Sustainable and Transparent Digitalization in Academic Teaching: The Role of Theoretical Research Perspectives and University Alignment for Learning Outcomes and Student Engagement in Higher Education

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Declaration on Contributions to Monography

This dissertation is written as a monography, and it includes content of three manuscripts that have already been published or are ready to submit. Passages of the manuscripts are found in the dissertation's theoretical chapters (Chapter 1 to 3), general discussion (Chapter 7), and summary (Chapter 8 to 9). The empirical findings of Manuscript 1 are presented in Chapter 4. Chapters 5 to 6 include the findings of Manuscript 2 and the findings of Manuscript 3. Prof. Dr. Joachim Kimmerle, Prof. Dr. Johannes Moskaliuk, and Prof. Dr. Ulrike Cress are co-authors of these manuscripts. The proportions of contribution to the manuscripts are presented in the subsequent tables.

Manuscript 1

Author	Author position	Scientific ideas %	Data generation %	Analysis & interpretation %	Paper writing %
Elke Kümmel	First author	50	100	100	70
Johannes Moskaliuk	Second author	20	0	0	0
Ulrike Cress	Third author	20	0	0	0
Joachim Kimmerle	Fourth author	10	0	0	30
Title of paper:		Digital Learning Environments in Higher Education: A Literature Review of the Role of Individual vs. Social Settings for Measuring Learning Outcomes.			
Status publication process:		Published: MDPI Education Sciences, 10, 3, 78 https://doi.org/10.3390/educsci10030078			

Manuscript 2

Author	Author position	Scientific ideas %	Data generation %	Analysis & interpretation %	Paper writing %
Elke Kümmel	First author	90	100	100	70
Joachim Kimmerle	Second author	10	0	0	30
Title of paper:		The Effects of a University's Self-Presentation and Applicants' Regulatory Focus on Emotional, Behavioral, and Cognitive Student Engagement.			
Status publication process:		Published: MDPI Education Sciences, 10, 3, 78 https://doi.org/10.3390/su122310045			

Manuscript 3

Author	Author position	Scientific ideas %	Data generation %	Analysis & interpretation %	Paper writing %
Elke Kümmel	First author	90 %	100 %	100 %	100 %
Joachim Kimmerle	Second author	10 %	0 %	0 %	0 %
Title of paper:		University's Self-Presentation and Situational Regulatory Focus Affected Emotional and Behavioral Student Engagement			
Status publication process:		Ready to submit			

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List of Abbreviations

CSCL	Computer-supported collaborative learning
GPA	Grade Point Average
ICT	Information Communication Technology
LIWC	Linguistic Inquiry and Word Count
MDPI	Multidisciplinary Digital Publishing Institute
NSSE	National Survey Student Engagement
ORSEE	Online Recruitment System for Economic Experiments
PANAS	Positive and Negative Affect Schedule

1 General Introduction

Higher education plays an important role in the long-term performance of society and a student's professional future. Educational researchers have been investigated for several years how to measure learning gain as well as learning goals, and to predict student's development as accurately and consistently as possible. Beyond this, effects of digitalization and effects of the corona pandemic now demand awareness of the structural influences of a university and openness for changes in higher education. There are new challenges for universities, for teachers and for learners beyond pure learning. Wilson et al. (2015) argue for "Learning in digital communities: Building the power of virtual skills through proficiency with networks of people, information, tools, and resources." (p. 74ff).

1.1 Research Gap: Structural Influence of Higher Education Institutions

My dissertation project takes up the idea of structural influences of a higher education institution within the framework of student engagement. Self-presentation of universities, student selection by a university, heterogeneity of the university network, research perspectives, campus life at a university, performance and assessment of students during their years of study are aspects that may vary depending on university structures. Unfortunately, there is little research on higher education that clarifies such structural influence of discipline or culture (i.e., theoretical research perspective and self-presentation) on assessment (i.e., learning outcomes and student engagement) within the meso system (Bronfenbrenner et al., 1981; Guo et al., 2015; Sembill & Frötschl, 2018). The work presented here addresses this deficit.

More precisely, higher education has several dimensions with different facets that should be more clearly defined. Most research on teaching and learning with digital media in higher education focuses on concrete courses or special settings in a microsystem of higher education (Bronfenbrenner et al., 1981) and even these results were difficult to distinguish. For this purpose, I will outline the theoretical background in Chapter 2 as a starting point for my research. The benefit of a transparent university structure is to provide a relevant overview. Distinguishing structures promotes the ability to reflect upon

professionalism. Such knowledge would support engaging with changing conditions and exploring the needs of a diverse student population. Additionally, continuing research could define alignments, diversity, hierarchical nesting and different relationships in the landscape of a higher education institution itself. Scattered studies have already been promising (Berkowitz et al., 2016; Giesenbauer & Müller-Christ, 2020; Sembill & Frötschl, 2018).

In Chapter 2, I introduce the theoretical background for my investigations on structural influence in higher education, with an overview of factors that are relevant for my project. The empirical part of the project starts with Chapter 3. In Chapter 4, I disentangle empirical results in reference to learning outcomes in digital learning environments from scientific perspectives, and describe the subsequent studies that were developed based on this. In Chapters 5 to 6, I present my approach to finding factors of a university's alignment that influence student engagement. To my knowledge, no research has compared the effects of different self-presentations on university applicants from a more outsider perspective. Altogether, my dissertation project specifically dealt with structural influences of higher education that have been neglected in scientific research. It creates a bridge from those structural influences to the context of teaching and learning with digital media in higher education. The next section introduces the topic of my work in more detail and justifies the method of the project.

1.2 Ambiguity about Teaching and Learning with Digital Media

Describing teaching and learning with digital media in higher education causes states of uncertainty from two points of view: that of the student population and higher education institutions. It is not clear from the beginning what initiating a digital change involves. It can be compared with open-heart surgery: serious, risky, and complex. Digital challenges comprise transition within and throughout the whole learning cycle.

On the one hand, prospective students have unlimited opportunities. Due to the increasing use of mobile devices, a large part of a career guidance in higher education takes place in the dynamic field of the world wide web. Digitally retrieved information on

professions, universities and courses of study is becoming increasingly important. Applicants use the internet as an encyclopedia to find courses of study, to read websites with descriptions of universities or to communicate interactively and exchange experience reports. They use their smart phones, tablets, or laptops to get an overview of life at university. They expect a certain degree of transparency and comparability between universities because this selection episode is a social situation that should match to their sense of self (Wynn, 1999). Such a match includes reflections about a locale change to a place where there's a university, about alignments of a university with personal objectives (goals, tasks, occupational field, or professional future), or financial aspects (private university versus state university). After choosing a university, higher education students are looking for a motivating course of study (Hartnett et al., 2014; Johnason et al., 2016) in an innovative digital learning environment (Schneider & Preckel, 2017) with the demand for high quality learning outcomes (Ehlers, 2007; Lorenzo & Moore, 2002; Schneider & Preckel, 2017) as the basis for a successful professional life (Beck, 2018; O'Connor & Allen, 2010; Penuel & O'Connor, 2018; Sallee, 2016).

University systems, on the other hand, are working to achieve Bologna goals, to manage digital challenges and ongoing changes in the three relevant areas of teaching, research, and sustainable efficiency (Giesenbauer & Müller-Christ, 2020; Huber, 2012; Moskaliuk et al., 2019). Universities aim to support personal development and social participation of their students while establishing acquisition of digital literacy (Binkley et al., 2012; Schüller et al., 2021). Universities manage such a balancing act between high-quality teaching, independent research and efficiently usable results in an environment that is becoming more and more digital. Higher education aims to assure continuity as well as to ensure creativity and change (Scherer, Siddiq, & Tondeur, 2019).

However, criteria for describing teaching and learning with digital media at university have been largely unclear (Clermont & Dirksen, 2016), and there is empirical evidence that students have difficulties in envisioning their student life (Briggs et al., 2012; Budd, 2017). A great body of research on first- year students, on retention rates, on socio

economic status or social capital showed that freshmen were a heterogeneous group (Braxton, 2016; Tinto, 1987, 1988, 2012). But less research on university applicants, aspects of universities' structure or public perception of universities can be found (Budd, 2017; Daenekindt & Huisman, 2020; Hemsley-Brown & Oplatka, 2015). This is surprising, as it seems to be proven that there is an interdependence between social and individual systems (Cress & Kimmerle, 2008; Vygotsky, 1978) – and accordingly in this case between higher education institutions and students. The social system of a university and the individual system of a single student should influence each other (Kuh, 2009). Wynn (1999) reported that even the time, during which applicants look for their future higher education institution constitutes a social situation, and that a match of social and organizational identity should lead to success and excellence. Therefore, a sustainable investigation on possible structural influence of a university on student's learning is overdue and necessary.

The main idea behind an investigation into the structural influence of higher education institutions is that such structural influence in higher education should result in success and excellence. The contribution of such an investigation is worth striving for because it enables higher education institutions to compare performance and to improve knowledge integration, to put universities' visions into practice, and to develop structural capital (Chen et al., 2004). Radloff and Coates (2010) reported that institutions can use such information to monitor and enhance the quality of education. And verifiable results help to answer reflective questions concerning salience, congruence and profitability (Trowler & Trowler, 2010a). The next chapter presents the research design and methodological approach to analyze structural influence of universities.

1.3 Methodological Approach

This project operationalized structural influence of higher education institutions in digital learning environments as a theoretical perspective of researchers on learning (Study 1) and alignment of university (Study 2 and Study 3). My working definition of the structural influence of higher education institutions in digital learning environments comprises the evaluation of learning outcomes, alignment of study programs, characteristics and design

of digital learning environments, perspectives on learning, and teaching and learning processes in the situational context of a university. In order to find regularities and mechanisms necessary to describe structural influence of higher education institutions on students' performance, I broke my research down to two empirical approaches from a psychological point of view: a secondary data analysis of different perspectives on learning and a primary data analysis of different alignments of universities. On the one hand, the analysis of research findings aimed to explore the social phenomena of a researcher's perspective, and whether this structural influence would be a promising study object. On the other hand, I integrated experimental studies where I manipulated a self-presentation of a university to find regularities and mechanisms necessary for an explanation of structural influence on students. The two approaches have in common that they aim at describing any existing implicit impact of the actors of a university.

To be precise, I chose examples of theoretical perspectives of researchers on learning and alignments of universities to represent influencing factors of higher education institutional structure. With this choice, I could explore the role of different factors and actors as a basis for whether the newly started investigation would yield profitable results and whether further research on structural influence in higher education would be promising. Furthermore, the approaches revealed an overview of different facets that can function as antecedents of performance as well as consequences of performance. For example, an alignment of a university or university's study programs with an applicant's personal objectives could possibly influence applicants' starting conditions or prime students' performance. A research and teaching perspective on learning, for example, defines initial requirements, reference standards or evaluation of learning outcomes which in turn implicitly influence a student's performance. Altogether, my project covers three main areas of a higher education institutions as introduced above, namely research (theoretical perspective of researchers on learning), teaching (evaluation of learning outcomes), and sustainable efficiency (alignment of university) which are subsequently discussed.

