicht zu beantworten" auszuwählen.

7. Sie finden im Folgenden eine Reihe von Aussagen, die sich darauf beziehen, wie Sie auf komplizierte Situationen im Forschungsprozess reagieren. Inwieweit treffen diese Aussagen auf Sie zu?

	1 trifft nicht zu	2 trifft kaum zu	3 teils/ teils	4 trifft eher zu	5 trifft zu	X Nicht zu beantworten
Wenn die Datenauswertung komplizierter ist als gedacht, habe ich Angst davor, den Überblick zu verlieren.	❍	❍	❍	❍	❍	❍
Wenn die Ergebnisse meiner Studie ein sehr kompliziertes Beziehungsgeflecht ergeben, finde ich das erst recht interessant.	❍	❍	❍	❍	❍	❍
Wenn ich im Verlauf meiner Forschungsarbeit weitere Literaturempfehlungen erhalte, aus denen sich viele neue Fragen ergeben, fühle ich mich überfordert.	❍	❍	❍	❍	❍	❍
Wenn ich bei der Literarturrecherche merke, dass der Forschungsstand zu meinem Thema widersprüchlich ist, spornt mich das an, mehr über die Hintergründe zu erfahren.	❍	❍	❍	❍	❍	❍
Wenn ich beim Aufarbeiten der Hintergrundliteratur merke, dass die Kernaussagen der Autor_innen nicht zusammenpassen, fühle ich mich dadurch angespornt.	❍	❍	❍	❍	❍	❍
Wenn es mehrere Forschungsstränge zu meinem Thema gibt, die aber bislang nicht aufeinander Bezug nehmen, würde ich mich an einem von ihnen orientieren.	❍	❍	❍	❍	❍	❍
Wenn meine Datenauswertung zu überraschenden Zwischenergebnissen führt, untersuche ich diese Unregelmäßigkeiten im Detail.	❍	❍	❍	❍	❍	❍
Wenn bei der Datenerhebung viele neue Fragen auftauchen, die nicht vorhersehbar waren, bin ich gleich Feuer und Flamme.	❍	❍	❍	❍	❍	❍
Wenn ich bei meiner Datenauswertung merke, dass einige Fälle nicht ins Muster passen, lasse ich mich dadurch nicht von meinem ursprünglichen Auswertungsplan ablenken.	❍	❍	❍	❍	❍	❍

	1 trifft nicht zu	2 trifft kaum zu	3 teils/ teils	4 trifft e-her zu	5 trifft zu	X Nicht zu beant-worten
Wenn sich durch eine forschungsmethodische Empfehlung meiner Betreuerin plötzlich viele neue Möglichkeiten auftun, fühle ich mich durch die entstehende Komplexität stark beunruhigt.	❍	❍	❍	❍	❍	❍
Wenn ich bei der Suche nach einer Forschungslücke auf eine komplizierte Literaturlage mit vielen abweichenden Perspektiven treffe, reizt es mich, die Hintergründe zu durchdringen.	❍	❍	❍	❍	❍	❍
Wenn ich bei der Literarturrecherche merke, dass der Forschungsstand zu meinem Thema widersprüchlich ist, versuche ich, mich auf eine Sichtweise zu beschränken.	❍	❍	❍	❍	❍	❍
Wenn ich bei meiner Datenauswertung merke, dass die Ergebnisse nicht erwartungskonform sind, will ich gleich herausfinden, woran das liegt.	❍	❍	❍	❍	❍	❍
Wenn sich bei der Auswertung von Daten plötzlich neue Aspekte auftun, befürchte ich ein großes Durcheinander.	❍	❍	❍	❍	❍	❍
Wenn die Ergebnisse der Datenauswertung meinen Vorannahmen in einigen wenigen Punkten widersprechen, dann suche ich nicht noch krampfhaft nach Gründen dafür.	❍	❍	❍	❍	❍	❍
Wenn beim Aufarbeiten der Literatur die bisherigen Ergebnisse überhaupt nicht zusammenpassen, will ich durchschauen, woran das liegt.	❍	❍	❍	❍	❍	❍

UNGEWISSE SITUATIONEN

Im Folgenden schildern wir Ihnen Situationen im Forschungsprozess, die mit Ungewissheiten verbunden sind. Falls Sie manche Situationen selbst noch nicht erlebt haben, versuchen Sie bitte, sich dennoch in diese Situationen hineinzuversetzen. Gelingt dies nicht, so haben Sie die Möglichkeit „nicht zu beantworten" auszuwählen.

8. Sie finden im Folgenden eine Reihe von Aussagen, die sich darauf beziehen, wie Sie auf ungewisse Situationen im Forschungsprozess reagieren. Inwieweit treffen diese Aussagen auf Sie zu?

	1 trifft nicht zu	2 trifft kaum zu	3 teils/ teils	4 trifft eher zu	5 trifft zu	X Nicht zu beantworten
Mich motiviert es, dass in meiner Forschung nicht immer alles vorab planbar ist.	❍	❍	❍	❍	❍	❍
Ich finde es problematisch, nicht genau zu wissen, ob meine gewählte Methodik gut funktionieren wird.	❍	❍	❍	❍	❍	❍
Ich habe kein Problem, mich in meiner Abschlussarbeit für ein Analyseverfahren zu entscheiden, auch wenn ich die Tragweite dieser Entscheidung noch nicht absehen kann.	❍	❍	❍	❍	❍	❍
Wenn das Ergebnis meiner Studie nicht absehbar ist, finde ich das so richtig spannend.	❍	❍	❍	❍	❍	❍
Ich finde es beunruhigend, dass ich vor Beginn meines Forschungsprojekts nicht weiß, ob alles so klappt, wie ich mir das vorstelle.	❍	❍	❍	❍	❍	❍
Wenn meine Betreuerin mir sagt, dass sie keinen kennt, der meine Methodik in der Form schon einmal angewandt hat, empfinde ich das als besonders herausfordernd.	❍	❍	❍	❍	❍	❍
Wenn ich mir nicht sicher bin, welche Methoden ich zur Auswertung meiner Daten anwenden sollte, dann belastet mich das.	❍	❍	❍	❍	❍	❍
Wenn ich gar nicht weiß, ob ich genug Literatur für meine Abschlussarbeit finden werde, fühle ich mich extrem unsicher.	❍	❍	❍	❍	❍	❍
Wenn völlig unklar ist, wie das Ergebnis meiner Datenauswertung aussehen wird, kann ich es kaum abwarten, mich an die Auswertung zu setzen.	❍	❍	❍	❍	❍	❍
Ich finde es unglaublich motivierend, dass ich bei meinen Erhebungen im Feld nicht immer alles genau planen kann.	❍	❍	❍	❍	❍	❍
Dass ich bei meiner Erhebung nicht alles unter Kontrolle haben kann, macht mir zu schaffen.	❍	❍	❍	❍	❍	❍

	1 trifft nicht zu	2 trifft kaum zu	3 teils/ teils	4 trifft e-her zu	5 trifft zu	X Nicht zu beant-worten
Dass ich nie genau vorhersagen kann, ob bei meiner Erhebung alles so funktioniert, wie ich mir das vorstelle, stellt für mich auch einen Nervenkitzel dar.	❍	❍	❍	❍	❍	❍
Wenn das Ergebnis meiner Studie völlig offen ist, beunruhigt mich das.	❍	❍	❍	❍	❍	❍
Ich fühle mich so richtig wohl, wenn ich mich in ein unbekanntes Forschungsthema einarbeiten muss.	❍	❍	❍	❍	❍	❍
Dass ich nicht vollständig überblicken kann, welche zusätzlichen Faktoren einen Einfluss auf meine Erhebung haben könnten, stört mich sehr.	❍	❍	❍	❍	❍	❍
Es verunsichert mich, dass im Laufe meiner Forschungsarbeit unvorhergesehene Probleme auftreten könnten.	❍	❍	❍	❍	❍	❍
Ich habe kein Problem, Entscheidungen bezüglich meines Forschungsdesigns zu treffen, auch wenn ich deren Tragweite noch nicht absehen kann.	❍	❍	❍	❍	❍	❍
Wenn ich die Wahl hätte, würde ich lieber vorher wissen, ob meine Erhebung funktioniert, als mich überraschen zu lassen.	❍	❍	❍	❍	❍	❍
Ich finde es spannend, wenn ich vor Beginn meines Forschungsvorhabens nicht abschätzen kann, was am Ende eigentlich rauskommen wird.	❍	❍	❍	❍	❍	❍
Wenn ich nicht weiß, welche Forschungsfrage ich wählen soll, weil ich die Ergebnisse kaum absehen kann, fühle ich mich unwohl.	❍	❍	❍	❍	❍	❍
Wenn ich für die Datenauswertung eine Methode benötige, von der ich noch nie gehört habe, empfinde ich das als eine Herausforderung.	❍	❍	❍	❍	❍	❍
Dass ich nicht sicher sein kann, ob ich nicht eine wichtige Einflussgröße in meiner Studie vergessen habe, finde ich eigentlich recht fesselnd.	❍	❍	❍	❍	❍	❍
Wenn völlig unklar ist, ob ich eigentlich die Software bekommen kann, die ich für mein Vorhaben benötige, finde ich das beunruhigend.	❍	❍	❍	❍	❍	❍
Dass man nie genau wissen kann, wie sich Studienteilnehmer verhalten werden, macht Forschung für mich erst interessant.	❍	❍	❍	❍	❍	❍
Dass es bei der Erhebung einige Bestandteile gibt, die ich nicht vollends vorhersagen kann, finde ich schon belastend.	❍	❍	❍	❍	❍	❍
Dass ich nie genau vorhersagen kann, wie meine Studienteilnehmer reagieren werden, macht mich schon ein bisschen nervös.	❍	❍	❍	❍	❍	❍

INTERESSANTE SITUATIONEN

Im Folgenden schildern wir Ihnen verschiedene Situationen, in denen Sie Neugier für bestimmte Fragen entwickeln können. Falls Sie manche Situationen selbst noch nicht erlebt haben, versuchen Sie bitte, sich dennoch in diese Situationen hineinzuversetzen. Gelingt dies nicht, so haben Sie die Möglichkeit „nicht zu beantworten" auszuwählen.

9. Sie finden im Folgenden eine Reihe von Aussagen, die sich darauf beziehen, wie sehr verschiedene Situationen Ihre Neugier wecken können. Inwieweit treffen diese Aussagen auf Sie zu?