First, I conducted a systematic literature review on the evaluation of learning outcomes in research on higher education. I decided to explore perspectives of researchers on learning and their evaluation standards for teaching and learning with digital media. The main idea behind this beginning approach is that an evaluation of learning outcome is not only a result of student's engagement and learning but also a consequence of predominant reference standards of researchers, in particular of higher education institutions. I investigated differences as well as predominant reference standards to evaluate learning outcomes and as a base for discussing consequences of such reference standards in terms of digital challenges. The theoretical perspectives of researchers on learning (individual vs. social perspective) was operationalized through learning settings with an individual vs. social orientation. The dependent variable evaluation of learning outcomes described measurement of learning outcomes that could possibly affect students' performance. The chosen categories of measurements of learning outcomes were designed with respect to design and characteristics of digital learning environments. These are introduced and elaborated in Chapter 2.2 and in Chapter 4.3.2 (Table 4). Study 1 explored how learning outcomes were measured in existing research on teaching and learning with digital media in higher education.

Second, I designed two experimental studies which investigated possible influences of a university's situational context. Based on current literature, I designed alignments of universities in the form of study programs with different university goals, study tasks and visons of a student's professional future. This alignment or lack thereof could possibly have an effect on a student's state in a certain moment, as well as on more stable traits of university applicants in higher education. The main idea behind these designs of alignments is that a university's alignment is an antecedent to the formation of a student's learning activity and individual performance. I operationalized the alignment of a university through the manipulation of a university's self-presentation of a study program (chances vs. obligation).

To investigate a holistic picture of such structural influence of higher education institutions on individual performance, I integrated state-like and trait-like variables. For this, I completed the design with student engagement (emotional, behavioral, and cognitive student engagement) and regulatory focus (chronic and situational regulatory focus). I am aware that beneath any situational fact of a learning situation, there may be personal facts that activate student engagement or workload endurance. That is why I expanded the empirical investigation with chronic regulatory focus theory (promotion vs. prevention focus) in the first experimental study (Study 1). Promotion focus (a person's striving for self-realization) and prevention focus (a person's need for security) are two self-regulatory systems. These two self-regulatory systems trigger different strategies to achieve a certain goal depending on the predominance of promotion or prevention focus (Higgins, 1998). According to the current state of research, the framework of student engagement is supposed to represent a motivational state of applicants which should be deepened in research. I could comply with this supposition by carrying out the two experimental studies with student engagement as dependent variable, and by choosing situational regulatory focus to describe promotion and prevention focus of university's applicants in the second experimental study (Study 3). The empirical studies (Study 2 and Study 3) clarified the role of university's self-presentation and regulatory focus for student engagement.

1.4 Research Question

The research question was whether there is a structural influence of higher education on student's performance. I explored different facets of structural influence. Study 1 [1] focused on the sub question how learning outcomes have been measured in

[1] The review was published as Kümmel, E., Moskaliuk, J., Cress, U., & Kimmerle, J. (2020). Digital Learning Environments in Higher Education: A Literature Review of the Role of Individual vs. Social Settings for Measuring Learning Outcomes. *Education Sciences, 10*(3), 78. https://doi.org/10.3390/educsci10030078 http://doi:10.3390/edusci10030078. In accordance with the granted author rights for scholarly purposes by MDPI (Multidisciplinary Digital Publishing Institute), the subchapters from the open access journal are adapted from the original article.

empirical studies on learning with digital media in higher education. Study 2 [2] and Study 3 [3] focused on the sub question whether the interplay between a university's self-presentation and people's regulatory focus has any effect on student engagement.

Research has shown that there is a reciprocal relationship between students and higher education institutions. A student's learning result seem to be related to institutional alignment. Universities have different profiles that should take student's perspective, experiences or social capital into account. Teaching at university provides the bases for quality and excellence with possibilities for students to engage, to learn and to interact. Digital learning environments during the course of study and instruction vary for each learner in connectivity, flexibility, and ability (Nguyen et al., 2014; Rienties et al., 2015). Higher education often promotes system-driven and system-serving norms (Gale & Parker, 2014) and thereby does not take student's experiences, personality traits or level of cognitive development into account. Furthermore, the role of institutional norms for applicants remains unclear. Students' perception of an institution, a match of learning environment and learning style or subjective perception that interacts with individual experiences or pre-dispositions should be investigated to get a clear picture for a fit of university and students.

A first step to get a clearer picture for a fit of university and students is to answer the research question whether a structural influence of higher education on student's performance even exists. This thesis explores any possible relation of universities' evaluation standards, universities' alignment, and students' performance. For this purpose of exploration, the work presented here operationalized the structural influence of higher education institutions in digital learning environments as a theoretical perspective of

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[2] The study was published as Kümmel, E., & Kimmerle, J. (2020). The Effects of a University's Self-Presentation and Applicants' Regulatory Focus on Emotional, Behavioral, and Cognitive Student Engagement. *Sustainability, 12*(23), Article 10045. https://doi.org/10.3390/su122310045 http://doi:10.3390/su122310045. In accordance with the granted author rights for scholarly purposes by MDPI, the subchapters from the open access journal are adapted from the original article.

[3] Unpublished manuscript.

researchers on learning (Study 1) and a university's alignment (Study 2 and Study 3). Table 1 presents an overview of the research questions and hypotheses of this work.

Table 1

Overview of the Research Questions and Research Hypotheses of the Thesis

Type	Research question
RQ	Is there a structural influence of higher education on students' performance? Study 1: Theoretical perspective of researchers (+) Study 2 and 3: Alignment of university (+)
Study 1	
RQ1	How have learning outcomes been measured in empirical studies on learning with digital media in higher education?
H1.1	Researchers use different evaluations of learning outcomes in their learning settings due to their particular perspective.
Study 2	
RQ2	Is there any effect on student engagement in the interplay between a university's self-presentation and people's regulatory focus?
H2.1	There is an interaction effect between a university's self-presentation (chances vs. obligations) and individual regulatory focus (promotion vs. prevention) on student engagement. Participants with a high promotion focus show higher student engagement scores in the chances condition of a university's self-presentation whereas participants with a high prevention focus show higher student engagement scores in the obligations condition of a university's self-presentation. (regulatory fit*).*
Study 3	
RQ3	Is there an effect on student engagement in the interplay between a university's self-presentation and situational regulatory focus?
H 3.1	There is an interaction effect between a university's self-presentation (chances vs. obligations) and situational regulatory focus (promotion vs. prevention) on the three levels of student engagement. Participants overall show lower student engagement scores in the obligations condition. Emotional, behavioral, and cognitive student engagement are different levels of student engagement.

Note. RQ = Research question, H = Research hypothesis, (+) = Results support research

1.5 Overview of this Work

The planning for this dissertation project with the literature review was conducted before the digitalization push in university teaching, the digital pact school, and the corona

pandemic. In the meantime, research on digitalization has exploded. It is important to understand that experts from many different research areas were investigating teaching and learning with digital media at this time, and it was unusual to structure teaching and learning with digital media for practitioners and researchers, or to find a common language. These were the conditions when the project started in 2017.

In the following Chapter 2, I will outline the background of learning in digital communities. I will introduce the terms for individual and social perspectives of research on learning with digital media in higher education that are relevant for the first study in Chapter 4. Existing empirical results already predict learning outcomes but unfortunately without considering researchers' perspectives or their operationalizations of learning settings. And without such reflection, it is not clear how empirical results overall can be compared. My investigation provides a foundation for universities to reflect upon quality of results and to support ongoing development of innovative educational concepts. For this purpose, and because learning outcomes are main predictors in research on students' performance in higher education, I focus on the role of individual and social settings for the evaluation of learning outcomes. Chapter 2.2 introduces evaluations of learning outcomes in higher education institutions that should be explored. I present an overview on structure and meaning of academic learning outcomes and their relation to learning theories. In addition, I describe actual challenges to defining adequate learning outcomes of skills and knowledge that a student should acquire in digital learning environments at university from a research and teaching perspective.

As a next step, I introduce the concept of self-presentation of a study-program for implicit alignment of universities that is relevant for the studies in Chapters 5 and 6. In Chapter 2.4, I elaborate upon student engagement in detail. The framework is one basis for the two further experimental studies. I refer to student engagement in higher education that is linked to the context of a digital learning environment. Learning outcomes in digital learning environments and the results of the systematic review on learning outcomes which I conducted provided a basis for these experimental studies as well as supplementary

insights. Engaged, self-regulated, and proactive learning are important factors in digital learning environments, and an investigation should aim to explore, and to enlarge these factors. I used an approach from a student-centered perspective that framed possible relationships with higher education institutions, antecedents, and consequences of a student's engagement. A learning process from a student-centered perspective implies that universities focus on student's needs as well as on institutional requirements and visions. The overarching objective is to provide students with skills and practices that enable life-long learning. Especially in digital learning environments, a learner should show autonomy, engagement, and independency. Institutions that shift their focus onto student engagement could meet these requirements.

In Chapter 3, I summarize the objective of the project and start in Chapter 4 with the investigation into the role of individual vs. social settings for measuring learning outcomes in digital learning environments in higher education. Chapters 5 and 6 follow with a focus on some effects of individual and situational influences on student engagement. The studies presented in these chapters were two related follow-up studies. In Study 2 and Study 3, I examined student engagement, and additionally considered individual aspects of regulatory focus theory that may influence student engagement. A person's regulatory focus (a) determines that learner's perception, motivation, and emotional well-being; and (b) triggers activities that are associated with a personal goal. Accordingly, it is important to understand these relationships. With regard to the initial situations described above, it is not yet clear whether there is a situational effect or how strong the structural effects of higher education institution are. The structural influence of universities has been neglected in research so far and my framework student engagement fits to my intention to investigate structural influence. It might offer useful results for learning in digital communities. Chapter 7 presents answers to the research question with conclusive results and discussion.

Table 2

Phenomenon Structural Influence in Higher Education on Students' Performance

No.	Manuscript	Research question	Implementation	Special feature & results
1	Kümmel, Moskaliuk, Cress & Kimmerle (2020)	…to find and describe phenomenon: Theoretical perspective of researchers on learning	Literature research: Exploration of common practice in the evaluation of learning outcome in research on learning with digital media in higher education. Systematic review: Correlative model to uncover interrelationships IV [a] Learning settings (social/ individual) with two orientations (1) individual orientation: selecting and acquiring knowledge through encoding, storage, and retrieval of information, versus (2) social orientation: Learning and constructing knowledge through developing social awareness, and knowledge-related activities. DV [b] Measurements of learning outcomes	(+) [h] Heterogeneous measurement of learning outcomes (+) Categorization with subscales to structure and to elaborate used measurements of learning outcomes that described learning outcomes Method: self-report, observable behaviour Cognition: Learning skills, elaboration Activities: personal initiative, digital activity, social interaction (+) Researchers use different evaluations due to their perspective
2	Kümmel & Kimmerle (2020)	…to explore regularities and mechanism to explain phenomenon: Alignment of university	Experimental study: Exploration of an influence of a university's self-presentation of a study-program within the framework student engagement for university's applicants. Linear regression model with three predictors university's self-presentation, promotion focus, and prevention focus IV [a] university's self-presentation of a study-program: Goals, tasks and professional future were presented from a perspective that emphasized independence and individual choices (chances), versus rigid structures and predefined choices (obligations).	Further processing of the category activities of Study 1 for items to measure behavioural student engagement: personal initiative, digital networking, goal-oriented learning activities Besides the situational context of university's self-presentation, personality trait [f] was taken into account. Review and verification of the framework student engagement

No.	Manuscript	Research question	Implementation	Special feature & results
			IV [a] chronic regulatory focus DV [b] student engagement: emotional [c], behavioral [d], and cognitive [e] level	(+) Support for interaction effect and regulatory fit hypothesis
3	Kümmel & Kimmerle (ready to submit)	Alignment of university	Experimental study: Exploration of the role of university's self-presentation and regulatory focus for applicant's student engagement. Analysis of variance for a 2 x 2 between-subject design Manipulation of IV [a] university's self-presentation (chances/ obligations) IV [a] situational regulatory focus (promotion/ prevention) for university applicants. DV [b] Student engagement	Follow-up study to Study 2 The situational context of university's self-presentation and the individual state [g] was taken into account. (+) support for main effects but no proof of regulatory fit for student engagement

Note. Overview of Reported Studies with assignment of manuscripts to number of study (No.), and phenomenon structural influence (research question), design of study (Implementation), and special feature & results.

[a] Independent variable; [b] Dependent variable; [c] PANAS, positive and negative regulatory focus emotion; [d] Personal initiative, digital networking, goal-oriented learning activities; [e] Analysis of written essays with LIWC Categories drives (achievement, power, risk, and reward); [f] Chronic regulatory focus questionnaire; [g] Induction of promotion and prevention focus; [h] (+) = main result

2 Theoretical Background

2.1 Perspectives on Learning: Individual vs. Social Settings for Measuring Learning Outcomes

The efficient use of digital learning environments in higher education is an important research topic from both a scientific and a practical perspective. Learning in digital learning environments is characterized by the provision of learning materials that are independent of time and location, and by broad access to learning materials. Moreover, digital learning environments also support educational opportunities for all types of learners and provide digitally enhanced instruction (Chan et al., 2006; Hartnett et al., 2014; Johnason et al., 2016). Educational researchers from diverse disciplines have been trying to identify the success factors of learning with digital media in higher education for about two decades (Mothibi, 2015; Pea, 2004; Perelmutter et al., 2017; Schneider & Preckel, 2017; Stepanyan et al., 2013; Volery & Lord, 2000; Wu et al., 2012). One central aim of higher education is to foster students' potential for high-quality accomplishments (Ellis et al., 2016; Graham et al., 2013; Hassanzadeh et al., 2012; Sun et al., 2008) and support them in applying their knowledge to future challenges in their professional lives (O'Connor & Allen, 2010; Yang et al., 2016). Therefore, research on the use of digital learning environments in higher education should pay particular attention to learning outcomes as a prerequisite for evaluating learning success.

There are two main reasons why researchers and practitioners recommend the use of digital learning environments in higher education. First, in an increasingly digitalized world, education needs to be digital as well (Fraillon et al., 2014; Koehler et al., 2017; Laurillard et al., 2007; Wilson et al., 2018). Students should be encouraged and empowered to use digital media for communication and collaboration as well as for learning and knowledge exchange in an appropriate way to become competent and proficient members of a knowledge society. Second, digital learning environments promise to make learning and teaching more effective, for example, by increasing learners' motivation (Muenks & Miele, 2017; Sun et al., 2008), adapting to students' prior knowledge (Yang et

al., 2016), or providing the possibility for mobile and ubiquitous learning (Hatlevik & Christophersen, 2013; Scherer et al., 2017).

However, the findings of existing studies on the impact of digital media on learning are ambiguous (Al-Zahrani & Laxman, 2016; Bernard et al., 2014; Kirkwood & Price, 2013; Steenbergen-Hu & Cooper, 2014). In general, influencing factors, such as teachers (Røkenes & Krumsvik, 2016; Scherer, Siddiq, & Tondeur, 2019), prior knowledge (Connor et al., 2019; Davis et al., 2018), or the novelty of the particular digital setting (Thai et al., 2017) seem to have greater effects on learning outcomes than the use of digital media per se. One reason for marginal findings on the effects of digital media in these studies might be that they are highly heterogeneous with regards to measurements and the learning settings that they were applied. Therefore, the study presented here summarizes common measurements of variables that capture learning outcomes in existing empirical studies. This contributes to finding a common language of researchers to describe the effects by having a shared understanding of distinctive learning outcomes. We also argue that the particular theoretical perspective that researchers and practitioners take toward learning with digital media may have an impact on how they design learning environments, how they operationalize relevant variables, and how they measure learning outcomes (Kirkwood & Price, 2013). Research on digital learning environments has traditionally applied two perspectives of examining and understanding how people learn (Hoadley, 2018): A cognitive, individual-oriented perspective that focuses on individual cognition, and a social, community-oriented perspective that focuses on distributed cognition and collaboration (Brown et al., 1989; Danish & Gresalfi, 2018; Kimmerle et al., 2015). The cognitive perspective has been upheld mainly in psychology and in cognitive science research, while the social perspective has been the dominant approach in the learning sciences for roughly 30 years now (Cress & Kimmerle, 2018).

One objective of the project presented here was to examine how a cognitive perspective compared to a social perspective determined the dependent variables that researchers have used in existing studies. The goal of this approach is to comprehend the

role that these theoretical perspectives play in the design of digital learning environments and the evaluation of learning outcomes.

Theoretical Perspectives on Learning. Understanding the importance of these theoretical perspectives is one precondition for transferring scientific results into educational practice. In the following sections, we summarize the key ideas, concepts, and methods of the individual and social perspectives on digital learning environments and introduce our study idea.

Individual Perspectives on Learning. Individual perspectives deal with individual information processing and focus on individual thinking, including attention, mental representation, learning, memory, problem solving, and decision-making (Anderson, 1996; Anderson, 2013). From this standpoint, learning can be described as selecting information and acquiring knowledge through the encoding, storage, and retrieval of information. Learning activities of a single learner would then involve, for example, content-specific examination of learning materials (e. g., leading to understanding), achieving a certain knowledge state (e. g., leading to a test result), or individually creating a previously defined product (e. g., leading to an essay or a work object). From this perspective, digital media can be used to adaptively provide learning content and instructions. Beyond studying how students learn, it is relevant to understand how learners can be instructed or supported (Hoadley, 2004; Mayer, 2014; Van Merriënboer et al., 2002).

Cognitive theorizing also takes meta-cognitive monitoring into account, as this is a major aspect of self-regulated learning (Winne & Hadwin, 1998). Cognitive models often rely on training, problem solving, or computational thinking (Förster et al., 2018; Lotz et al., 2017; Scherer, 2016). They emphasize strategies for instructing learners to understand new information, construct mental representations of knowledge, and integrate information into cognitive schemas (Tsarava et al., 2018). Cognitive processes are mechanisms that induce learning depending on the mental capacity of learners (Chandler & Sweller, 1991; Paas et al., 2003; Sweller, 1994). With the development of digital media, learning

environments can be designed in such a way that they can rise to the challenge of meeting a learner's current cognitive load.

To predict learning from a cognitive perspective, researchers have investigated the process of knowledge acquisition where learners create mental representations of their knowledge (Barsalou, 1999; Chi & Wylie, 2014; Deng et al., 2017; Glenberg & Gallese, 2012). From a cognitive perspective, a learner's memory and cognitive capacity (Atkinson & Shiffrin, 1968; Baddeley & Hitch, 1974; Clark & Paivio, 1991; Paivio, 2013), attention (Higgins & Silberman, 1998), or decision-making (Petty & Cacioppo, 1986) are characteristics which determine learning. Research on individual learning with digital media, for example, indicated that dealing with digital learning material implies handling multimodality and interactivity (Moreno & Mayer, 2007; Strømsø, 2017), and that digital learning material is associated with specific e-tools (Coldwell et al., 2011) or virtual elements (Bailenson et al., 2008; Thai et al., 2017).

Social Perspectives on Learning. The social perspective postulates that learning is strongly influenced by the social environment in which it occurs (Vygotsky, 1978). This assumption is in line with the social constructivist theory developed by (Vygotsky, 1978) and indicates that learners need to be actively engaged in their social environment. As a consequence, learning can be conceptualized as a cooperative or collaborative endeavor (Doolittle, 1997). From this perspective, individual learning is socially mediated and not independent of the social context it is embedded in. On the contrary, the individual learners' cognitive systems strongly interact with social systems (Cress & Kimmerle, 2008). Learning (as an individual process) and knowledge construction (as a collective process) depend on knowledge-related activities that arise through socio-cognitive conflicts between these two systems (Kimmerle et al., 2015). Thus, communication and social interaction may trigger learning and knowledge construction (Aghaee & Keller, 2016; Goggins & Xing, 2016; Smet et al., 2010).

To solve a task for the first time, learners need scaffolding and support from peers or teachers (Damon & Phelps, 1989; Dillenbourg, 1999; Fischer et al., 2013). If two or more

people work together in computer-supported collaborative learning (CSCL), CSCL researchers tend not to focus on what happens in a single learner's cognitive system. They rather take the interaction among people or within the CSCL environment into account (Engelmann et al., 2009). Learners are part of a social context, and they learn how to act and interact within this situation. Such learners make important contributions in two respects. On the one hand, they internalize knowledge and develop as an individual; and on the other hand, they react to other people and externalize their knowledge into the social context (Kimmerle et al., 2015). From a social perspective, learning activity and learning outcomes are strongly dependent on the interaction within the group.

Research on social learning in digital learning environments indicates that dealing with digital media implies the development of social awareness (Reis et al., 2018). This involves making use of social media and social communication technology (Eid & Al-Jabri, 2016; Sobaih et al., 2016), and defining one's role in a digital network (Buder et al., 2015; Wilson et al., 2018). Moreover, social awareness can be developed by using specific e-tools (Erkens & Bodemer, 2019) or virtual elements (Bailenson et al., 2008; Schneider & Pea, 2013) to influence learning in a social setting.

This first elaboration of structural influence in the form of a researcher's perspective on learning provides a variety of possibilities for a researcher to predict learning outcomes. The following chapter links the importance of structural influence in higher education and the role of an evaluation of learning outcomes, in this case with the theoretical meaning of academic learning outcomes. I present first insights into the relationship of learning outcomes and learning activities.

2.2 Evaluation of Learning Outcomes: Measuring Academic Learning Outcomes

Learning outcomes were designed to be clear indicators of the learning result or academic achievement that are pre-determined by educators (Scott, 2011). The author describes three relevant actors that act according to their special perspectives of learning outcomes: a potential learner, potential employer, and quality agencies. A potential learner

can see change and improvement at the end of a learning period in his learning outcomes. Potential employers require testimonials. Testimonials about learning outcomes are relevant at the beginning of vocational employment to compare qualifications or applicants. Quality agencies serve as overall monitors or controllers. Universities, for example, can be compared, audited and judged by their own or external quality agencies.

A learning outcome is not a general outcome statement that all-inclusively explains what was learnt. Instead, learning outcomes refer to a special learning context with pre-supposed prior knowledge in a special community. “Learning outcomes are statements of what a learner is expected to know, understand and/or be able to demonstrate at the end of a period of learning” (Adam & Expert, 2008), p.4). From a learner perspective, successful learning at university implies that the student becomes part of this community, and that the student participates actively in an academic community to understand what is required. Universities report desired learning outcomes in structural documentations of a module for a qualification level (Scott, 2011). An adequate assessment of learning outcome depends on teaching and learning objectives and usually elicits a learning activity (Biggs & Tang, 2011). Biggs and Tang (2011) propose that beneath knowing *what* should be learned, it is extremely relevant to know *how* to learn and to *what* standard. Fook and Sidhu (2014) said that measuring learning outcomes in core content areas such as language, arts, mathematics, sciences, and social studies were predominant compared to measurements that prepare students for a future workplace in a global as well as a technological environment.