	1 trifft nicht zu	2 trifft kaum zu	3 teils/ teils	4 trifft eher zu	5 trifft zu	X Nicht zu beantworten
Wenn ich einen Widerspruch in der Forschungsliteratur entdecke, muss ich unbedingt mehr darüber erfahren.	❍	❍	❍	❍	❍	❍
Durch das Lesen von Artikeln oder Lehrbüchern meines Fachs entstehen bei mir oft eigene Fragen, zu denen ich dann unbedingt mehr lesen muss.	❍	❍	❍	❍	❍	❍
Über gesellschaftliche Probleme, die die Wissenschaft noch nicht zufriedenstellend gelöst hat, will ich unbedingt mehr erfahren.	❍	❍	❍	❍	❍	❍
Wenn ich mit der Erklärung für ein Problem in meinem Fach nicht zufrieden bin, halte ich nicht still, bis ich mehr darüber erfahren habe.	❍	❍	❍	❍	❍	❍
Wenn ich auf ein praktisches Problem stoße, kann ich nicht aufhören darüber nachzudenken, bis ich Ideen für eine mögliche Lösung habe.	❍	❍	❍	❍	❍	❍
Wenn ich das Gefühl habe, dass eine Fragestellung aus meinem Fach noch nicht zufriedenstellend beantwortet ist, spornt mich das an, mich tiefer damit auseinanderzusetzen.	❍	❍	❍	❍	❍	❍
Wenn ich im Austausch mit Kommiliton_innen auf einen interessanten Sachverhalt hingewiesen werde, kann ich nicht anders als direkt mehr darüber zu lesen.	❍	❍	❍	❍	❍	❍
Beim Lesen von Fachtexten fallen mir oft interessante Aspekte auf, zu denen ich dann unbedingt mehr erfahren muss.	❍	❍	❍	❍	❍	❍
Themen aus der Berufspraxis, die von der Wissenschaft bisher nicht zufriedenstellend ergründet werden, möchte ich näher verstehen.	❍	❍	❍	❍	❍	❍
Durch die Konfrontation mit Erkenntnissen und Themen meines Fachs entstehen bei mir oft eigene Fragen, zu denen ich dann unbedingt mehr lesen will.	❍	❍	❍	❍	❍	❍
Praktische Probleme, für die die Wissenschaft noch keine Antwort hat, lassen bei mir den Wunsch entstehen, mich da tiefer reinzudenken.	❍	❍	❍	❍	❍	❍
Wenn ich auf eine offene Fragestellung in meinem Fach stoße, entsteht bei mir der Drang, sofort mehr darüber erfahren zu wollen.	❍	❍	❍	❍	❍	❍

	1 **trifft <u>nicht</u> zu**	**2** **trifft kaum zu**	**3** **teils/ teils**	**4** **trifft e-her zu**	**5** **trifft zu**	**X** **Nicht zu beant-worten**
Bei Diskussionen in Uni-Seminaren entstehen bei mir oft Fragen, zu denen ich auf jeden Fall mehr erfahren möchte.	❍	❍	❍	❍	❍	❍
Wenn mir ein gesellschaftliches Problem auffällt, zu dem ich bisher nichts wusste, möchte ich mich unbedingt dazu informieren.	❍	❍	❍	❍	❍	❍
Wenn mir in einer Vorlesung neue Ideen zum Thema kommen, die nicht ausreichend besprochen werden, kann ich nicht anders als mehr darüber zu lesen.	❍	❍	❍	❍	❍	❍

RÜCKSCHLÄGE IM FORSCHUNGSPROZESS

Es gibt im Forschungsprozess immer wieder Rückschläge, die sehr frustrierend sind. Falls Sie manche Situationen selbst noch nicht erlebt haben, versuchen Sie bitte, sich dennoch in diese Situationen hineinzuversetzen. Gelingt dies nicht, so haben Sie die Möglichkeit „nicht zu beantworten" auszuwählen.

10. Sie finden im Folgenden eine Reihe von Aussagen, die sich auf verschiedene Rückschläge im Forschungsprozess beziehen. Inwieweit treffen diese Aussagen auf Sie zu?

	1 trifft nicht zu	2 trifft kaum zu	3 teils/ teils	4 trifft eher zu	5 trifft zu	X Nicht zu beantworten
Wenn ich einen wissenschaftlichen Artikel wieder und wieder nicht verstehe, würde ich es am liebsten einfach lassen.	❍	❍	❍	❍	❍	❍
Wenn ich einen komplizierten Text, den mir meine Betreuerin empfohlen hat, auch nach mehrmaligem Lesen nicht verstehe, bleibe ich ruhig und versuche es noch einmal.	❍	❍	❍	❍	❍	❍
Wenn ich eine komplizierte Theorie auch nach Erklärung nicht verstehe, entwickle ich Versagensgefühle.	❍	❍	❍	❍	❍	❍
Wenn zu wenige Leute an meiner Datenerhebung teilnehmen, würde ich am liebsten alles hinschmeißen.	❍	❍	❍	❍	❍	❍
Wenn meine Datenerhebung nicht so klappt wie erhofft, suche ich nach Wegen, um das Problem zu lösen.	❍	❍	❍	❍	❍	❍
Wenn ich Daten, die ich selbst erhoben habe, durch ein Computerproblem verlieren würde, hätte ich keine Lust mehr, weiterzuarbeiten.	❍	❍	❍	❍	❍	❍
Wenn bei meiner Datenerhebung etwas schief läuft, überlege ich, wie ich die Erhebung noch retten kann.	❍	❍	❍	❍	❍	❍
Wenn meine Datenauswertung wieder nicht so funktioniert wie erhofft, würde ich am liebsten aufhören.	❍	❍	❍	❍	❍	❍
Wenn sich große Teile meiner Datenauswertung im Nachhinein als überflüssig herausstellen, bin ich trotzdem nicht frustriert.	❍	❍	❍	❍	❍	❍
Wenn bei meiner Datenauswertung etwas schief läuft, dann mache ich es am nächsten Tag einfach nochmal und dann besser.	❍	❍	❍	❍	❍	❍
Wenn mir mein Betreuer eine negative Rückmeldung zu meinem Forschungsdesign gibt, kann ich daran erst einmal nicht weiterarbeiten.	❍	❍	❍	❍	❍	❍
Wenn mein Betreuer ständig Kritik an meinen Analysen übt, könnte ich verzweifeln.	❍	❍	❍	❍	❍	❍

	1 trifft nicht zu	2 trifft kaum zu	3 teils/ teils	4 trifft e-her zu	5 trifft zu	X Nicht zu beant-worten
Wenn das Lesen von Forschungsartikeln viel länger dauert als geplant, bleibe ich trotzdem am Ball.	❍	❍	❍	❍	❍	❍
Wenn meine Datenerhebung nicht so funktio-niert wie erhofft, würde ich mein Vorhaben am liebsten auf der Stelle beenden.	❍	❍	❍	❍	❍	❍
Wenn ich feststelle, dass ich bei der Literatur-recherche viele relevante Texte übersehen habe, bewahre ich Ruhe und überlege mir, wie ich jetzt weiter vorgehe.	❍	❍	❍	❍	❍	❍
Wenn sich meine Datenauswertung als fehler-haft erweist und ich noch einmal von vorne an-fangen muss, würde ich wahrscheinlich ver-zweifeln.	❍	❍	❍	❍	❍	❍
Wenn ich am Ende meiner Datenauswertung feststelle, dass ich ein nicht geeignetes Auswer-tungsverfahren genutzt habe, wäre ich total frustriert.	❍	❍	❍	❍	❍	❍
Wenn ich Probleme habe, Leute für meine Da-tenerhebung zu gewinnen, gebe ich trotzdem nicht auf.	❍	❍	❍	❍	❍	❍
Wenn ich meiner Betreuerin vorab ein Kapitel meiner Bachelorarbeit schicke und sie mir meine fehlerhafte Zitierweise um die Ohren haut, würde ich am liebsten nicht mehr weiter-machen.	❍	❍	❍	❍	❍	❍
Wenn mich mein Betreuer im Kolloquium dafür angreift, dass meine Hypothesen nicht gut be-gründet sind, bleibe ich ruhig und beginne eine erneute Literaturanalyse.	❍	❍	❍	❍	❍	❍
Wenn ich am Ende meiner Datenauswertung bemerke, dass ich einen groben Fehler gemacht habe, behalte ich einen kühlen Kopf und suche nach Lösungen für mein Problem.	❍	❍	❍	❍	❍	❍
Wenn mich meine Betreuerin dafür kritisiert, dass ich relevante Literatur nicht berücksichtigt habe, fange ich gleich am nächsten Tag damit an, diese Literatur einzuarbeiten.	❍	❍	❍	❍	❍	❍
Wenn ich einen komplizierten Text einfach nicht verstehen kann, fühle ich mich unfähig.	❍	❍	❍	❍	❍	❍
Wenn meine Betreuerin anmerkt, dass ich viel zu viel in meine Forschungsergebnisse reinin-terpretiert habe, überarbeite ich das entspre-chende Kapitel in aller Ruhe.	❍	❍	❍	❍	❍	❍

BEDEUTUNG VON FORSCHUNG

Zur Frage, für wie wichtig man Forschung hält, kann man ganz unterschiedlicher Auffassung sein. Uns interessiert nun, was Sie darüber denken. Wie bedeutend ist Forschung für Sie?

11. Sie finden im Folgenden eine Reihe von Aussagen, die sich auf die Bedeutsamkeit von Forschung für Sie persönlich beziehen. Inwieweit treffen diese Aussagen auf Sie zu?

	1 trifft nicht zu	2 trifft kaum zu	3 teils/ teils	4 trifft eher zu	5 trifft zu	X Nicht zu beantworten
Forschung hat für mich persönlich einen hohen Stellenwert.	❍	❍	❍	❍	❍	❍
Forschung in meinem Fach hilft dabei, gesellschaftliche Probleme der Gegenwart zu lösen.	❍	❍	❍	❍	❍	❍
Nur durch Forschung kann in meinem Fach das bestehende Wissen erweitert werden.	❍	❍	❍	❍	❍	❍
Im Vergleich zu anderen Themen messe ich der Forschung eine große Bedeutung bei.	❍	❍	❍	❍	❍	❍
Forschung in meinem Fach trägt dazu bei, die Realität besser zu verstehen.	❍	❍	❍	❍	❍	❍
Erkenntnisse aus der Forschung in meinem Fach sind für die berufliche Praxis hoch relevant.	❍	❍	❍	❍	❍	❍
Die Forschung in meinem Fach ist nützlich, weil man durch Forschung interessante Erkenntnisse erzielen kann.	❍	❍	❍	❍	❍	❍
Forschung in meinem Fach ist geeignet, um politische Missstände aufzuklären.	❍	❍	❍	❍	❍	❍
Es ist für mich persönlich sehr wichtig, dass ich mich mit Forschung beschäftigen kann.	❍	❍	❍	❍	❍	❍
Mir ist Forschung wichtiger als anderen Leuten.	❍	❍	❍	❍	❍	❍
Forschung in meinem Fach ist ein guter Weg, um Antworten auf Fragen zu finden, die die Menschheit schon immer interessiert haben.	❍	❍	❍	❍	❍	❍
Wenn es in meinem Fach keine Forschung geben würde, könnten viele gesellschaftliche Probleme nicht gelöst werden.	❍	❍	❍	❍	❍	❍

	1 **trifft <u>nicht</u> zu**	**2** **trifft kaum zu**	**3** **teils/ teils**	**4** **trifft e-her zu**	**5** **trifft zu**	**X** **Nicht zu beant-worten**
Forschung in meinem Fach bringt die Mensch-heit voran.	❍	❍	❍	❍	❍	❍
Mir ist wichtig, über neue wissenschaftliche Er-rungenschaften in meinem Fach Bescheid zu wissen.	❍	❍	❍	❍	❍	❍
Forschung in meinem Fach ist wichtig, um Probleme der Berufspraxis lösen zu können.	❍	❍	❍	❍	❍	❍
Ich könnte mir vorstellen, mich in meiner Frei-zeit mit Forschungsthemen zu beschäftigen.	❍	❍	❍	❍	❍	❍

SPASS AN FORSCHUNG

Im Folgenden schildern wir Ihnen verschiedene Forschungstätigkeiten, die einem mehr oder auch weniger Spaß machen können. Falls Sie manche Tätigkeiten selbst noch nicht durchgeführt haben, versuchen Sie bitte, sich dennoch in diese Tätigkeiten hineinzuversetzen. Gelingt dies nicht, so haben Sie die Möglichkeit „nicht zu beantworten" auszuwählen.

12. Bitte geben Sie an, wie viel Spaß Ihnen das Durchführen der folgenden Forschungstätigkeiten macht, oder machen würde.

	1 Macht mir überhaupt keinen Spaß	2 Macht mir eher keinen Spaß	3 teils/ teils	4 Macht mir eher Spaß	5 Macht mir richtig viel Spaß	X Nicht zu beantworten
eine eigene Forschungsfrage entwickeln	❍	❍	❍	❍	❍	❍
Literatur zu einem Forschungsfeld recherchieren	❍	❍	❍	❍	❍	❍
wissenschaftliche Artikel zu einem Forschungsfeld lesen	❍	❍	❍	❍	❍	❍
ein Forschungsdesign/ einen Untersuchungsplan entwickeln	❍	❍	❍	❍	❍	❍
Daten empirisch erheben (z.B. messen, befragen, interviewen, testen)	❍	❍	❍	❍	❍	❍
Daten auswerten	❍	❍	❍	❍	❍	❍
aus neuen Erkenntnissen Schlussfolgerungen ziehen	❍	❍	❍	❍	❍	❍
bestehende Theorien meines Faches weiterentwickeln	❍	❍	❍	❍	❍	❍
neue Erkenntnisse vor einer Gruppe präsentieren	❍	❍	❍	❍	❍	❍
wissenschaftliche Texte schreiben	❍	❍	❍	❍	❍	❍

ENDE DES FRAGEBOGENS

13. Haben Sie ergänzende Anregungen zu dieser Befragung? Wenn ja, haben Sie hier Platz für Ihre Schlussbemerkungen:

Herzlichen Dank für Ihre Teilnahme an dieser Erhebung und für Ihre Unterstützung!

Unter **u.hu-berlin.de/FL** erfahren Sie mehr über das Projekt ForschenLernen. Falls Sie darüber hinaus noch Fragen haben, können Sie mir gerne eine E-Mail schreiben: insa.wessels@hu-berlin.de

Appendix E Questionnaire Validation Study

ZU IHRER PERSON

14. Welches Studienfach (Hauptfach) studieren Sie?

15. In welchem Semester studieren Sie in Ihrem derzeitigen Studiengang?

im _____. Fachsemester ❍ Bachelor ❍ Master ❍ Dipl./ Mag. ❍ Promotion

16. Haben Sie vor Ihrem derzeitigen Studiengang bereits ein anderes Fach studiert? Wenn ja, welches?

❍	Ja, und zwar: _____
❍	Nein

17. Haben Sie während Ihres Studiums an Forschungsprojekten mitgearbeitet?

	Mitarbeit an …	**Anzahl Projekte**
❑	studentischen Forschungsprojekten (z.B. Studienprojekt im Seminar)	_____ Projekte
❑	realen Forschungsprojekten (z.B. im Rahmen einer Hilfskraft-Tätigkeit)	_____ Projekte
❑	keine Mitarbeit an Forschungsprojekten	

18. Viele Studierende konzentrieren sich im Studium auf bestimmte Methodentraditionen. Sehen Sie sich eher in der quantitativen oder qualitativen Forschungstradition?

❍	eher quantitative Forschungstradition (z.B. Fragebögen, statistische Auswertung)
❍	eher qualitative Forschungstradition (z.B. Interviews, teilnehmende Beobachtung)
❍	beide Forschungstraditionen gleichermaßen
❍	keine Aussage möglich

Im Folgenden werden Sie zu verschiedenen Eigenschaften Ihrer Person befragt. Bitte versuchen Sie zügig und aufrichtig zu antworten.

UNGEWISSE SITUATIONEN

Inwieweit stimmen Sie diesen Aussagen zu?

		1 stimme nicht zu	2 stimme kaum zu	3 teils/ teils	4 stimme eher zu	5 stimme zu
1.	Ich probiere gerne Dinge aus, auch wenn nicht immer etwas dabei herauskommt.	❍	❍	❍	❍	❍
2.	Ich beschäftige mich nur mit Aufgaben, die lösbar sind.	❍	❍	❍	❍	❍
3.	Ich mag es, wenn unverhofft Überraschungen auftreten.	❍	❍	❍	❍	❍
4.	Ich lasse die Dinge gerne auf mich zukommen.	❍	❍	❍	❍	❍
5.	Ich weiß gerne, was auf mich zukommt.	❍	❍	❍	❍	❍
6.	Ich warte geradezu darauf, dass etwas Aufregendes passiert.	❍	❍	❍	❍	❍
7.	Wenn um mich herum alles drunter und drüber geht, fühle ich mich so richtig wohl.	❍	❍	❍	❍	❍
8.	Ich habe es gerne, wenn die Arbeit gleichmäßig verläuft.	❍	❍	❍	❍	❍

KOMPLIZIERTE SITUATIONEN

Inwieweit stimmen Sie diesen Aussagen zu?

	1 stimme nicht zu	2 stimme kaum zu	3 teils/ teils	4 stimme eher zu	5 stimme zu
1. Mehrdeutige Situationen erlebe ich oft als belastend.	❍	❍	❍	❍	❍
2. Ich arbeite lieber an komplexen Problemen als mich Aufgaben zu widmen, deren Lösung leicht ersichtlich ist.	❍	❍	❍	❍	❍
3. Ich mag es nicht, wenn eine Situation nur einseitig betrachtet wird.	❍	❍	❍	❍	❍
4. Auch wenn ich den Überblick verliere, fühle ich mich nicht so schnell überfordert.	❍	❍	❍	❍	❍
5. Wenn sich mir zu viele Möglichkeiten bieten, werde ich dadurch eher überfordert.	❍	❍	❍	❍	❍
6. Mich reizen Aufgaben, die unlösbar zu sein scheinen.	❍	❍	❍	❍	❍
7. Ich beschäftige mich gerne mit Fragen, auf die es möglicherweise keine eindeutige Antwort gibt.	❍	❍	❍	❍	❍
8. Ich halte es für notwendig, Probleme von verschiedenen Standpunkten aus zu betrachten.	❍	❍	❍	❍	❍

UMGANG MIT VERSCHIEDENEN IMPULSEN

Inwieweit stimmen Sie diesen Aussagen zu?

	1 stimme nicht zu	2 stimme kaum zu	3 teils/ teils	4 stimme eher zu	5 stimme zu
1. Ich lasse mich selten zu übermäßig auf etwas ein.	❍	❍	❍	❍	❍
2. Ich habe Schwierigkeiten, meinen Begierden zu widerstehen.	❍	❍	❍	❍	❍
3. Ich habe wenig Schwierigkeiten, Versuchungen zu widerstehen.	❍	❍	❍	❍	❍
4. Ich esse meist zu viel von meinen Lieblingsspeisen.	❍	❍	❍	❍	❍
5. Ich gebe selten meinen spontanen Gefühlen nach.	❍	❍	❍	❍	❍
6. Manchmal esse ich, bis mir schlecht wird.	❍	❍	❍	❍	❍
7. Manchmal handele ich aus einem spontanen Gefühl heraus und bereue es später.	❍	❍	❍	❍	❍
8. Ich bin stets in der Lage, meine Gefühle unter Kontrolle zu halten.	❍	❍	❍	❍	❍

HERAUSFORDERUNGEN IM FORSCHUNGSPROZESS

Im Folgenden schildern wir Ihnen herausfordernde Situationen, die im Laufe eines Forschungsprozesses auftreten können. Falls Sie manche Situationen selbst noch nicht erlebt haben, versuchen Sie bitte, sich dennoch in diese Situationen hineinzuversetzen.

UNGEWISSE SITUATIONEN BEIM FORSCHEN

Inwieweit stimmen Sie diesen Aussagen zu?

	1 stimme nicht zu	2 stimme kaum zu	3 teils/ teils	4 stimme eher zu	5 stimme zu
1. Mich motiviert es, dass in meiner Forschung nicht immer alles planbar ist.	❍	❍	❍	❍	❍
2. Ich finde es beunruhigend, dass ich vor Beginn meines Forschungsprojekts nicht weiß, ob alles klappt, wie ich mir das vorstelle.	❍	❍	❍	❍	❍
3. Wenn ich mir nicht sicher bin, welche Methoden ich zur Auswertung meiner Daten anwenden sollte, dann belastet mich das.	❍	❍	❍	❍	❍
4. Ich finde es unglaublich motivierend, dass ich bei meinen Erhebungen im Feld nicht immer alles genau planen kann.	❍	❍	❍	❍	❍
5. Wenn ich die Wahl hätte, würde ich lieber vorher wissen, ob meine Erhebung funktioniert, als mich überraschen zu lassen.	❍	❍	❍	❍	❍
6. Ich finde es spannend, wenn ich vor Beginn meines Forschungsvorhabens nicht abschätzen kann, was am Ende eigentlich rauskommen wird.	❍	❍	❍	❍	❍
7. Wenn ich nicht weiß, welche Forschungsfrage ich wählen soll, weil ich die Ergebnisse kaum absehen kann, fühle ich mich unwohl.	❍	❍	❍	❍	❍
8. Wenn ich für die Datenauswertung eine Methode benötige, von der ich noch nie gehört habe, empfinde ich das als eine schöne Herausforderung.	❍	❍	❍	❍	❍

KOMPLIZIERTE FORSCHUNGSSITUATIONEN

Inwieweit stimmen Sie diesen Aussagen zu?

		1 stimme nicht zu	2 stimme kaum zu	3 teils/ teils	4 stimme eher zu	5 stimme zu
1.	Wenn ich bei der Literarturrecherche merke, dass der Forschungsstand zu meinem Thema widersprüchlich ist, spornt mich das an, mehr über die Hintergründe zu erfahren.	❍	❍	❍	❍	❍
2.	Wenn ich beim Aufarbeiten der Hintergrundliteratur merke, dass die Kernaussagen der Autor_innen nicht zusammenpassen, finde ich das belastend.	❍	❍	❍	❍	❍
3.	Wenn meine Datenauswertung zu überraschenden Zwischenergebnissen führt, untersuche ich diese Unregelmäßigkeiten im Detail.	❍	❍	❍	❍	❍
4.	Wenn sich durch eine forschungsmethodische Empfehlung meiner Betreuerin plötzlich viele neue Möglichkeiten auftun, fühle ich mich durch die entstehende Komplexität stark beunruhigt.	❍	❍	❍	❍	❍
5.	Wenn ich bei der Suche nach einer Forschungslücke auf eine komplizierte Literaturlage mit vielen abweichenden Perspektiven treffe, reizt es mich, die Hintergründe zu durchdringen.	❍	❍	❍	❍	❍
6.	Wenn ich bei meiner Datenauswertung merke, dass die Ergebnisse nicht erwartungskonform sind, will ich gleich herausfinden, woran das liegt.	❍	❍	❍	❍	❍
7.	Wenn sich bei der Auswertung von Daten plötzlich neue Aspekte auftun, befürchte ich ein großes Durcheinander.	❍	❍	❍	❍	❍
8.	Wenn beim Aufarbeiten der Literatur die bisherigen Ergebnisse überhaupt nicht zusammenpassen, will ich durchschauen, woran das liegt.	❍	❍	❍	❍	❍

RÜCKSCHLÄGE IM FORSCHUNGSPROZESS

Inwieweit stimmen Sie diesen Aussagen zu?