Following this ideas, it seemed worthwhile to investigate more deeply how learning outcomes were measured empirically in existing research on learning with digital media in higher education. From a theoretical point of view, an evaluation of learning outcomes requires an understanding of learning theories as well as of affordances of teaching and learning processes in an innovative digital learning environment. Students use technology tools with core characteristics within a digital learning environment, and these in turn influence student’s learning processes, learning outcomes, collaboration and

communication. Therefore, the next paragraphs provide a selection of examples on how to determine academic learning outcomes from a psychological point of view. This will provide a more elaborated view on the characteristics and design of digital learning environments which should be considered in an evaluation of learning outcomes. Both aspects are relevant, because university teachers as well as scientists in higher education still create digital learning settings and measure learning outcomes to evaluate learning success, or to create passing criteria of exams. A clear picture of outcomes in digital learning environments may create a connection between common practice in teaching with digital media, state of the art in research, and innovative changes. Such transparency is the basis for a sustainable use of measurements in digital learning environments and effective comparison of learning outcomes.

According to Sembill and Frötschl (2018), academic learning outcomes mainly describe cognitive learning processes, but that is not totally accurate. Different learning theories proposed different strategies and foci that I shortly summarize in Table 3. I provide a selection of examples on how to determine learning outcomes from a psychological point of view. This contributes to the understanding of the challenge of designing appropriate evaluations of learning outcomes in research and education.

Table 3

Exemplary Presentation how Learning Theories Determine Academic Learning Outcomes

Learning theory	Implementation and example
Behaviorism	
What to learn	Knowledge stands for itself Example: Plant names Teacher is an authority
How to learn	Specifying and reinforcing by interrogation
Learning outcome	Right vs. wrong
Cognitivism	
What to learn	Transfer knowledge and problem solving Example: annual depreciation Teacher is an instructor
How to learn	Establish predispositions to solve problems, and retrieval of stored content
Learning outcome	Right application of a method in a new problem situation
Constructivism	
What to learn	Mind as network with skills and knowledge; perception and thinking

Learning theory	Implementation and example
	Example: Practice case such as bee care during the year Teacher is a facilitator
How to learn	Discuss and elaborate in authentic learning situation
Learning outcome	Cope with complex situations and construct personal meaning (not right nor wrong)
Connectivism	
What to learn	Participation, critical thinking, and responsibility in a global network Teacher is a facilitator
How to learn	Determine tempo, learning goal and engagement independently
Learning outcome	Individual knowledge carrier and participation in intellectual capital

Note. The table summarizes an overview about alignment of topic (what to learn), learning activity (how to learn), and learning outcome in relation to prevailing learning theories (Biggs & Tang, 2011; Duke et al., 2013).

Yet, affordances of the initiated digital change to digital learning environments involve further elaboration of existing evaluation standards, the relationship of digital learning environment and learning success, and whether existing measurements of the learning outcome should be developed as well. The following paragraph gives a short specification of aspects that provide an appropriate differentiation in digital learning environments for evaluation practices. Chee Meng and Werner (2016) identified three important factors for implementing a successful digital learning environment in higher education: technology, administration, faculty (which together constitute the institution), and students. However, it remains unclear how digital learning environments improve learning outcome (Al-Zahrani & Laxman, 2016). This may be due to the heterogeneous definitions of learning with digital media and a high variety of different measurements of learning outcome. Based on these considerations, a detailed review of which characteristics of a digital learning environment contribute to which learning outcome would be valuable. Before it is possible to evaluate the relationship between digital learning environments and learning success, the question arises as to how learning outcome is defined. This work contributes to this discussion by providing a more elaborated view of

characteristics and design of digital learning environments that possibly moderate learning. The project focuses on different characteristics and designs of digital learning environments that have been introduced from different research perspectives. This takes the history and development of digital learning environments into account and summarizes relevant aspects for the successful design of digital learning environments discussed in the literature.

There is a broad range of literature that defines digital learning environments (Avella et al., 2016; Conley et al., 2016; Tamim et al., 2011). Moore et al. (2011) analyzed existing literature to identify how current research defines digital learning environments. They identified the terms (a) distance education, (b) online learning, and (c) e-learning. They then asked participants in an educational technology conference which terms they would use to describe digital learning environments. They brought together different researchers and practitioners to find commonalities and differences of the identified terms. The authors confirmed a lack of consistency in the terminology. However, core characteristics of all these digital learning environments evolved historically: (a) the provision of learning materials independent of time and space, (b) the broad access to learning materials, and (c) the support of educational opportunities (d) even for non-traditional learners.

Provision of Learning Material Independent of Time and Space. The digital learning environments identified by Moore et al. (2011) have in common a mixture of text-based, digital-based, and media-based learning materials (Akbar, 2016). This mixture is not inclusive but helpful in linking learners' learning activities in digital environments at the time of the development of this dissertation project. To be considered as digitally literate, learners should consume, produce, and even distribute these learning materials without any difficulties (Martin & Grudziecki, 2006; Reyna et al., 2018; Shen et al., 2013). Books, copies, and scripts were the original mediums of text-based learning materials that a learner *consumes*. Digitally based computer technologies, multi-modal representation, videos, records, data storage and data management expand upon these original mediums. Universities' digital learning platforms distribute and store the originals in many ways, and

learners, for example, *produce* own scripts and digital copies of these older mediums. Media-based learning materials represent the goal of fulfilling the upcoming and new requirements of a digital transformation, where university and learners use social media and new technologies (i.e., videos, applications, software, Web 2.0). Learners *distribute* and interact with digital content.

University students use their laptops and computers to gain access to all the learning materials. This helps students avoid further acquisition costs but may be irritating for some students because of the many hyperlinks and documents. A learner in a digital learning environment can also choose preferred learning times independently of given time and schedules dictated from the distance, with online access to these materials from everywhere and outside the university.

Support of educational opportunities. Teachers implement an instructional design that can be *task specific* or *media specific*. A task specific aspect focuses on the practical implementation of a learning task (authenticity), while a media specific aspect represents a distinct level of synchronicity, adaptivity, virtualization, interactivity level (Moskaliuk et al., 2019) or usability such as, for example, human-machine interaction. In this way, teachers can balance the offer of support within digital learning environments to meet the individual needs of learners (Leutner, 2004; Moreno & Mayer, 2007).

Special user in a network. Teaching and learning design can be *user specific* or *network specific*, depending on the role a learner takes in a digital learning environment. User specific characteristics could represent either individual preferences (Kerr et al., 2006) or social interaction, such as collaboration, cooperation, feedback or communication style (Jeong et al., 2017). Network specific characteristics focus more on the role a person has in an organization (i.e., bachelor student, PhD student, research associate). These characteristics can be explained with the idea of a personal vs. social identity (Tajfel, 1974), or with a social identity model of a deindividuation effect (Reicher et al., 1995). Such network characteristics emphasize that social support is critical for learning success in a student's learning space (i.e., a kind of *home office*). Depending on the salience of identity,

users decide whether they will switch on a camera during a conference or choose phoning, chatting or writing as the preferred communication style. Research assumes that being part of a network implies being loyal, accepting norms and data security aspects, team arrangements or official procedures on compulsory attendance.

Broad access and extent of communication and collaboration. Teaching and learning designs differ in the amount of interaction they encourage. Digital media provide new affordances for communication and social interaction and thus trigger individual learning and knowledge building (Cress & Kimmerle, 2008). Learners apply various ways to interact within digital media, and there is a shift from one-way communication to two-way communication (Jeong et al., 2017; Jones, 2012).

To sum up there are different approaches to differentiating digital learning environments being driven by universities values (Santo et al., 2018). Digital learning environments nowadays are diverse and connected to the world wide web with a university specific platform and multiple applications or communication technologies, all of which influence learning activities and learning outcomes. Therefore, these characteristics should be included in a learning process and taken into account in the evaluation of learning outcomes. Learning outcomes shape students' results and therefore their professional future. So, beyond the pure naming of an assessment outcome, the focus on evaluation standards to measure learning in Chapter 4 is overdue. Chapter 4 outlines which dependent variables were used in current research to evaluate learning outcomes. Based on literature research, I created categories of learning measurements that integrate the affordances and characteristics of learning outcomes in digital learning environments. I used empirical results in existing research to compare measurement of learning outcomes for the research perspectives presented above.

This first overview provided theoretical information for university teachers on possible design elements in a digital learning environment. One conclusion from this information is that possible learning outcomes in digital learning environments weren't a simple *either/or* solution of learning with or without digital media. It seems worthwhile to

scrutinize the heterogeneity of learning with digital media in higher education with respect to scientific perspectives on learning outcomes, and to explore whether and how student performance in such learning scenarios of universities can be made transparent.

A further relevant structural influence that this work explored is the alignment of a university with students' goals. The following chapter introduces the term *university alignment* as a characteristic that possibly promotes certain different perspectives on study programs.

2.3 Alignment of Universities: Self-Presentation of a Study-Program

Sustainable digitalization plays an increasingly important role in academic teaching (Stepanyan et al., 2013). In addition to the successful implementation of academic teaching in digital learning environments, there are social and economic aspects of sustainability. Graham (Graham et al., 2013) pointed out that a university's culture provides structural and, at the same time, social alignment for lecturers and students. Students and lecturers increasingly collaborate at universities with the help of digital learning tools (Howard et al., 2016; Kümmel et al., 2020). Lewison and Hawes (2007) reported the necessity of marketing plans to attract future students, recommending a marketing approach that requires universities to emphasize relevant foci. It is important to understand how universities can present themselves clearly in digital environments.

For some universities, it may be more important to support the development of social identity (Sallee, 2016; Scholl et al., 2019; Stephens et al., 2012; Weidman & Stein, 2003), whereas others have a vision of structuring students' futures (O'Connor & Allen, 2010; Penuel & O'Connor, 2018), or others wish to invest in public relations and comparative evaluations with other universities (Clermont & Dirksen, 2016). Overall, it is not clear how these particular foci of interest are experienced by student applicants from outside the university and how this affects their (future) student commitment and engagement.

Universities across the board focus on academic and personal success of their students, but the path to reaching this goal differs and is not always obvious. Universities

present value guidance and student incentives in study-programs that, for example, signal the university's willingness and openness to fully accept the new students into the academic community, even if they are not yet experts. Further incentives are, for example, mentoring programs, social support, and role models of advisors or leadership. Values taken into consideration are responsibility vs. ambition, growing into a role, and fostering an adequate feedback culture, trust, or commitment. Applicants read and derive values and goals of the institutional structure in study-program offers. But little research can be found that investigates whether such university self-presentations influence student performance. Santo et al. (2018) found that digital learning organizations varied in “their focus on *access to existing social futures* vs *creation of alternative social realities*” (p.1673). Upon considering single findings (Santo et al., 2018), an alignment of a university deserves attention, and this work closes this research gap. I investigated two different self-presentations of universities (chances vs. obligation) and clarified their influence on students’ performance in Study 2 and Study 3 (student engagement). One self-presentation emphasized independence and individual choices, whereas the other self-presentation described a rigid structure with predefined choices. In Chapter 5.2.3 I present details and validation of a study program’s self-created presentations.