		1 stimme nicht zu	2 stimme kaum zu	3 teils/ teils	4 stimme eher zu	5 stimme zu
1.	Wenn ich einen komplizierten Text, den mir meine Betreuerin empfohlen hat, auch nach mehrmaligem Lesen nicht verstehe, bleibe ich ruhig und versuche es noch einmal.	❍	❍	❍	❍	❍
2.	Wenn ich Daten, die ich selbst erhoben habe, durch ein Computerproblem verlieren würde, hätte ich keine Lust mehr, weiterzuarbeiten.	❍	❍	❍	❍	❍
3.	Wenn mein Betreuer ständig Kritik an meinen Analysen übt, könnte ich verzweifeln.	❍	❍	❍	❍	❍
4.	Wenn sich meine Datenauswertung als fehlerhaft erweist und ich noch einmal von vorne anfangen muss, würde ich wahrscheinlich verzweifeln.	❍	❍	❍	❍	❍
5.	Wenn ich Probleme habe, Leute für meine Datenerhebung zu gewinnen, gebe ich trotzdem nicht auf.	❍	❍	❍	❍	❍
6.	Wenn ich am Ende meiner Datenauswertung bemerke, dass ich einen groben Fehler gemacht habe, behalte ich einen kühlen Kopf und suche nach Lösungen für mein Problem.	❍	❍	❍	❍	❍
7.	Wenn ich einen komplizierten Text einfach nicht verstehen kann, fühle ich mich unfähig.	❍	❍	❍	❍	❍
8.	Wenn meine Betreuerin anmerkt, dass ich viel zu viel in meine Forschungsergebnisse reininterpretiert habe, überarbeite ich das entsprechende Kapitel in aller Ruhe.	❍	❍	❍	❍	❍

BEDEUTUNG VON FORSCHUNG

Zur Frage, für wie wichtig man Forschung hält, kann man ganz unterschiedlicher Auffassung sein. Uns interessiert nun, was Sie darüber denken. Wie bedeutend ist Forschung für Sie?

	1 stimme nicht zu	2 stimme kaum zu	3 teils/ teils	4 stimme eher zu	5 stimme zu
1. Forschung in meinem Fach hilft dabei, gesellschaftliche Probleme der Gegenwart zu lösen.	❍	❍	❍	❍	❍
2. Nur durch Forschung kann in meinem Fach das bestehende Wissen erweitert werden.	❍	❍	❍	❍	❍
3. Im Vergleich zu anderen Themen messe ich der Forschung eine große Bedeutung bei.	❍	❍	❍	❍	❍
4. Die Forschung in meinem Fach ist nützlich, weil man durch Forschung interessante Erkenntnisse erzielen kann.	❍	❍	❍	❍	❍
5. Mir ist Forschung wichtiger als anderen Leuten.	❍	❍	❍	❍	❍
6. Forschung in meinem Fach ist ein guter Weg, um Antworten auf Fragen zu finden, die die Menschheit schon immer interessiert haben.	❍	❍	❍	❍	❍
7. Wenn es in meinem Fach keine Forschung geben würde, könnten viele gesellschaftliche Probleme nicht gelöst werden.	❍	❍	❍	❍	❍
8. Mir ist wichtig, über neue wissenschaftliche Errungenschaften in meinem Fach Bescheid zu wissen.	❍	❍	❍	❍	❍
9. Forschung in meinem Fach ist wichtig, um Probleme der Berufspraxis lösen zu können.	❍	❍	❍	❍	❍

HERAUSFORDERUNGEN

Im Folgenden schildern wir Ihnen verschiedene Situationen, in denen es im Forschungsprozess zu besonderen Herausforderungen kommen kann. Falls Sie manche Situationen selbst noch nicht erlebt haben, versuchen Sie bitte, sich dennoch in diese Situationen hineinzuversetzen.

	1 stimme nicht zu	2 stimme kaum zu	3 teils/ teils	4 stimme eher zu	5 stimme zu
1. Ich bin sicher, dass ich meine Daten sinnvoll interpretieren kann, auch wenn sie auf den ersten Blick nichts hergeben.	❍	❍	❍	❍	❍
2. Ich traue mir zu, Schlussfolgerungen aus der Literatur zu ziehen, auch wenn die Literatur widersprüchlich ist.	❍	❍	❍	❍	❍
3. Ich bin mir sicher, dass ich Methoden zur Datenauswertung anwenden kann, auch wenn ich diese vorher noch nicht benutzt habe.	❍	❍	❍	❍	❍
4. Ich bin überzeugt, dass ich eine Forschungslücke finden kann, auch wenn die Literatur dazu unübersichtlich ist.	❍	❍	❍	❍	❍
5. Ich habe keinen Zweifel, dass ich meine Forschungsergebnisse präzise in Worte fassen kann, auch wenn die zu beschreibenden Zusammenhänge sehr kompliziert sind.	❍	❍	❍	❍	❍
6. Ich bin überzeugt, dass ich meine Forschungsergebnisse mit bisherigen Studien in Beziehung setzen kann, auch wenn ich andere Methoden genutzt habe.	❍	❍	❍	❍	❍
7. Ich bin mir sicher, dass ich zur Beantwortung meiner Fragestellung ein sinnvolles Forschungsdesign entwickeln kann, auch wenn ich dabei viel Einfallsreichtum beweisen muss.	❍	❍	❍	❍	❍
8. Ich habe keinen Zweifel, dass ich meine Studie überzeugend darstellen kann, auch wenn meine Ergebnisse nicht viel Neues aufzeigen.	❍	❍	❍	❍	❍
9. Ich bin mir sicher, dass ich mit meiner Datenerhebung gut zurechtkomme, auch wenn ich diese in einem schwierigen Umfeld durchführe.	❍	❍	❍	❍	❍

FORSCHUNGSWISSEN

Im Folgenden werden Ihnen einige Aufgaben zu verschiedenen Methoden und Methodologien der sozialwissenschaftlichen Forschung präsentiert. Bitte versuchen Sie die Fragen zu beantworten.

1. FRAGE

Welcher der folgenden Schritte ist bei der Vorbereitung einer quantitativ orientierten Fragebogenstudie am wichtigsten, d.h. bei welchem Schritt sollten Sie am gründlichsten vorgehen?

(Bitte kreuzen Sie genau eine Antwortoption an)

❍	Die Optimierung der Länge von Fragen und des Fragebogens
❍	Die Optimierung der Verständlichkeit von Hinweistexten zu den Fragen
❍	Die Übersetzung der theoretischen Begriffe und Konstrukte in Indikatoren und Fragen
❍	Die Übersetzung der Antwortformate von Fragen in Variablenmerkmale und Messniveaus

2. FRAGE

Masterarbeit

Forschungsthema: „Postnatale Depression" (Depression einer Mutter nach der Geburt eines Kindes)

Literatur zum Thema: Es gibt bereits eine Fülle an theoretischer Literatur und an empirischer Forschungsliteratur zur postnatalen Depression.

Bisherige Schritte:
- Durchsicht des Vorlesungsmaterials zum Thema Depression
- Lektüre der medizinischen Fachinformationen zur postnatalen Depression

Welchen der folgenden Schritte würden Sie durchführen, um eine sinnvolle Forschungsfrage zu finden?

(Bitte kreuzen Sie genau eine Antwortoption an)

❍	Forschungsliteratur auf explizit benannte Desiderate und offene Fragen durchsuchen und aus ihnen eine Forschungsfrage ableiten
❍	Theoretische Literatur auf inhaltliche Übereinstimmungen überprüfen und aus ihnen eine Forschungsfrage ableiten
❍	In Forschungsliteratur nach viel diskutierten Themen suchen und eines davon auswählen
❍	In theoretischer Literatur nach viel diskutierten Themen suchen und eines davon auswählen

3. FRAGE

Was bedeutet es in der quantitativen Methodentradition, wenn ein signifikanter Effekt auf einem Signifikanzniveau von 5 Prozent festgestellt wird?

(Bitte kreuzen Sie genau eine Antwortoption an)

❍	Die Wahrscheinlichkeit, diesen oder einen noch extremeren Effekt zu beobachten – obwohl in Wahrheit kein Effekt vorliegt – beträgt höchstens 5 Prozent.
❍	Die Wahrscheinlichkeit, keinen Effekt zu beobachten – obwohl in Wahrheit ein Effekt vorliegt – beträgt höchstens 5 Prozent.
❍	Die Wahrscheinlichkeit, dass man einen tatsächlich vorhandenen Effekt auch feststellt, beträgt mindestens 95 Prozent.
❍	Ein Effekt liegt nur dann vor, wenn mindestens 5 Prozent der Befragungspersonen vom Konfidenzintervall abweichen.

4. FRAGE

Forschungsfrage: „Lässt sich die Studienzufriedenheit durch Mentoring erhöhen?"

Forschungsdesign:
- Zur Messung der Studienzufriedenheit liegt bereits ein entwickelter und validierter Fragebogen vor, der auch schon in mehreren anderen Forschungsprojekten genutzt wurde. Dieser Fragebogen wird leicht modifiziert (einzelne Formulierungen) und gekürzt (von 18 auf 12 Fragen, 5er Likert-Skala).
- Kontrollgruppendesign (1 Versuchsgruppe, 1 Kontrollgruppe, Zuordnung zufällig), Messung der Studienzufriedenheit vor und nach der Einführung von Mentoring.
- Vergleich des erzielten Effekts (Erhöhung der Studienzufriedenheit) mit den Effekten aus vorliegenden Studien.

Was ist das größte Problem des dargestellten Forschungsprojektes?

(Bitte kreuzen Sie genau eine Antwortoption an)

❍	Es hätte der bereits vorhandene und validierte Fragebogen genutzt werden sollen.
❍	Es hätten mehr Fragen im Fragebogen verwendet werden sollen.
❍	Es hätte eine Zuordnung zur Versuchsgruppe gemäß relevanter Außenkriterien erfolgen sollen.
❍	Es hätte eine zweite Versuchsgruppe geben sollen.

5. FRAGE

Welche der folgenden Forschungsfragen passt am besten zur qualitativen Methodentradition?

(Bitte kreuzen Sie genau eine Antwortoption an)

❍	„Wie gestaltet sich der Abwägungsprozess für einen Promotionsabbruch und welche Rolle spielen die Eltern dabei?"
❍	„Gibt es einen Zusammenhang zwischen Promotionsabbruch und Schichtzugehörigkeit der Eltern von Promovierenden?"
❍	„Verringert sich die Abbruchwahrscheinlichkeit von Promotionsvorhaben bei Promovierenden höherer sozialer Schichten gegenüber der anderer Promovierender?"
❍	„Inwiefern unterscheidet sich die Abbruchwahrscheinlichkeit von Promovierenden mit Eltern besserer sozio-ökonomischer Lebensbedingungen von der Abbruchwahrscheinlichkeit anderer Promovierender?"

6. FRAGE

Studentisches Forschungsprojekt (4 Studierende, Bearbeitungszeit 3 Monate)

Forschungsfrage: „Welche subjektiven Theorien haben Spielsüchtige über Spielautomaten?"

Forschungsdesign:
- Teilnehmende Beobachtung in 4 Automatencasinos in Stuttgart
- Beobachtungsprotokolle über das Verhalten der Spieler/innen (nur Beobachtung von häufig wiederkehrenden Spieler/innen)
- Auswertung der Protokolle mittels Grounded Theory

Was ist das größte Problem des dargestellten Forschungsprojektes?

(Bitte kreuzen Sie genau eine Antwortoption an)

❍	Die Erhebungsmethode passt nicht zur Forschungsfrage.
❍	Die Auswertungsmethode passt nicht zur Forschungsfrage.
❍	Die Anfertigung von Beobachtungsprotokollen ist zu unsystematisch für die Erhebungsmethode.
❍	Die Anzahl der Casinos ist zu niedrig für die Erhebungsmethode.

7. FRAGE

Forschungsprojekt im Auftrag des Bundesverbandes der deutschen Binnenschifffahrt (Dauer: 2 Jahre)

Forschungsthema: Normen und Werte von Binnenschifffahrer/innen

Forschungsstand: Bislang gibt es kaum Studien zu dem Thema; die vorliegenden Theorien sind noch sehr undifferenziert, d.h. sie erklären wenig Zusammenhänge und Sachverhalte.

Forschungsdesign:
- Methodologie: Grounded Theory (qualitative Methodentradition)
- Durchführung von 10 narrativen Interviews
- Entwicklung einer Theorie zu den Normen und Werten in der Binnenschifffahrt auf Basis der Interviewtranskripte

Für das Forschungsdesign stellt sich die Frage, wann und nach welchen Kriterien die Interviewpartner/innen ausgewählt werden sollten. Welche Entscheidung sollte für das dargestellte Projekt getroffen werden?

(Bitte jeweils eine Antwort ankreuzen, d.h. insgesamt 2 Antworten geben)

Kriterien der Auswahl:

Es wäre wünschenswert, dass der Forscher / die Forscherin die Interviewpartner/innen …	
❍	auf Basis einer zufälligen Ziehung auswählt.
❍	auf Basis theoretischer Überlegungen auswählt.

Zeitpunkt der Auswahl:

Es wäre wünschenswert, dass der Forscher / die Forscherin die Interviewpartner/innen …	
❍	im Vorhinein auswählt, d.h. vor Beginn des ersten Interviews.
❍	sukzessive auswählt, d.h. während der Erhebungs- und Auswertungsphase.

8. FRAGE

Für die Formulierung einer Forschungsfrage in der empirischen Sozialforschung sind verschiedene Kriterien wichtig. Welches der folgenden Kriterien ist Ihrer Meinung nach am wichtigsten für studentische Forschungsprojekte?

(Bitte kreuzen Sie genau eine Antwortoption an)

Die Forschungsfrage sollte …	
❍	… unterschiedliche empirische Theorien vergleichen.
❍	… anhand empirischer Ergebnisse beantwortbar sein.
❍	… noch nicht empirisch bearbeitet worden sein.
❍	… empirisch ermittelte Praxisprobleme behandeln.

9. FRAGE

Bachelorarbeit

Forschungsfrage: „Welche Mechanismen der sozialen Kontrolle weisen Hausbesetzer/innen auf?"

Forschungsdesign:
- Fragebogenerhebung mit 100 Hausbesetzer/innen (Fragebogen bereits mehrfach validiert)
- Interviews mit 4 Hausbesetzer/innen
- im Vorfeld Besprechung der Erhebungsinstrumente im Kolloquium

Forschungsergebnisse:
- Die Befunde aus der quantitativen Erhebung und der qualitativen Erhebung widersprechen sich augenscheinlich: Hinweise auf soziale Kontrolle finden sich in den Interviews, aber nicht in der Fragebogenerhebung.

In der Bachelorarbeit werden die sich widersprechenden Forschungsergebnisse gleichberechtigt beschrieben. Gründe für den Widerspruch werden nicht behandelt.

Was ist das größte Problem des dargestellten Forschungsprojektes?

(Bitte kreuzen Sie genau eine Antwortoption an)

❍	Nur das quantitative Ergebnis hätte in der Bachelorarbeit dargestellt werden sollen.
❍	Nur das qualitative Ergebnis hätte in der Bachelorarbeit dargestellt werden sollen.
❍	Mögliche Gründe für den Widerspruch hätten in einer zusätzlichen Interviewstudie untersucht und zu diesem Zweck eine Verlängerung der Bearbeitungszeit beantragt werden sollen.
❍	Mögliche Gründe für den Widerspruch hätten mit dem Betreuer oder mit Kommilitonen besprochen und in der Bachelorarbeit diskutiert werden sollen.

ERGÄNZENDE ANGABEN

Um zu untersuchen, ob es einen Zusammenhang zwischen den Testergebnissen und Noten in Schule und Studium gibt, möchten wir Sie bitten, uns Ihre Abitur- und Bachelorarbeitsnote zu verraten. Dies ist ein wichtiger Schritt für die Validierung unseres Tests.

Sollten Sie Ihre Noten nicht nennen wollen, so kreuzen Sie bitte jeweils „keine Angabe" an.

Welche Bachelorarbeitsnote haben Sie erhalten?
Gemeint ist nur die Note der Abschlussarbeit, nicht die Gesamtnote Ihres Studiums.

Bachelorarbeitsnote: ____ , ____ (z.B.: 2,7)

❍ Keine Angabe

Welche Abiturnote haben Sie erhalten?

Abiturnote: ____ , ____ (z.B.: 2,7)

❍ Keine Angabe

ENDE DES FRAGEBOGENS

Haben Sie ergänzende Anregungen oder Bemerkungen zu dieser Befragung?

Herzlichen Dank für Ihre Teilnahme an dieser Erhebung!

Unter **u.hu-berlin.de/FL** erfahren Sie mehr über das Projekt „ForschenLernen".

Falls Sie darüber hinaus Fragen haben, können Sie mir gerne eine E-Mail schreiben:
insa.wessels@hu-berlin.de

Appendix F Questionnaire Post Measurement (Students)

ZU IHRER PERSON

1. Wie alt sind Sie? _____ Jahre

2. Welchem Geschlecht ordnen Sie sich zu? ❍ männlich ❍ weiblich ❍ keine Angabe

3. Haben Sie schon an der Prä-Messung zu Beginn der Veranstaltung teilgenommen?

❍	Ja. Bitte weiter bei Frage 6.
❍	Nein. Bitte weiter bei der nächsten Frage.

4. Welches Studienfach (Hauptfach) studieren Sie?

5. In welchem Semester studieren Sie in Ihrem derzeitigen Studiengang?

im ____. Fachsemester ❍ Bachelor ❍ Master ❍ Dipl./ Mag. ❍ Dr./Phd ❍ Staatsexamen

6. Sind Sie in diesem Semester – zusätzlich zu diesem Seminar – noch in einem anderen Kontext mit Forschung in Berührung gekommen?

(Mehrfachnennungen möglich)

Ich habe in diesem Semester außerdem noch ….		
❑	1	an anderen Veranstaltungen teilgenommen, in denen ich selbst (mit)geforscht habe. (z.B. Studienprojekt, Forschungsprojekt)
❑	2	an meiner Abschlussarbeit gearbeitet. (z.B. BA- oder MA-Arbeit)
❑	3	an Veranstaltungen teilgenommen, in denen ich Forschungsmethoden gelernt oder geübt habe. (z.B. Methodenvorlesung oder -seminar)
❑	4	als studentische Hilfskraft in einem Forschungsprojekt gearbeitet.
❑	5	in keinem anderen Kontext geforscht.

7. Bitte nennen Sie uns kurz den Nachnamen der Dozentin bzw. des Dozenten sowie Wochentag und Uhrzeit des Seminars, damit wir Ihre Angaben sicher mit einer Veranstaltung verknüpfen können.

Nachname der Dozentin bzw. des Dozenten:
Wochentag und Uhrzeit des Seminars:

ZUM SEMINAR

Welche Methoden haben Sie in Ihrem Forschungsprojekt genutzt bzw. werden Sie noch nutzen?

(Bitte kreuzen Sie genau eine Antwortoption an)

❍	1	ausschließlich qualitative Methoden
❍	2	ausschließlich quantitative Methoden
❍	3	sowohl quantitative als auch qualitative Methoden
❍	4	keine Methoden der empirischen Sozialforschung

Welche der folgenden Forschungstätigkeiten haben Sie im Seminar selbst durchgeführt? Welche stehen noch an?

(Bitte kreuzen Sie in jeder Zeile genau eine Antwortoption an)

Im Seminar habe ich zum jetzigen Zeitpunkt…	**1** **habe ich bereits durch-geführt**	**2** **werde ich noch durch-führen**	**3** **werde ich nicht durch-führen**
eine eigene Forschungsfrage entwickelt	❍	❍	❍
mit Literatur gearbeitet (z.B. recherchiert, gelesen, diskutiert, ausgewertet)	❍	❍	❍
ein Forschungsdesign entwickelt (d.h. Entwicklung eines Plans, wie die Forschungsfrage beantwortet wird)	❍	❍	❍
empirisch gearbeitet (z.B. messen, befragen, interviewen, Daten auswerten)	❍	❍	❍
wissenschaftliche Texte geschrieben (z.B. Hausarbeit, Forschungsbericht, wissenschaftlicher Artikel)	❍	❍	❍

Glauben Sie, dass Sie in diesem Seminar selbst wissenschaftliche Erkenntnisse, also „echte" Forschungsergebnisse erzielen?

(Bitte kreuzen Sie genau eine Antwortoption an)

Die im Seminar erzielten Erkenntnisse …		
❍	1	sind keine echten Forschungsergebnisse.
❍	2	sind eher keine echten Forschungsergebnisse.
❍	3	sind teils-teils echte Forschungsergebnisse.
❍	4	sind eher echte Forschungsergebnisse.
❍	5	sind echte Forschungsergebnisse.

ZUM SEMINAR

Wie nützlich war das Thema des Seminars für eine mögliche spätere Berufspraxis (außerhalb der Wissenschaft)?

(Bitte kreuzen Sie genau eine Antwortoption an)

Das Thema des Seminars ist für eine mögliche spätere Berufspraxis …		
❍	1	nicht nützlich.
❍	2	eher nicht nützlich.
❍	3	teils-teils nützlich.
❍	4	eher nützlich.
❍	5	nützlich.

DIE ROLLE DES LEHRENDEN

In welcher Rolle haben Sie die Dozentin bzw. den Dozenten des Seminars erlebt? Bitte wählen Sie die Antwortoption aus, die am ehesten auf Ihre Dozentin bzw. Ihren Dozenten passt.

(Bitte kreuzen Sie genau eine Antwortoption an)

❍	1	Lehrende/r
❍	2	Forscher/in

Wie war die Rolle der Dozentin bzw. des Dozenten beim Forschen im Seminar? Bitte wählen Sie die Antwortoption aus, die am ehesten auf Ihre Dozentin bzw. Ihren Dozenten passt.

(Bitte kreuzen Sie genau eine Antwortoption an)

❍	1	Die Dozentin/ Der Dozent hat die studentische Forschung angeleitet.
❍	2	Die Dozentin/ Der Dozent hat gemeinsam mit den Studierenden geforscht.

Hatten Sie das Gefühl, dass sich die Dozentin bzw. der Dozent für die Erkenntnisse interessiert, die in den studentischen Forschungsprojekten erzielt werden?

(Bitte kreuzen Sie genau eine Antwortoption an)

Die Erkenntnisse aus den studentischen Forschungsprojekten interessieren die Dozentin/ den Dozentin …		
❍	1	nicht.
❍	2	eher nicht.
❍	3	teils-teils.
❍	4	ein wenig.
❍	5	sehr.

VERHALTEN DES LEHRENDEN

Wie ist die Dozentin bzw. der Dozent damit umgegangen, wenn im Forschungsprojekt eine wichtige Entscheidung getroffen werden musste?