This theoretical background offered a scope of structural influence and what an institution or its academics aspire to for their students. In the next step I present my approach to assess students’ performance in the context of an application to a university in digital learning environments.

2.4 Students’ Performance: Challenges in Learning with Digital Media

A learner needs to take initiative and be self-regulated to actively participate and construct knowledge in a learning environment that is becoming more and more digital. Chi et al. (2018) stated, “when students are detected to be looking at the learning materials at the right time, then students are considered to be actively engaged” (p.6). Cela et al. (2016) showed that learning styles influence social structures in online learning environments. And

learning success often depends on the right application of a method to internalize knowledge (Bada & Olusegun, 2015; Tam, 2000). Furthermore, in times of corona, is it more difficult to build relationships to peer and teachers, or to receive feedback. And social contacts are reduced to the digital space. Davidovitch and Belichenko (2018) proved that students who were more satisfied with their social media group demonstrated higher achievement, and the other way round. Complementary aspects of a connectivism perspective imply that every learner has his/her own knowledge carrier within the digital network. One pre-condition for this is that learners regulate their own learning tempo, learning goal and learning activity (Siemens, 2005). And research has also shown that learners need additional resources to collaborate and learn in digital networks and to profit from support in digital learning environment (Lacka et al., 2021). However, these authors critically recommend that learners use not only social media and virtual tools. And what does this mean for teaching in digital learning environment? It is clear, that the teacher's role changes in digital environments. Teachers need theoretical and practical knowledge (Sharma, 2018). They slip more and more into the role of a learning guide and facilitator (Belichenko et al., 2017). Sharma (2018) and Scherer, Siddiq and Tondeur (2019) recommend that a teacher uses Information Communication Technology (ICT) skills effectively and in combination with traditional techniques of teaching. Altogether higher education is creating a challenging ambiguity, as teachers write structural documentations about learning outcomes on the one hand and students who regulate learning more and more independently on the other hand.

The previous paragraphs have presented the state of the art in research with its lively discourse that reflects educational challenges and a paradigm from a research and teaching perspective. From a student-centered perspective, up to this point there is little evidence about the role of a situational context, or the role of personality or individual disposition that results in learning activities. That is the reason this work also contributes to the discourse about structural influences of higher education institutions on students'

performance from a student-centered perspective. The following chapter introduces learning activities as motivational state within the framework of student engagement. It further presents cognitive-motivational aspects of regulatory focus theory for insights into the relation of higher education structural influences with student performance. This presentation leads to refinement of the framework for student engagement.

2.4.1 Student Engagement

Learning activities should empower university students and help them to achieve the best possible results. According to Ehlers (2007), educational environments, educational processes, target groups, and stakeholders should be taken into account in a given concrete educational context. In his opinion, quality learning arises through active participation of learners who create their own educational biography. Gale and Parker (2014) emphasize students' need for capability to navigate through change in higher education. And Gale and Parker (2014) propose that student transition in higher education means not only adjusting to given university norms or maturing in identity, but rather responding to students' lived reality. This implies greater openness and flexibility of universities for heterogeneous students in modern life, and demand that the university be a place where students may think innovatively and differently.

Student engagement is one key factor that promotes self-regulated learning which is proactive in the context of a digital learning environment. This work explores the effects of individual and situational influences on student engagement. Students develop competencies and regulate goal-orientated actions to succeed in higher education, and student engagement is one key element (Skinner & Pitzer, 2012). Student engagement is a motivational state of a learner which should be represented by educationally productive activities (Kuh, 2009). Research has already shown that student engagement is a prerequisite for positive learning outcomes and learning success (Finn, 1993; Trowler & Trowler, 2010b). And Bakker et al. (2008) showed that student engagement in higher education provides learners with the high level of energy and strong identification necessary to learn within a digital learning environment. Fredricks et al. (2004) showed that

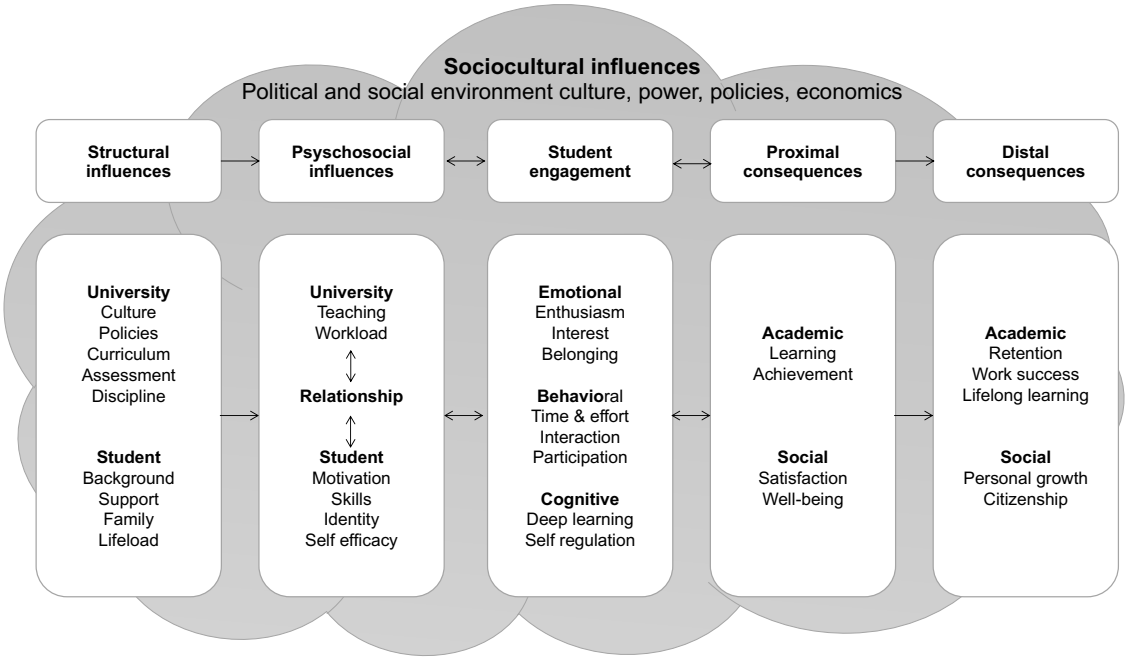
student engagement functions as an antidote to low achievement, to a high level of boredom, and to high drop-out rates. Maroco et al. (2016) found evidence for student engagement as a mediator for improving achievement and reducing failure. Student engagement seems to depend on the situational context, but something more still has to be proven (Finn & Voelkl, 1993; Fredricks et al., 2005; Fredricks et al., 2004; Moloney & Oakley, 2010). Fredricks et al. (2004) reported three different approaches in existing research on student engagement:

- The behavioral approach focuses on institutional teaching practices and student behavior (i.e., time and effort) and possible relations to achievement (i.e., Grade Point Average GPA) and satisfaction of students.
- The socio-cultural approach explores institution culture and student experiences with a special interest in background and families of non-traditional or risk-students.
- The psychological approach aims to predict internal processes of affect, behavior and cognition.

This work uses the psychological approach as abasis for investigation which I introduce in detail as follows (see Figure 1). One strength of this approach is that it integrates affective student engagement in addition to behavioral student engagement and cognitive student engagement. And, compared to the socio-cultural approach, another strength is a distinction between engagement's consequences and antecedents (Kahu, 2013). Behavioral student engagement picks up the idea of observable behavior that is spent in learning, but also includes attendance, involvement (like asking questions or personal initiative) and extracurricular activities. Affective student engagement focuses on actual emotional responses to the higher education institution, academic staff, or peers with a willingness to learn (Darr, 2012). Cognitive student engagement includes thinking about power and passion, seeking challenge, or going beyond the requirements (Darr, 2012). All these approaches were integrated in the conceptual framework for research on student engagement of Kahu (2013).

Figure 1

Conceptual Framework of Student Engagement adapted from Kahu (2013, p.766)



Kahu (2013) assumed that student engagement was the result of antecedents (i.e., psychosocial and structural influences), along with the political and social environment. From a student perspective, psychosocial influences include students' relationships with the university, teacher or peer, as well as their individual disposition, their sense of self, skills, support, and workload. Teaching practices should be supportive for high student engagement. Structural influences of the university and of students themselves were variables from a more outsider perspective. For example, a student's background, family, and life-load are well-studied variables from this perspective, while the structural influence of the university itself has been neglected in research so far. The work presented addresses this deficit.

The framework of Kahu (2013) separates consequences of student engagement into proximal and distal consequences. As already shown above, student engagement directly influences learning and achievement, as well as satisfaction and well-being. And according to this same framework, long-term aspects such as work success, personal

growth and citizenship were also influenced. Research on student engagement uniformly assumed that further research is needed to underpin and deepen the constructs presented so far of student engagement to yield benefits for universities and students in higher education (Trowler & Trowler, 2010a).

A high level of student engagement implies a positive and work-focused state. Nevertheless, it is also possible that a student will show negative engagement. Student engagement can be seen as a dichotomously multidimensional construct. Skinner and Pitzer (2012) described negative engagement as disaffection and negative feedback-loops that mitigate engagement and learning. Failure, unsupportive relationships or feeling incompetent, for example, may result in low self-efficacy and disengagement. Other research uses the terms active vs. passive learning, where educational activity is defined as deep vs. surface learning (Chi et al., 2018). In my approach I used a scale from no student engagement at all to a high level of student engagement, which I describe in detail in Chapter 5. All together it is necessary “to recognize that engagement is not an outcome of any *one* of these influences, but rather the complex interplay between them, as suggested by the arrows within this section of the framework.” (Kahu, 2013), p.767).

Individual disposition and personal resources that are, for example, described in regulatory focus theory, are closely related with well-being and resilience. This would mean that beneath situational facts of a learning situation there may be personal facts that activate student engagement or enable a student to endure the work-load. This relationship has already been reported in research on student engagement at school but, as far as I know, not yet in higher education. Darr (2012) attached importance to aspects that support student engagement prevailing through positivity and activity. Among other beneficial aspects, he reported feelings of personal safety and commitment, with relevance for- in this case- higher education. I present some theoretical background of regulatory focus theory that unites these aspects in the following chapter.

2.4.2 Regulatory Focus Theory: Promotion Focus and Prevention Focus

Regulatory focus theory proposes two self-regulatory system (Higgins, 1997; Higgins, 1998). Promotion focus represents a person's need for self-realization and to reach maximized positive results with a motivational tendency to reach ideals and goals. Prevention focus represents the need for protection and security with a motivational tendency to avoid failure. Both orientations are based on the hedonic principle to approach positive end states and to avoid negative end states. Persons with prevention focus shift their attention to the absence of negative end state (i.e., loss and non-loss) while persons with promotion focus shift their attention to the occurrence of positive end states (i.e., gain and non-gain). These two self-regulatory systems trigger different strategies to achieve a certain goal depending on the predominance of promotion or prevention focus.