(Mehrfachnennungen möglich)

Wenn die Studierenden Schwierigkeiten hatten, beim Forschungsprojekt eine Entscheidung zu treffen …		
❑	1	hat die Dozentin/ der Dozent Vor- und Nachteile aufgezeigt.
❑	2	hat die Dozentin/ der Dozent die Entscheidung abgenommen.
❑	3	hat die Dozentin/ der Dozent frustriert auf die Entscheidungsschwierigkeiten reagiert.
❑	4	ist die Dozentin/ der Dozent auf Entscheidungsschwierigkeiten nicht weiter eingegangen.

Wie ist die Dozentin bzw. der Dozent damit umgegangen, wenn im Forschungsprojekt mal etwas nicht so gut geklappt hat wie erhofft?

(Mehrfachnennungen möglich)

Wenn bei mir oder bei Kommiliton/innen im Forschungsprojekt Probleme aufgetreten sind …		
❑	1	hat die Dozentin/ der Dozent uns klar gemacht, dass Forschung nicht immer so laufen muss, wie geplant.
❑	2	hat die Dozentin/ der Dozent davon berichtet, dass sie/ er selbst auch schon Rückschläge beim Forschen erlebt hat.
❑	3	hat die Dozentin/ der Dozent die Fehler im Vorgehen kritisiert.
❑	4	hat die Dozentin/ der Dozent die Rückschläge im Seminar nicht weiter thematisiert.

SPASS AN FORSCHUNG

Im Folgenden schildern wir Ihnen verschiedene Forschungstätigkeiten, die einem mehr oder auch weniger Spaß machen können.
Falls Sie manche Tätigkeiten selbst noch nicht durchgeführt haben, versuchen Sie bitte sich dennoch in diese Tätigkeiten hineinzuversetzen.

		1 Macht mir überhaupt keinen Spaß	2 Macht mir eher kei-nen Spaß	3 teils/ teils	4 Macht mir eher Spaß	5 Macht mir sehr viel Spaß
1.	eine eigene Forschungsfrage entwickeln	❍	❍	❍	❍	❍
2.	Literatur zu einem Forschungsfeld recherchie-ren	❍	❍	❍	❍	❍
3.	wissenschaftliche Artikel zu einem For-schungsfeld lesen	❍	❍	❍	❍	❍
4.	ein Forschungsdesign/ einen Untersuchungs-plan entwickeln	❍	❍	❍	❍	❍
5.	Daten empirisch erheben (z.B. messen, befragen, interviewen, testen)	❍	❍	❍	❍	❍
6.	Daten auswerten	❍	❍	❍	❍	❍
7.	aus neuen Erkenntnissen Schlussfolgerungen ziehen	❍	❍	❍	❍	❍
8.	bestehende Theorien meines Faches weiter-entwickeln	❍	❍	❍	❍	❍
9.	neue Erkenntnisse vor einer Gruppe präsen-tieren	❍	❍	❍	❍	❍
10.	wissenschaftliche Texte schreiben	❍	❍	❍	❍	❍

BEDEUTUNG VON FORSCHUNG

Zur Frage, für wie wichtig man Forschung hält, kann man ganz unterschiedlicher Auffassung sein. Uns interessiert nun, was Sie darüber denken.

		1 stimme nicht zu	2 stimme kaum zu	3 teils/ teils	4 stimme eher zu	5 stimme zu
1.	Forschung in meinem Fach hilft dabei, gesellschaftliche Probleme der Gegenwart zu lösen.	❍	❍	❍	❍	❍
2.	Nur durch Forschung kann in meinem Fach das bestehende Wissen erweitert werden.	❍	❍	❍	❍	❍
3.	Im Vergleich zu anderen Themen messe ich der Forschung eine große Bedeutung bei.	❍	❍	❍	❍	❍
4.	Die Forschung in meinem Fach ist nützlich, weil man durch Forschung interessante Erkenntnisse erzielen kann.	❍	❍	❍	❍	❍
5.	Mir ist Forschung wichtiger als anderen Leuten.	❍	❍	❍	❍	❍
6.	Wenn es in meinem Fach keine Forschung geben würde, könnten viele gesellschaftliche Probleme nicht gelöst werden.	❍	❍	❍	❍	❍

FORSCHUNGSWISSEN

Im Folgenden werden Ihnen einige Aufgaben zu verschiedenen Methoden und Methodologien der sozialwissenschaftlichen Forschung präsentiert. Wenn Sie die Fragen noch nicht beantworten können, ist das kein Problem! Sicher werden Sie im Laufe Ihres Studiums noch genügend Gelegenheiten haben, um dazuzulernen.

1. FRAGE

Welcher der folgenden Schritte ist bei der Vorbereitung einer quantitativ orientierten Fragebogenstudie am wichtigsten, d.h. bei welchem Schritt sollten Sie am gründlichsten vorgehen?

(Bitte kreuzen Sie genau eine Antwortoption an)

❍	Die Optimierung der Länge von Fragen und des Fragebogens
❍	Die Optimierung der Verständlichkeit von Hinweistexten zu den Fragen
❍	Die Übersetzung der theoretischen Begriffe und Konstrukte in Indikatoren und Fragen
❍	Die Übersetzung der Antwortformate von Fragen in Variablenmerkmale und Messniveaus

2. FRAGE

Masterarbeit

Forschungsthema: „Postnatale Depression" (Depression einer Mutter nach der Geburt eines Kindes)

Literatur zum Thema: Es gibt bereits eine Fülle an theoretischer Literatur und an empirischer Forschungsliteratur zur postnatalen Depression.

Bisherige Schritte:
- Durchsicht des Vorlesungsmaterials zum Thema Depression
- Lektüre der medizinischen Fachinformationen zur postnatalen Depression

Welchen der folgenden Schritte würden Sie durchführen, um eine sinnvolle Forschungsfrage zu finden?

(Bitte kreuzen Sie genau eine Antwortoption an)

❍	Forschungsliteratur auf explizit benannte Desiderate und offene Fragen durchsuchen und aus ihnen eine Forschungsfrage ableiten
❍	Theoretische Literatur auf inhaltliche Übereinstimmungen überprüfen und aus ihnen eine Forschungsfrage ableiten
❍	In Forschungsliteratur nach viel diskutierten Themen suchen und eines davon auswählen
❍	In theoretischer Literatur nach viel diskutierten Themen suchen und eines davon auswählen

3. FRAGE

Was bedeutet es in der quantitativen Methodentradition, wenn ein signifikanter Effekt auf einem Signifikanzniveau von 5 Prozent festgestellt wird?

(Bitte kreuzen Sie genau eine Antwortoption an)

❍	Die Wahrscheinlichkeit, diesen oder einen noch extremeren Effekt zu beobachten – obwohl in Wahrheit kein Effekt vorliegt – beträgt höchstens 5 Prozent.
❍	Die Wahrscheinlichkeit, keinen Effekt zu beobachten – obwohl in Wahrheit ein Effekt vorliegt – beträgt höchstens 5 Prozent.
❍	Die Wahrscheinlichkeit, dass man einen tatsächlich vorhandenen Effekt auch feststellt, beträgt mindestens 95 Prozent.
❍	Ein Effekt liegt nur dann vor, wenn mindestens 5 Prozent der Befragungspersonen vom Konfidenzintervall abweichen.

4. FRAGE

Forschungsfrage: „Lässt sich die Studienzufriedenheit durch Mentoring erhöhen?"

Forschungsdesign:
- Zur Messung der Studienzufriedenheit liegt bereits ein entwickelter und validierter Fragebogen vor, der auch schon in mehreren anderen Forschungsprojekten genutzt wurde. Dieser Fragebogen wird leicht modifiziert (einzelne Formulierungen) und gekürzt (von 18 auf 12 Fragen, 5er Likert-Skala).
- Kontrollgruppendesign (1 Versuchsgruppe, 1 Kontrollgruppe, Zuordnung zufällig), Messung der Studienzufriedenheit vor und nach der Einführung von Mentoring.
- Vergleich des erzielten Effekts (Erhöhung der Studienzufriedenheit) mit den Effekten aus vorliegenden Studien.

Was ist das größte Problem des dargestellten Forschungsprojektes?

(Bitte kreuzen Sie genau eine Antwortoption an)

❍	Es hätte der bereits vorhandene und validierte Fragebogen genutzt werden sollen.
❍	Es hätten mehr Fragen im Fragebogen verwendet werden sollen.
❍	Es hätte eine Zuordnung zur Versuchsgruppe gemäß relevanter Außenkriterien erfolgen sollen.
❍	Es hätte eine zweite Versuchsgruppe geben sollen.

5. FRAGE

Welche der folgenden Forschungsfragen passt am besten zur qualitativen Methodentradition?

(Bitte kreuzen Sie genau eine Antwortoption an)

❍	„Wie gestaltet sich der Abwägungsprozess für einen Promotionsabbruch und welche Rolle spielen die Eltern dabei?"
❍	„Gibt es einen Zusammenhang zwischen Promotionsabbruch und Schichtzugehörigkeit der Eltern von Promovierenden?"
❍	„Verringert sich die Abbruchwahrscheinlichkeit von Promotionsvorhaben bei Promovierenden höherer sozialer Schichten gegenüber der anderer Promovierender?"
❍	„Inwiefern unterscheidet sich die Abbruchwahrscheinlichkeit von Promovierenden mit Eltern besserer sozio-ökonomischer Lebensbedingungen von der Abbruchwahrscheinlichkeit anderer Promovierender?"

6. FRAGE

Studentisches Forschungsprojekt (4 Studierende, Bearbeitungszeit 3 Monate)

Forschungsfrage: „Welche subjektiven Theorien haben Spielsüchtige über Spielautomaten?"

Forschungsdesign:
- Teilnehmende Beobachtung in 4 Automatencasinos in Stuttgart
- Beobachtungsprotokolle über das Verhalten der Spieler/innen (nur Beobachtung von häufig wiederkehrenden Spieler/innen)
- Auswertung der Protokolle mittels Grounded Theory

Was ist das größte Problem des dargestellten Forschungsprojektes?

(Bitte kreuzen Sie genau eine Antwortoption an)

❍	Die Erhebungsmethode passt nicht zur Forschungsfrage.
❍	Die Auswertungsmethode passt nicht zur Forschungsfrage.
❍	Die Anfertigung von Beobachtungsprotokollen ist zu unsystematisch für die Erhebungsmethode.
❍	Die Anzahl der Casinos ist zu niedrig für die Erhebungsmethode.

7. FRAGE

Forschungsprojekt im Auftrag des Bundesverbandes der deutschen Binnenschifffahrt (Dauer: 2 Jahre)

Forschungsthema: Normen und Werte von Binnenschifffahrer/innen

Forschungsstand: Bislang gibt es kaum Studien zu dem Thema; die vorliegenden Theorien sind noch sehr undifferenziert, d.h. sie erklären wenig Zusammenhänge und Sachverhalte.

Forschungsdesign:
- Methodologie: Grounded Theory (qualitative Methodentradition)
- Durchführung von 10 narrativen Interviews
- Entwicklung einer Theorie zu den Normen und Werten in der Binnenschifffahrt auf Basis der Interviewtranskripte

Für das Forschungsdesign stellt sich die Frage, wann und nach welchen Kriterien die Interviewpartner/innen ausgewählt werden sollten. Welche Entscheidung sollte für das dargestellte Projekt getroffen werden?

(Bitte jeweils eine Antwort ankreuzen, d.h. insgesamt 2 Antworten geben)

Kriterien der Auswahl:

Es wäre wünschenswert, dass der Forscher / die Forscherin die Interviewpartner/innen …	
❍	auf Basis einer zufälligen Ziehung auswählt.
❍	auf Basis theoretischer Überlegungen auswählt.

Zeitpunkt der Auswahl:

Es wäre wünschenswert, dass der Forscher / die Forscherin die Interviewpartner/innen …	
❍	im Vorhinein auswählt, d.h. vor Beginn des ersten Interviews.
❍	sukzessive auswählt, d.h. während der Erhebungs- und Auswertungsphase.

8. FRAGE

Für die Formulierung einer Forschungsfrage in der empirischen Sozialforschung sind verschiedene Kriterien wichtig. Welches der folgenden Kriterien ist Ihrer Meinung nach am wichtigsten für studentische Forschungsprojekte?

(Bitte kreuzen Sie genau eine Antwortoption an)

Die Forschungsfrage sollte …	
❍	… unterschiedliche empirische Theorien vergleichen.
❍	… anhand empirischer Ergebnisse beantwortbar sein.
❍	… noch nicht empirisch bearbeitet worden sein.
❍	… empirisch ermittelte Praxisprobleme behandeln.

9. FRAGE

Bachelorarbeit

Forschungsfrage: „Welche Mechanismen der sozialen Kontrolle weisen Hausbesetzer/innen auf?"

Forschungsdesign:
- Fragebogenerhebung mit 100 Hausbesetzer/innen (Fragebogen bereits mehrfach validiert)
- Interviews mit 4 Hausbesetzer/innen
- im Vorfeld Besprechung der Erhebungsinstrumente im Kolloquium

Forschungsergebnisse:
- Die Befunde aus der quantitativen Erhebung und der qualitativen Erhebung widersprechen sich augenscheinlich: Hinweise auf soziale Kontrolle finden sich in den Interviews, aber nicht in der Fragebogenerhebung.

In der Bachelorarbeit werden die sich widersprechenden Forschungsergebnisse gleichberechtigt beschrieben. Gründe für den Widerspruch werden nicht behandelt.

Was ist das größte Problem des dargestellten Forschungsprojektes?

(Bitte kreuzen Sie genau eine Antwortoption an)

❍	Nur das quantitative Ergebnis hätte in der Bachelorarbeit dargestellt werden sollen.
❍	Nur das qualitative Ergebnis hätte in der Bachelorarbeit dargestellt werden sollen.
❍	Mögliche Gründe für den Widerspruch hätten in einer zusätzlichen Interviewstudie untersucht und zu diesem Zweck eine Verlängerung der Bearbeitungszeit beantragt werden sollen.
❍	Mögliche Gründe für den Widerspruch hätten mit dem Betreuer oder mit Kommilitonen besprochen und in der Bachelorarbeit diskutiert werden sollen.

HERAUSFORDERUNGEN IM FORSCHUNGSPROZESS

Im Folgenden schildern wir Ihnen herausfordernde Situationen, die im Laufe eines Forschungsprozesses auftreten können. Wie reagieren Sie in solchen Situationen?
Falls Sie einige der Situationen selbst noch nicht erlebt haben, versuchen Sie bitte, sich dennoch in diese Situationen hineinzuversetzen.

UNGEWISSE SITUATIONEN

		1 stimme nicht zu	2 stimme kaum zu	3 teils/ teils	4 stimme eher zu	5 stimme zu
1.	Mich motiviert es, dass in meiner Forschung nicht immer alles planbar ist.	❍	❍	❍	❍	❍
2.	Ich finde es beunruhigend, dass ich vor Beginn meines Forschungsprojekts nicht weiß, ob alles klappt, wie ich mir das vorstelle.	❍	❍	❍	❍	❍
3.	Wenn ich mir nicht sicher bin, welche Methoden ich zur Auswertung meiner Daten anwenden sollte, dann belastet mich das.	❍	❍	❍	❍	❍
4.	Ich finde es unglaublich motivierend, dass ich bei meinen Erhebungen im Feld nicht immer alles genau planen kann.	❍	❍	❍	❍	❍
5.	Wenn ich die Wahl hätte, würde ich lieber vorher wissen, ob meine Erhebung funktioniert, als mich überraschen zu lassen.	❍	❍	❍	❍	❍
6.	Ich finde es spannend, wenn ich vor Beginn meines Forschungsvorhabens nicht abschätzen kann, was am Ende eigentlich rauskommen wird.	❍	❍	❍	❍	❍
7.	Wenn ich nicht weiß, welche Forschungsfrage ich wählen soll, weil ich die Ergebnisse kaum absehen kann, fühle ich mich unwohl.	❍	❍	❍	❍	❍
8.	Wenn ich für die Datenauswertung eine Methode benötige, von der ich noch nie gehört habe, empfinde ich das als eine schöne Herausforderung.	❍	❍	❍	❍	❍

KOMPLIZIERTE FORSCHUNGSSITUATIONEN

		1 stimme nicht zu	2 stimme kaum zu	3 teils/ teils	4 stimme eher zu	5 stimme zu
1.	Wenn ich bei der Literarturrecherche merke, dass der Forschungsstand zu meinem Thema widersprüchlich ist, spornt mich das an, mehr über die Hintergründe zu erfahren.	❍	❍	❍	❍	❍
2.	Wenn ich beim Aufarbeiten der Hintergrundliteratur merke, dass die Kernaussagen der Autor_innen nicht zusammenpassen, finde ich das belastend.	❍	❍	❍	❍	❍
3.	Wenn meine Datenauswertung zu überraschenden Zwischenergebnissen führt, untersuche ich diese Unregelmäßigkeiten im Detail.	❍	❍	❍	❍	❍
4.	Wenn sich durch eine forschungsmethodische Empfehlung meiner Betreuerin plötzlich viele neue Möglichkeiten auftun, fühle ich mich durch die entstehende Komplexität stark beunruhigt.	❍	❍	❍	❍	❍
5.	Wenn ich bei der Suche nach einer Forschungslücke auf eine komplizierte Literaturlage mit vielen abweichenden Perspektiven treffe, reizt es mich, die Hintergründe zu durchdringen.	❍	❍	❍	❍	❍
6.	Wenn ich bei meiner Datenauswertung merke, dass die Ergebnisse nicht erwartungskonform sind, will ich gleich herausfinden, woran das liegt.	❍	❍	❍	❍	❍
7.	Wenn sich bei der Auswertung von Daten plötzlich neue Aspekte auftun, befürchte ich ein großes Durcheinander.	❍	❍	❍	❍	❍
8.	Wenn beim Aufarbeiten der Literatur die bisherigen Ergebnisse überhaupt nicht zusammenpassen, will ich durchschauen, woran das liegt.	❍	❍	❍	❍	❍

RÜCKSCHLÄGE IM FORSCHUNGSPROZESS

		1 stimme nicht zu	2 stimme kaum zu	3 teils/ teils	4 stimme eher zu	5 stimme zu
1.	Wenn ich einen komplizierten Text, den mir meine Betreuerin empfohlen hat, auch nach mehrmaligem Lesen nicht verstehe, bleibe ich ruhig und versuche es noch einmal.	❍	❍	❍	❍	❍
2.	Wenn ich Daten, die ich selbst erhoben habe, durch ein Computerproblem verlieren würde, hätte ich keine Lust mehr, weiterzuarbeiten.	❍	❍	❍	❍	❍
3.	Wenn mein Betreuer ständig Kritik an meinen Analysen übt, könnte ich verzweifeln.	❍	❍	❍	❍	❍
4.	Wenn sich meine Datenauswertung als fehlerhaft erweist und ich noch einmal von vorne anfangen muss, würde ich wahrscheinlich verzweifeln.	❍	❍	❍	❍	❍
5.	Wenn ich Probleme habe, Leute für meine Datenerhebung zu gewinnen, gebe ich trotzdem nicht auf.	❍	❍	❍	❍	❍
6.	Wenn ich am Ende meiner Datenauswertung bemerke, dass ich einen groben Fehler gemacht habe, behalte ich einen kühlen Kopf und suche nach Lösungen für mein Problem.	❍	❍	❍	❍	❍
7.	Wenn ich einen komplizierten Text einfach nicht verstehen kann, fühle ich mich unfähig.	❍	❍	❍	❍	❍
8.	Wenn meine Betreuerin anmerkt, dass ich viel zu viel in meine Forschungsergebnisse reininterpretiert habe, überarbeite ich das entsprechende Kapitel in aller Ruhe.	❍	❍	❍	❍	❍

ENDE DES FRAGEBOGENS

Würden Sie uns Ihre E-Mail-Adresse nennen?

Gerne würden wir ggf. noch einmal auf Sie zukommen, um Sie rückblickend zu Ihren Einschätzungen zum Seminar zu befragen – insbesondere – wenn zum jetzigen Zeitpunkt noch einige Forschungsschritte vor Ihnen liegen sollten.

Wenn Sie einverstanden sind, dass wir uns noch einmal bei Ihnen melden, wäre es schön, wenn Sie hier **Ihre E-Mail-Adresse** angeben würden, die wir nur zu diesem Zweck nutzen werden. Bitte beachten Sie, dass Sie uns gegenüber damit nicht mehr anonym bleiben. Natürlich werden wir Ihre Angaben aber nicht an die Dozentin/ den Dozenten zurückspiegeln und selbstverständlich wird Ihre E-Mail-Adresse nicht weitergegeben.

Haben Sie ergänzende Anregungen oder Bemerkungen zu dieser Befragung?

Herzlichen Dank für Ihre Teilnahme an dieser Erhebung!

Unter **u.hu-berlin.de/FL** erfahren Sie mehr über das Projekt „ForschenLernen".

Falls Sie darüber hinaus Fragen haben, können Sie mir gerne eine E-Mail schreiben:
insa.wessels@hu-berlin.de

Appendix G Questionnaire Post Measurement (Lecturers)

ZUM SEMINAR

Bitte nennen Sie uns kurz Ihren Nachnamen sowie Wochentag und Uhrzeit Ihres Seminars, damit wir Ihre Angaben sicher mit der Studierendenbefragung verknüpfen können.

Nachname der Dozentin bzw. des Dozenten:
Wochentag und Uhrzeit des Seminars:

Wie spezifisch war das übergreifende Thema des Seminars, zu dem die Studierenden geforscht haben? Bitte wählen Sie die Antwortoption aus, die am ehesten auf das Seminarthema passt.
(Bitte kreuzen Sie genau eine Antwortoption an)

			Beispiele			
❍	1	ganz offen auf das Fach bezogen	*Erziehungswissenschaften*	*Politikwissenschaften*	*Soziologie*	*Psychologie*
❍	2	breites Themengebiet	*Unterrichtsforschung*	*Demokratieforschung*	*Jugendsoziologie*	*Entwicklungspsychologie*
❍	3	enges Thema	*Mathematikangst*	*Verfassungspolitik der BRD*	*Lebensumstände Jugendlicher mit Migrationshintergrund*	*Sprachentwicklung und -verzögerung*
❍	4	sehr spezifisches Thema	*Effekte von Mathematikangst auf die Leistung bei Grundschüler/innen*	*Verfassungspolitische Vorstellungen im Parteienvergleich der BRD*	*Zukunftsvorstellungen Berliner Jugendlicher mit Migrationshintergrund*	*Prädiktive Rolle der Feinmotorik auf die Sprachentwicklung beim Kleinkind*

Was war das vorrangige Lernziel in Ihrem Seminar? Bitte wählen Sie die Antwortoption aus, die am ehesten auf Ihr Seminar passt.
(Bitte kreuzen Sie genau eine Antwortoption an)

In meinem Seminar ging es vor allem darum, dass die Studierenden…		
❍	1	fachliche Themen (kennen-)lernen
❍	2	Methoden lernen
❍	3	Forschungserfahrungen sammeln
❍	4	Erkenntnisse zum Seminarthema erzielen

ZUM ABLAUF DES SEMINAR

In Ihrem Seminar gab es vermutlich verschiedene Phasen. Bitte schätzen Sie ein, welchen zeitlichen Anteil die folgenden Phasen in Ihrem Seminar hatten.