According to the theory, a predominant regulatory focus is determined by trait-like chronic regulatory focus *and* by situational regulatory focus in a special context with well-established effects on emotion, behavior and cognition. This ties in appropriately with possible effects of university alignment and verifies the framework student engagement. Research has found interaction effects for a fit between chronic and situational regulatory focus, with the highest effects under a congruent chronic and situational focus (Keller & Bless, 2006). Information that was compatible with a person's regulatory focus was preferred (Lee & Aaker, 2004). A person's chronic regulatory focus is usually assessed via self-report in questionnaires. Situational regulatory focus can be manipulated via lexical tasks (for example, sorting adjectives), motorial tasks (for example, approach and avoidance motion, or mouse labyrinth), or biographical tasks (for example, thinking or writing about situations related to promotion or prevention focus). Regulatory focus theory and the framework of student engagement both refer to an interplay of emotion, behavior and cognition. A person with promotion focus is open to new challenges and behaves more eagerly, which should result in a higher level of student engagement. That should differ from the behavior of a person with prevention focus who is more cautious and shows more due diligence.

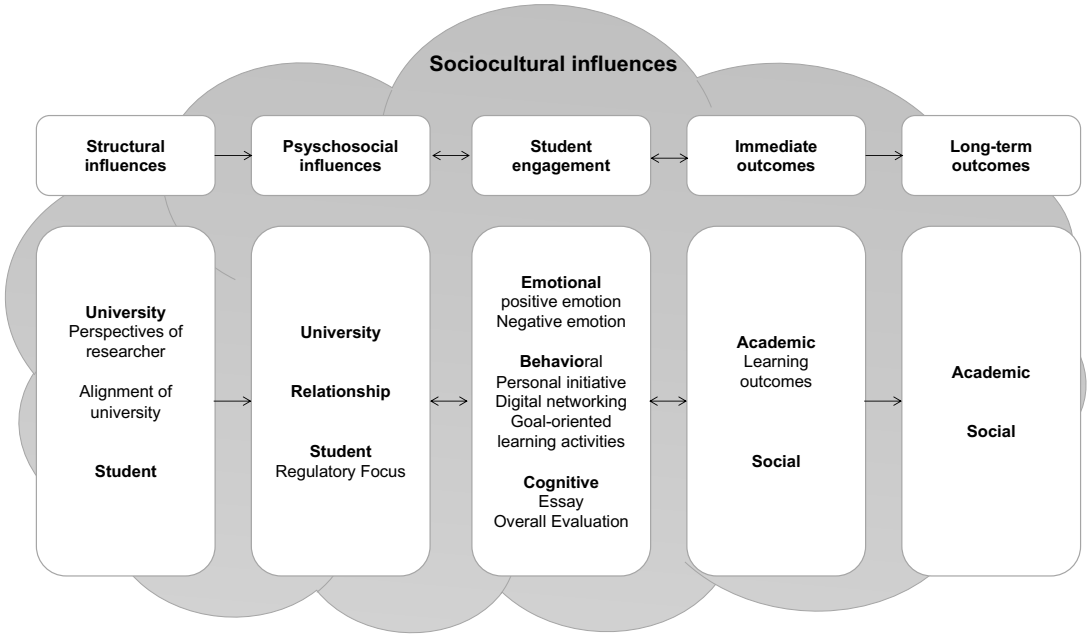
Promotion and prevention focus were two independent self-regulatory mechanisms with well-established effects. Possible effects of a university alignment on student engagement should at least occur in the interplay with regulatory focus. This approach contributes to the delineation of the nature of student engagement. The question about the composition of emotional, behavioral and cognitive student engagement in the framework of student engagement is not yet clarified (Fredricks et al., 2004). The question as to how student engagement should be measured also is largely unclear (Fredricks & McColskey, 2012). An attentional focus like promotion or prevention focus is described as a psychosocial influence in the framework of student engagement presented here. Study 2 clarified a regulatory fit in measuring chronic regulatory focus of applicants, and Study 3 completed the series of studies in manipulating situational regulatory focus. Further details can be found in Chapters 5 and 6. As shown above, student engagement enhances learning and student development in important ways (Trowler, 2010). From a student-centered perspective, the learner is responsible for student engagement (Kuh, 2009), and this seems to be especially important for learning in an ever more digital learning environment.

3 Objective and Expected Output

Structural Influence in Higher Education on Student Engagement and Learning Outcomes in Digital Learning Environments. This project investigated whether a structural orientation of university's teaching and learning with digital media influences studying. Research has already called for varying analyses of social context and practices that were assumed to be crucial for learning careers (Ecclestone & Pryor, 2003). Higher education institutions claim to be bases for excellent research and teaching, but they have no clear vision as to whether there is a contribution of institutional interests on the performance of students. Higher education institutions appreciate having a clear idea of what needs to be done, so that their university students achieve the best possible results. Some examples of their reasons for this is that they wish to understand the respective roles of the university and the student (Budd, 2017), or to teach more than content (Roberson, 2020). The work presented here strives to contribute to launching a scientific discourse. It seems promising to provide first insights into how to develop learning careers (Ecclestone & Pryor, 2003), how to shape a student's transition or adjustment to university (Gale & Parker, 2014), or how to design evaluation of learning that is more contemporary, transparent, and sustainable. At this point, it should be noted that I used the wording *university's structural influence* to describe this dissertation's levels of investigation with a researcher's theoretical perspective on learning and a university's alignment of a study-program as influencing factors (Figure 2).

Figure 2

Study Concept: Structural Influence in Higher Education on Student Engagement and Learning Outcomes



Note. This project aimed to find evidence for an impact of university's situational context, and psychosocial influence of regulatory focus on student engagement with the three levels to measure student engagement described. The concept was adapted from Kahu (2013, p.766). to specify the research design and procedure to explore structural influence of higher education on students' performance.

For both factors I checked if there was an influence on student's performance. The selection of these implicit factors led to the fact that the investigations I chose were rather different. First, researchers make statements and recommendations for practicians based on their research results, and an evaluation of students' performance relies on their outcome statements. Unfortunately, it is largely unclear what differences there are in learning outcomes. An investigation that compares such existing empirical results of individual vs. social perspectives of research on learning settings in retrospect is a useful approach to fill this gap and to describe any correlations with learning outcomes. Second,

research on initial conditions of student's performance already exists especially for socio-cultural factors. For example, parental influence, social capital or social status are well studied phenomena, but unfortunately without considering the meaning of value guidance and student incentives of universities. An empirical investigation on university's alignment in the self-presentation of a study-program is a useful approach to explore influences on student engagement.

To answer my research question and to predict existing effects, I chose learning outcomes and student engagement as output variables in rather different empirical studies. I conducted a systematic literature review in the first study. I expected evidence of a downstream impact of research perspectives on the evaluation of learning outcomes of higher education students. I specified categories to measure learning outcomes with respect to the digital challenge of building virtual skills (Wilson et al., 2018). This elaboration of common measurements of learning outcomes in turn provided the linkage for the further investigations. I used results of the activity category to describe learning behavior in digital learning environments in my subsequent studies. Especially behavioral student engagement relied on these findings. Nevertheless, all three studies could also stand alone for the purpose of submitting the studies to scientific journals for publication. Therefore, I answer and discuss the sub questions and results of all three studies separately. I conclude in Chapter 7 with a general discussion where I answer my research question about possible impacts of different higher education structures on learning outcomes and student engagement. This work offers

- evidence for structural influence in higher education,
- evidence for heterogeneous evaluation of learning outcomes in digital learning environments,
- evidence that researchers use different measurements to determine learning outcomes depending on their perspective,
- expertise for actual needs and specifications on how to design evaluation of learning outcomes in university digital learning environments in an applicable and reflective way,

- evidence that a university's situational context influences student engagement,
- support for the framework for student engagement at the three different levels of emotion, behavior, and cognition,
- insights into the interplay of university's self-presentation and with a promotion and prevention focus for student engagement,
- a regulatory fit for chronic regulatory focus: especially providing many opportunities leads to a boost of positive emotions and personal initiative for those with a promotion focus,
- a situational regulatory focus that influenced personal initiative,
- an overview to empower practitioners and researchers to deal with structural influence in higher education in a confident manner.

The following chapter ties in with the facets of structural influence and theory introduced in Chapter 2.1 and Chapter 2.2. It presents the method and results of Study 1 that focused on the sub question of how learning outcomes have been measured in empirical studies on learning with digital media in higher education.

4 Study 1

Digital Learning Environments in Higher Education: A Literature Review of the Role of Individual vs. Social Settings for Measuring Learning Outcomes. The systematic literature review explored a relationship between general theoretical perspectives and the particular learning outcomes in empirical research that describe learning with digital media. I disentangle empirical results in reference to learning outcomes in digital learning environments from a scientific perspective. Figure 3 presents the taxonomy and methodological standards proposed by Cooper (2017) that I used.

Figure 3

Taxonomy for the Systematic Literature Review

Characteristic	Categories	
Focus	Research findings	Design online-learning: instructional,
	Research methods	learning- related, knowledge
		National and international context
		Cognitive, social and motivational aspects
		Empirical studies
Goal	Identification of central issues	Learning and teaching in higher education with the help of digital media
		Performance of students: learning outcomes
Perspective	Neutral representation	Psychological perspective
Coverage	Exhaustive of all studies	Peer reviewed journals
	Representative citations	Web Of Science
		SSCI- Social Sciences Citation Index
		Timespan 2000- 2017
Organisation	Methodological	Systematic literature review
Audience	Specialized scholars	Integrate empirical results in a framework
	General scholars	Significant need for research
	Practitioners or policy makers	Scope of application

Note. The project used a taxonomy adapted from (Cooper, 1988, zitiert nach Cooper (2017, p.6) to conduct the systematic literature review on the evaluations of learning outcomes.

DECLARATION ACCORDING TO § 5 ABS. 2 NO. 8 OF THE PHD REGULATIONS OF THE FACULTY OF SCIENCE

-SHARE IN COLLABORATIVE PUBLICATIONS/ MANUSCRIPTS -

The subsequent chapters (Chapter 4.1 to 4.6) consist of a manuscript that is published in *Education Sciences*. Prof. Dr. Joachim Kimmerle, Prof. Dr. Johannes Moskaliuk, and Prof. Dr. Ulrike Cress are co-authors of this manuscript. The proportions of contribution to the manuscript are presented in the following table. The following chapters are written as separately readable manuscripts. This results in content that overlaps in the introduction, summary and empirical chapters.

Manuscript 1

Author	Author position	Scientific ideas %	Data generation %	Analysis & interpretation %	Paper writing %
Elke Kümmel	First author	50	100	100	70
Johannes Moskaliuk	Second author	20	0	0	0
Ulrike Cress	Third author	20	0	0	0
Joachim Kimmerle	Fourth author	10	0	0	30
Title of paper:		Digital Learning Environments in Higher Education: A Literature Review of the Role of Individual vs. Social Settings for Measuring Learning Outcomes.			
Status publication process:		Published: MDPI Education Sciences, 10, 3, 78 https://doi.org/10.3390/educsci10030078			

4.1 Introduction

The efficient use of digital learning environments in higher education is an important research topic from both a scientific and a practical perspective. Learning in digital learning environments is characterized by the provision of learning materials that are independent of time and location, and by broad access to learning materials. Moreover, digital learning environments also support educational opportunities for all types of learners and provide digitally enhanced instruction (Chan et al., 2006; Hartnett et al., 2014; Johnason et al., 2016). Educational researchers from diverse disciplines have been trying to identify the success factors of learning with digital media in higher education for about two decades (Mothibi, 2015; Pea, 2004; Perelmutter et al., 2017; Schneider & Preckel, 2017; Stepanyan et al., 2013; Volery & Lord, 2000; Wu et al., 2012). One central aim of higher education is to foster students' potential for high-quality accomplishments (Ellis et al., 2016; Graham et al., 2013; Hassanzadeh et al., 2012; Sun et al., 2008) and support them in applying their knowledge to future challenges in their professional lives (O'Connor & Allen, 2010; Yang et al., 2016). Therefore, research on the use of digital learning environments in higher education should pay particular attention to learning outcomes as a prerequisite for evaluating learning success.

There are two main reasons why researchers and practitioners recommend the use of digital learning environments in higher education. First, in an increasingly digitalized world, education needs to be digital as well (Fraillon et al., 2014; Koehler et al., 2017; Laurillard et al., 2007; Wilson et al., 2018). Students should be encouraged and empowered to use digital media for communication and collaboration as well as for learning and knowledge exchange in an appropriate way to become competent and proficient members of a knowledge society. Second, digital learning environments promise to make learning and teaching more effective, for example, by increasing learners' motivation (Muenks & Miele, 2017; Sun et al., 2008), adapting to students' prior knowledge (Yang et al., 2016), or providing the possibility for mobile and ubiquitous learning (Hatlevik & Christophersen, 2013; Scherer et al., 2017).

However, the findings of existing studies on the impact of digital media on learning are ambiguous (Al-Zahrani & Laxman, 2016; Bernard et al., 2014; Kirkwood & Price, 2013; Steenbergen-Hu & Cooper, 2014). In general, influencing factors, such as teachers (Røkenes & Krumsvik, 2016; Scherer, Siddiq, & Tondeur, 2019), prior knowledge (Connor et al., 2019; Davis et al., 2018), or the novelty of the particular digital setting (Thai et al., 2017) seem to have greater effects on learning outcomes than the use of digital media per se. One reason for marginal findings on the effects of digital media in these studies might be that they are highly heterogeneous with regards to measurements and the learning settings that they were applied. Therefore, the study presented here summarizes common measurements of variables that capture learning outcomes in existing empirical studies. This contributes to finding a common language of researchers to describe the effects by having a shared understanding of distinctive learning outcomes. We also argue that the particular theoretical perspective that researchers and practitioners take toward learning with digital media may have an impact on how they design learning environments, how they operationalize relevant variables, and how they measure learning outcomes (Kirkwood & Price, 2013). Research on digital learning environments has traditionally applied two perspectives of examining and understanding how people learn (Hoadley, 2018): A cognitive, individual-oriented perspective that focuses on individual cognition, and a social, community-oriented perspective that focuses on distributed cognition and collaboration (Brown et al., 1989; Danish & Gresalfi, 2018; Kimmerle et al., 2015). The cognitive perspective has been upheld mainly in psychology and in cognitive science research, while the social perspective has been the dominant approach in the learning sciences for roughly 30 years now (Cress & Kimmerle, 2018).

The objective of the project presented here was to examine how a cognitive perspective compared to a social perspective determined the dependent variables that researchers have used in existing studies. The goal of this approach is to comprehend the role that these theoretical perspectives play in the design of digital learning environments and the evaluation of learning outcomes.

4.2 Theoretical Perspectives on Learning

Understanding the importance of these theoretical perspectives is one precondition for transferring scientific results into educational practice. In the following sections, we summarize the key ideas, concepts, and methods of the individual and social perspectives on digital learning environments and introduce our study idea.

4.2.1 Individual Perspectives on Learning

Individual perspectives deal with individual information processing and focus on individual thinking, including attention, mental representation, learning, memory, problem solving, and decision-making (Anderson, 1996; Anderson, 2013). From this standpoint, learning can be described as selecting information and acquiring knowledge through the encoding, storage, and retrieval of information. Learning activities of a single learner would then involve, for example, content-specific examination of learning materials (e. g., leading to understanding), achieving a certain knowledge state (e. g., leading to a test result), or individually creating a previously defined product (e. g., leading to an essay or a work object). From this perspective, digital media can be used to adaptively provide learning content and instructions. Beyond studying how students learn, it is relevant to understand how learners can be instructed or supported (Hoadley, 2004; Mayer, 2014; Van Merriënboer et al., 2002).

Cognitive theorizing also takes meta-cognitive monitoring into account, as this is a major aspect of self-regulated learning (Winne & Hadwin, 1998). Cognitive models often rely on training, problem solving, or computational thinking (Förster et al., 2018; Lotz et al., 2017; Scherer, 2016). They emphasize strategies for instructing learners to understand new information, construct mental representations of knowledge, and integrate information into cognitive schemas (Tsarava et al., 2018). Cognitive processes are mechanisms that induce learning depending on the mental capacity of learners (Chandler & Sweller, 1991; Paas et al., 2003; Sweller, 1994). With the development of digital media, learning environments can be designed in such a way that they can rise to the challenge of meeting a learner’s current cognitive load.

To predict learning from a cognitive perspective, researchers have investigated the process of knowledge acquisition where learners create mental representations of their knowledge (Barsalou, 1999; Chi & Wylie, 2014; Deng et al., 2017; Glenberg & Gallese, 2012). From a cognitive perspective, a learner's memory and cognitive capacity (Atkinson & Shiffrin, 1968; Baddeley & Hitch, 1974; Clark & Paivio, 1991; Paivio, 2013), attention (Higgins & Silberman, 1998), or decision-making (Petty & Cacioppo, 1986) are characteristics which determine learning. Research on individual learning with digital media, for example, indicated that dealing with digital learning material implies handling multimodality and interactivity (Moreno & Mayer, 2007; Strømsø, 2017), and that digital learning material is associated with specific e-tools (Coldwell et al., 2011) or virtual elements (Bailenson et al., 2008; Thai et al., 2017).

4.2.2 Social Perspectives on Learning

The social perspective postulates that learning is strongly influenced by the social environment in which it occurs (Vygotsky, 1978). This assumption is in line with the social constructivist theory developed by Vygotsky (1978) and indicates that learners need to be actively engaged in their social environment. As a consequence, learning can be conceptualized as a cooperative or collaborative endeavor (Doolittle, 1997). From this perspective, individual learning is socially mediated and not independent of the social context it is embedded in. On the contrary, the individual learners' cognitive systems strongly interact with social systems (Cress & Kimmerle, 2008). Learning (as an individual process) and knowledge construction (as a collective process) depend on knowledge-related activities that arise through socio-cognitive conflicts between these two systems (Kimmerle et al., 2015). Thus, communication and social interaction may trigger learning and knowledge construction (Aghaee & Keller, 2016; Goggins & Xing, 2016; Smet et al., 2010).

To solve a task for the first time, learners need scaffolding and support from peers or teachers (Damon & Phelps, 1989; Dillenbourg, 1999; Fischer et al., 2013). If two or more people work together in computer-supported collaborative learning (CSCL), CSCL

researchers tend not to focus on what happens in a single learner's cognitive system. They rather take the interaction among people or within the CSCL environment into account (Engelmann et al., 2009). Learners are part of a social context, and they learn how to act and interact within this situation. Such learners make important contributions in two respects. On the one hand, they internalize knowledge and develop as an individual; and on the other hand, they react to other people and externalize their knowledge into the social context (Kimmerle et al., 2015). From a social perspective, learning activity and learning outcomes are strongly dependent on the interaction within the group.

Research on social learning in digital learning environments indicates that dealing with digital media implies the development of social awareness (Reis et al., 2018). This involves making use of social media and social communication technology (Eid & Al-Jabri, 2016; Sobaih et al., 2016), and defining one's role in a digital network (Buder et al., 2015; Wilson et al., 2018). Moreover, social awareness can be developed by using specific e-tools (Erkens & Bodemer, 2019) or virtual elements (Bailenson et al., 2008; Schneider & Pea, 2013) to influence learning in a social setting.

4.2.3 The Research Presented Here

To answer the question how learning outcomes have been measured in empirical studies on learning with digital media in higher education, it is relevant for educational research and practice to understand what perspectives researchers have on learning and, as a consequence, how they tend to measure learning outcomes (Laurillard et al., 2007). In the study presented here, we focused on individual and social approaches in existing empirical research in order to identify whether there is a relationship between the learning setting that researchers have chosen for their studies in higher education and the particular variables they have measured. Educational researchers tend to operationalize a learning setting in their research according to their own general perspective on learning, as described above. For this reason, we identified the learning setting of each study and considered which learning outcomes were measured. This approach provided an overview of existing empirical research, which can serve as a basis for further discussion. In

identifying certain gaps in the research, it furthermore suggests where future studies need to focus.

We hypothesized that there would be a relationship between the general perspective and the particular learning outcomes in such a way to show that researchers use different dependent variables in their learning settings due to their particular perspectives. To examine potential co-occurrence of learning perspective and learning outcomes on a basis with solid data, we gathered data from published studies on digital learning environments in higher education. In the following section, we describe the method of our empirical procedure in detail.