1	thematischer Input:	_____ Prozent	*Bitte tragen Sie die Prozentwerte so ein, dass sie sich insgesamt auf 100 Prozent addieren.*
2	methodischer Input:	_____ Prozent	
3	Forschungsphase: (von Design bis Ergebnispräsentation)	_____ Prozent	
4	Sonstiges: (z.B. Organisatorisches)	_____ Prozent	

Hatte Ihr Seminar einen methodischen Fokus?
(Bitte kreuzen Sie genau eine Antwortoption an)

❍	1	ausschließlich qualitative Methoden
❍	2	ausschließlich quantitative Methoden
❍	3	sowohl quantitative als auch qualitative Methoden
❍	4	keine Methoden der empirischen Sozialforschung

Haben die Studierenden im Team geforscht?
(Bitte kreuzen Sie genau eine Antwortoption an)

❍	1	Ja, das gesamte Seminar hat als ein Team geforscht.
❍	2	Ja, die Studierenden haben in studentischen Kleingruppen geforscht.
❍	3	Manche Studierende haben in studentischen Kleingruppen, manche individuell geforscht.
❍	4	Nein, die Studierenden haben alle individuell geforscht.

ZUR FORSCHUNG DER STUDIERENDEN

Konnten die Studierenden in Ihrem Seminar eine eigene Forschungsfrage wählen?
(Bitte kreuzen Sie genau eine Antwortoption an)

❍	1	Die Forschungsfrage war vorgegeben.
❍	2	Die Studierenden konnten aus mehreren Forschungsfragen auswählen.
❍	3	Die Studierenden konnten die Forschungsfrage selbst entwickeln.
❍	4	Die Studierenden haben in meinem Seminar keine Forschungsfragen bearbeitet.

Haben Sie den Studierenden vorgegeben, welche Methoden für die Forschungsarbeit genutzt werden sollen?
(Bitte kreuzen Sie genau eine Antwortoption an)

❍	1	Die Methode war vorgegeben.
❍	2	Die Studierenden konnten aus mehreren Methoden auswählen.
❍	3	Die Studierenden konnten die Methode selbst wählen.
❍	4	Es wurden keine Methoden der empirischen Sozialforschung genutzt.

Haben Ihre Studierenden die Forschungsmethoden mit aller methodischen Strenge angewandt?
(Bitte kreuzen Sie genau eine Antwortoption an)

❍	1	Ja, die Methoden wurden so genutzt, wie es fach- und methodenüblich ist.
❍	2	Nein, die Methoden wurden unter reduzierten Anforderungen erprobt.

Glauben Sie, dass Sie durch das Seminar auch für Ihre eigene Forschung profitieren können?
(Bitte kreuzen Sie genau eine Antwortoption an)

Durch das Seminar kann ich…		
❍	1	nicht für meine eigene Forschung profitieren.
❍	2	eher nicht für meine eigene Forschung profitieren.
❍	3	teils/ teils profitieren.
❍	4	ein wenig für meine eigene Forschung profitieren.
❍	5	für meine eigene Forschung profitieren.

PRÜFUNG UND ABSCHLUSS

Welche Prüfungsleistung war in Ihrem Seminar zu erbringen?
(Mehrfachnennungen möglich)

❑	1	Klausur
❑	2	Referat
❑	3	Hausarbeit/ Forschungsbericht
❑	4	Portfolio
❑	5	Exposé
❑	6	Poster
❑	7	Forschungstagebuch
❑	8	eine andere Prüfungsleistung, und zwar _____
❑	9	keine Prüfungsleistung

Sollen die Studiereden in Ihrem Seminar Abschlussprodukte erarbeiten, die sich auch an Dritte richten?
(Bitte kreuzen Sie genau eine Antwortoption an)

❍	1	Ja, für eine Zielgruppe der scientific community (z.B. Artikel, Buchbeitrag, Symposium, Vortrag auf Konferenz)
❍	2	Ja, für eine Zielgruppe außerhalb der Wissenschaft (z.B. Broschüre, Handreichung, Film)
❍	3	Nein, nicht für Dritte (d.h. Abschlussprodukte richten sich an die Dozentin/ den Dozenten und/ oder an die Kommiliton/innen

KOMPETENZERWERB DER STUDIERENDEN

Welche der folgenden Kompetenzen bzw. Haltungen wurden bei den Studierenden Ihrer Meinung nach in Ihrem Seminar gefördert? Und wie haben Sie durch die Seminargestaltung dazu beitragen können?

In meinem Seminar haben die Studierenden…	**Ja, gefördert**	**Wie gefördert?**
thematisches Wissen erworben	❍	
forschungsmethodisches Wissen erworben (Wissen zu quantitativen und/ oder qualitativen Erhebungs- und Auswertungsmethoden)	❍	
Freude und Spaß an den Forschungstätigkeiten erworben	❍	
ein größeres Interesse an Forschung entwickelt (z.B. Forschung als nützlich anzusehen, um Erkenntnisse zu generieren oder Praxisprobleme zu lösen)	❍	
forschungsbezogene Ungewissheitstoleranz entwickelt (also die Fähigkeit, forschungsinhärente Unsicherheiten auszuhalten und zu akzeptieren)	❍	
forschungsbezogene Frustrationstoleranz entwickelt (also die Fähigkeit, Rückschläge im Forschungsprozess auszuhalten und zu akzeptieren)	❍	
forschungsbezogene Komplexitätstoleranz entwickelt (also die Fähigkeit, die Komplexität im Forschungsprozess auszuhalten und Willen, sie zu begreifen)	❍	

ENDE DES FRAGEBOGENS

Haben Sie ergänzende Anregungen oder Bemerkungen zu dieser Befragung?

Herzlichen Dank für Ihre Angaben!

Wir melden uns bei Ihnen, wenn die Ergebnisse unserer Studie vorliegen.

Falls Sie weitere Fragen oder Anmerkungen haben, können Sie mir gerne eine E-Mail schreiben:
insa.wessels@hu-berlin.de

Appendix H Short Version of the Research Competence Test

H.1 Background and aim

Both in the validation study and the subsequent pre-post study of research-based learning, it was planned to assess both affective-motivational and cognitive research dispositions. The test instrument to assess the cognitive facet of research competence was developed in an earlier project and consists of 27 short vignettes that ask for different aspects of the social scientific research process (Gess et al., 2018, 2017). The original test takes 35 minutes to complete which was too long for the context of the current studies. Thus, to avoid fatigue effects, a short version of the research competence test was developed based on data from the original validation study with $N = 675$ students (for more details on the study see Gess et al., 2018).

H.2 Item selection process

The model of research competence in the social sciences encompasses three knowledge dimensions (methodical research knowledge, methodological research knowledge and research process knowledge) that are needed to complete three main research activities (defining a research problem, planning a research project, analysing and interpreting data). Each combination of a knowledge dimension and a research step is assessed with three items, adding up to 27 items that represent qualitative and quantitative research. The short version was intended to represent the full breadth of the test's content and difficulty, to have a sufficient reliability and to show a high correlation to the long version of the test. Several steps were repeatedly performed to ensure a criteria-based selection of nine suitable items:

(1) For each knowledge dimension (9 items each) of the long version the three items with the highest discrimination parameters were selected.

(2) The reliability and correlation of the short version with the long version were tested.

(3) The difficulty of the selected items was assessed and compared to the long version. By replacing individual items of a knowledge domain with other items from the long version it was made sure that the whole range of difficulty was covered.

(4) The reliability and correlation of the short version with the long version were tested.

(5) To assure that all research steps were equally represented, individual items were replaced.

(6) The reliability and correlation of the short version with the long version were tested.

(7) To assure that the short version still assessed a research-related construct that was acquired during a social scientific study programme, the original sample from the validation study was used to test that psychology students had a higher probability of solving the selected items than chemistry students.

H.3 Results

After repeatedly passing through these steps, the final item selection consists of 9 items that represent the three knowledge dimensions and the difficulty of the original test. However, a trade-off between the test's validity and its breadth had to be made: the three research steps could not be represented equally – the research step 'planning a research project' is represented four times, the research step 'analysing and interpreting data' only twice. The final item selection for the short version consists of the following items:

Table 14: Selected items for the short version of the research competence test

Selected Item	Knowledge dimension	Research step	Research tradition	Percentage of correct answers	Item difficulty
BM_RP_2	Research process knowledge	Defining a research problem	Both methods	71%	-0.974
BM_RP_8	Research process knowledge	Defining a research problem	Both methods	63%	-0.481
BM_RP_9	Research process knowledge	Analysing and interpreting data	Both methods	77%	-1.418
QN_MD_4	Methodical knowledge	Planning a research project	Quant	54%	-0.203
QN_MD_2	Methodical knowledge	Planning a research project	Quant	53%	-0.033
QL_MD_4	Methodical knowledge	Planning a research project	Qual	20%	1.476
QN_ML_3	Methodological knowledge	Analysing and interpreting data	Quant	41%	0.538
QL_ML_2	Methodological knowledge	Defining a research problem	Qual	75%	-1.360
QL_ML_3	Methodological knowledge	Planning a research project	Qual	71%	-1.063

Analogous to the methodical procedure for the original version of the research competence test, the selection of the items was performed by applying 2PL-IRT-modelling. The WLE-Reliability of the short version is Rel_{WLE} = .65. The correlation of the WLE person scores of the short version with the WLE person scores of the long version is r = .86. While this high correlation indicates that the long and the short version measure a similar construct, it must be noted that the short version has not undergone the same validation steps as the long version.

Statement of Independence

Hiermit erkläre ich, dass ich diese Dissertation selbstständig und auf Grundlage der angegebenen Hilfen und Hilfsmittel angefertigt habe. Weiterhin hat keine Zusammenarbeit mit gewerblichen Promotionsberater_innen stattgefunden.
Die zugrundliegende Promotionsordnung der Lebenswissenschaftlichen Fakultät der Humboldt-Universität zu Berlin vom 5. März 2015 habe ich zur Kenntnis genommen.
Ich erkläre weiterhin, dass die vorliegende Dissertation oder Teile davon nicht bereits bei einer anderen wissenschaftlichen Einrichtung eingereicht, angenommen oder abgelehnt wurden. Ich habe mich nicht anderwärts um einen Doktorgrad beworben oder besitze bereits einen entsprechenden Doktorgrad.
Ich versichere, dass die Grundsätze der Humboldt-Universität zu Berlin zur Sicherung guter wissenschaftlicher Praxis eingehalten wurden.

I hereby declare that I completed the doctoral thesis independently and based on the stated resources and aids. Furthermore, there has been no collaboration with commercial doctoral advisors.
I acknowledge the underlying Doctoral Degree Regulations of the Faculty of Life Sciences of Humboldt-Universität zu Berlin dated March 5, 2015. I further declare that the doctoral thesis or parts of it have not already been submitted, accepted, or rejected by another academic institution. I have not applied elsewhere for a doctoral degree and or already hold a corresponding doctoral degree.
I declare that the principles of Humboldt-Universität zu Berlin for ensuring good academic practice were abided by.

_____

Insa Reichow (geb. Wessels)