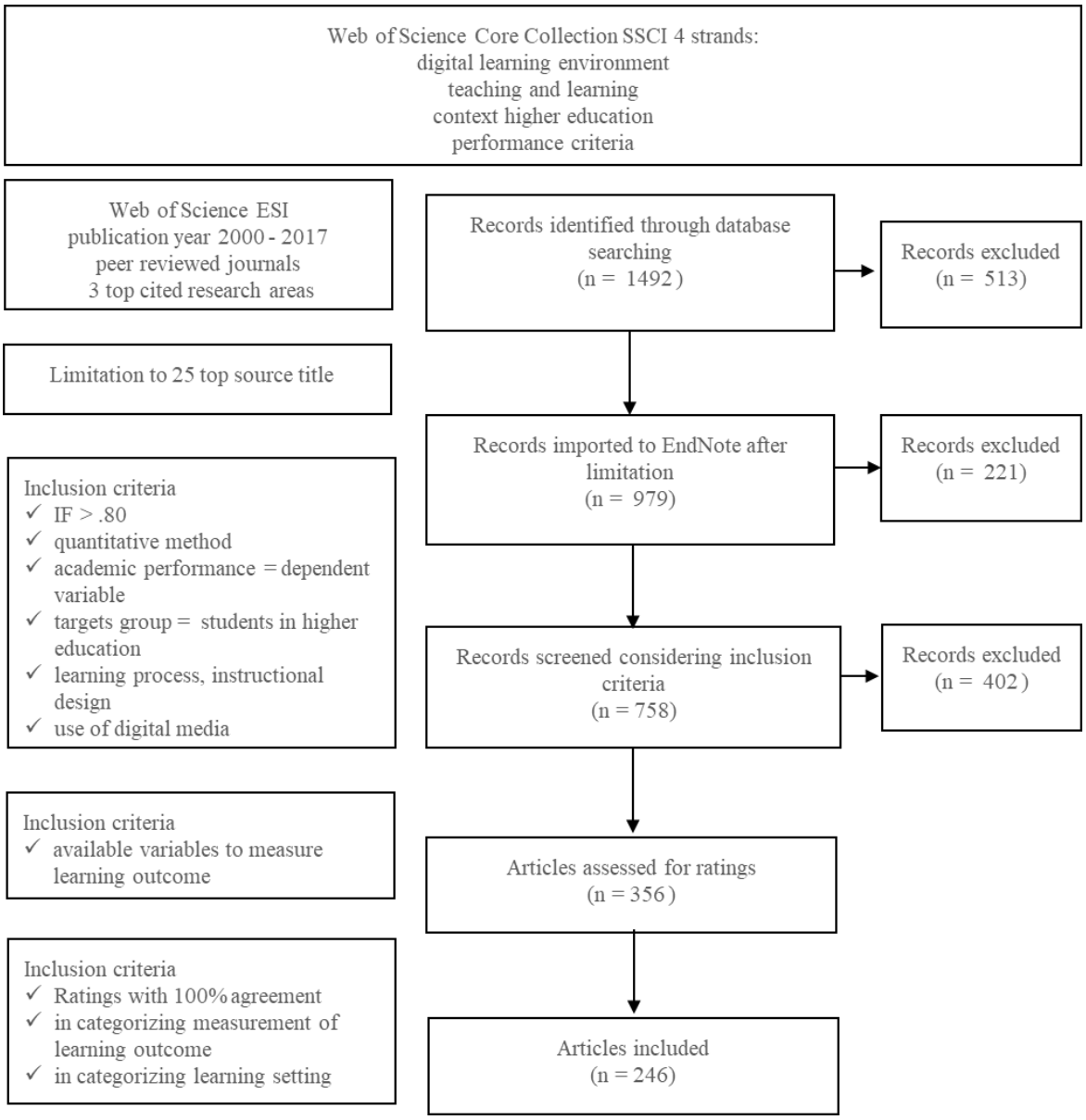
4.3 Method

4.3.1 Searching the Literature: Article Selection

Following the procedure proposed by Cooper (2017), we analyzed which learning outcomes previous research has captured in the context of digital learning environments in higher education. We used the standard Web of Science search (ISI Web of Knowledge, Clarivate Analytics). We selected the categories education, psychology, and computer science and identified four relevant topics for our search: (a) digital learning environments, (b) instructional design, (c) higher education, and (d) performance criteria. The first string ensured a neutral perspective which enabled us to find studies about digital learning environments. The second string focused on the instructional perspective, as we aimed to examine processes of learning and teaching. The third string restricted the search to higher education and academic performance (Richardson et al., 2012). Performance criteria refer to the proficiency of a learner or a group in a given task (e. g., individual or collaborative) and the resulting activities for accomplishing this task. Consequently, the fourth string aimed at identifying performance criteria that are frequently considered for evaluating achievement in higher education. The search procedure and the inclusion criteria for the articles considered for analysis are shown in Figure 4.

Figure 4

Search Procedure and Inclusion Criteria for the Articles Considered for Analysis



4.3.2 Gathering Information from Studies: Coding Guide

Our variables of interest were measures of learning outcome (seven categories as described below) and learning setting (individual / social orientation). Independent raters assessed this information in all of the 356 articles and transferred it into an SPSS coding

sheet (the rating procedure is described in section ‘Evaluating the Quality of Studies: Rating Procedure.’). The availability of the information was substantial for an article’s inclusion in further analyses. Articles without detailed information about these particular variables of interest were excluded.

Learning Setting: Individual vs. Social Orientation. In the studies we selected, we identified two different orientations in higher education learning settings that represented a researcher’s perspective: An individual orientation vs. a social orientation. Studies with an individual orientation supported individual learners in digital learning environments to create a mental representation and to foster knowledge acquisition (Sfard, 1998; Suping, 2003). This orientation implied that learning activities should be affected by individual cognitive, motivational, and behavioral aspects. A study design was coded as an individual setting if its abstract revealed that learners in individual learning scenarios were assigned to an individual task that they fulfilled on their own.

In studies with a social orientation, learners’ participation in social systems and the collaborative application of learning materials were key aspects of learning. This was the case, for example, if two or more people worked together in a CSCL environment (Liu et al., 2017; Siqin et al., 2015; Wang et al., 2011). A study design was thus coded as representing a social setting if the study abstract indicated any kind of collaborative task, either accomplished in a group or through teamwork.

Measurements of Learning Outcomes. We created categories that indicated several different options for measuring particular learning outcomes in digital learning environments. We focused on the outcomes of learning processes, knowledge construction, or knowledge-related activities. By developing meaningful categories for the measurement of learning outcomes, we met the challenge of sorting through current requirements of research in learning with digital media and acquiring first insights from the articles (i.e., records were screened with inclusion criteria in mind). We took two theoretical approaches into account that describe learning processes in digital learning environments (Binkley et al., 2012; Chi & Wylie, 2014; Chi et al., 2018; Wilson et al., 2018).

Chi and Wylie (2014) proposed four types of engagement activities: passive, active, constructive, and interactive. Engagement can be interpreted as a continuum of growing learning processes with predefined learning materials. The authors describe typical materials and activities which enable handling information within a digital learning environment safely and lead to success in learning. Therefore, any attempt at measuring learning outcomes should include these considerations.

Wilson et al. (2015) proposed the perspective of social networking to describe learning in digital communities. They proposed a hypothetical individual learner who was embedded in a social network and who fulfilled a certain role. This goes along with the assumption that the key to learning effectiveness is to create interaction, to encourage deep reflection, and to reach definitive conclusions (Lorenzo & Moore, 2002). The authors considered different levels of performance and provided suggestions about how to order skills and competencies. We considered this also to be a potential method to measure learning with digital media.

These approaches provide theoretical frameworks to describe what is important for research in learning with digital media and offer a basis for categorizing measurements of learning outcomes. We integrated subjective (i.e., self-reports) and objective measurements (i.e., observable behavior) as well as measurements of self-regulation and knowledge changes (i.e., learning skills, elaboration). Furthermore, we integrated the current need to measure learning with digital media that emerged from the reasoning above (Lorenzo & Moore, 2002), that is, measurement of interaction on a personal, technological, and context-specific level (i.e., personal initiative, digital activity, and social interaction). For each category, we first provide a short description and theoretical assumption extracted from existing research. We then point out the role of each category for learning in digital learning environments in general and provide examples to underpin our categorizations, which we grouped into the superordinate categories of method, cognition, and activities (see Table 4).

Table 4

Measurements of Learning Outcomes in Digital Learning Environments

Category	Examples	Learning outcome is evaluated on the basis of …
Method		
Self-report	Students report about their satisfaction, motivation or attitude	…experience, perception, or values of a learner.
Observable behavior	Enrollment or final completion of lectures or seminars	… intention, persistence or effectiveness of a learner's behavior.
Cognition		
Learning skills	Self-regulation, awareness or writing skills	… meta-cognition.
Elaboration	Vocabulary-tests or transfer tasks	…cognitive measurements.
Activities		
Personal initiative	Number of contributions to discussions or frequency of use	… mere participation or pro-activeness of a learner.
Digital activity	Sourcing and searching behavior	… digital maturity level or active usage of digital tools.
Social interaction	Collaboration with peers or communication with professors	… social influence on activities of a learner.

Self-report. Self-reports reveal what individual learners think about their abilities, the learning material, the digital learning environment, or the learning outcomes they wanted to achieve (Muenks & Miele, 2017; Sun et al., 2008; Tondeur et al., 2017). Such data may be relevant for understanding the subjective side of learning, but they also carry the risk of containing biased information due to a fragile and subjective measurement.

Examples: Learners' perceptions of their own attitude, satisfaction, or motivation; self-reported information may comprise personal relevance, commitment, self-efficacy, and perceived importance or beliefs.

Observable behavior. Observable behavior represents the objective behavior of a learner and evaluates learning outcomes in an action-oriented manner. This measurement focuses on the goals of learners and their intention to learn. It includes activities such as choice of lectures, persistence, or efficacy to complete a course (Cho & Heron, 2015; Nistor & Neubauer, 2010).

Examples: Passing or not passing a course, course selection, choosing a field of study or a subject of specialization.

Learning Skills. This category relies on models of self-regulation, for example, the model of self-regulated learning that comprises three-layer levels of regulation processes (Boekaerts, 1999): regulation of the self, of the learning process, and of processing modes. At another level, according to Krathwohl (2002) , learning outcomes in this category refer to metacognitive knowledge, or knowledge about own cognitive processes, reflection, or self-regulation.

Examples: Reading and listening skills, awareness of group processes, or writing involved in acquiring learning skills.

Elaboration. Elaboration refers to learners' levels of cognitive processing. Either the surface approach, deep approach, or achieving approach were used in the learning processes (Craik & Lockhart, 1972; Letellier & Mayo, 2017). Learning outcomes reflect these levels of processing via recall, comprehension, or application tasks (Biggs & Collis, 2014; Bloom, 1956; Brabrand & Dahl, 2009).

Examples: Multiple choice tests, vocabulary tests, comprehension tests, or essays.

Personal Initiative. Being pro-active is a core characteristic for initiating interaction with digital media. Personal initiative is helpful to begin learning in digital environments and to take advantage of educational opportunities in learning with digital media. A minimum of personal initiative is important to initiate learning (Fredricks et al., 2004; Kahu, 2013).

Examples: Participation, attendance, access to email accounts, data about log-ins, quantity of sent emails, or number of contributions.

Digital Activity. This category includes engagement in a digital learning environment and active contributions (Calvani et al., 2012). Digital activity can be measured as performance via log-files. This may include learners' accessing information, their management, integration, and evaluation of information, their search inquiries, and their use of blogs or wikis.

Examples: Help-seeking behavior, network behavior, search behavior, or reflective and conscious usage of digital environments.

Social Interaction. Since most digital learning environments integrate several instructional designs, and even individual learning settings include communication tools and situations, this is not a category that would be limited to a social learning setting. This indicator allows considering studies that measure a kind of social interaction as a dependent variable. It includes activities that refer to any kind of cooperation or collaboration (Kuh, 2009).

Examples: A dyad's discussion, a presentation, or a discussion outcome on an individual and a group level.

4.3.3 Evaluating the Quality of Studies: Rating Procedure

Three raters (a research associate and two student assistants) were trained to identify available variables of interest within the articles' abstracts. They received written descriptions of the categories (Table 4), written descriptions of the learning settings (see 4.3.2), and verbal instructions about the categorization tasks and about the coding sheet. Raters were trained to identify available dependent variables (i.e., measurements of learning outcomes) and to assign these variables to one of the seven categories of the coding guide. In those cases, in which the raters were unable to make a decision based on the abstract, they were instructed to examine the relevant information in main text. In order to ensure a high level of inter-rater agreement, we only included ratings with a full agreement among the raters.

The raters rated study design (0 = exclude article, 1 = individual, 2 = social) and measures of learning outcomes (0 = not available, 1 = self-report, 2 = observable behavior, 3 = learning skills, 4 = elaboration, 5 = personal initiative, 6 = digital activity, 7 = social interaction). An article's abstract could reveal more than one measurement of learning outcomes; in this case, several codes were assigned.

The rating procedure needed to distinguish two methodological approaches: on the one hand, we identified available unambiguous descriptions of one learning setting per

article (i.e., individual or social). On the other hand, we identified dependent variables within these articles (i.e., measure of learning outcomes). We created word clouds to visualize word frequency using the website https://tagcrowd.com. We excluded filling words and used a maximum of 75 words in the word clouds.

4.4 Results

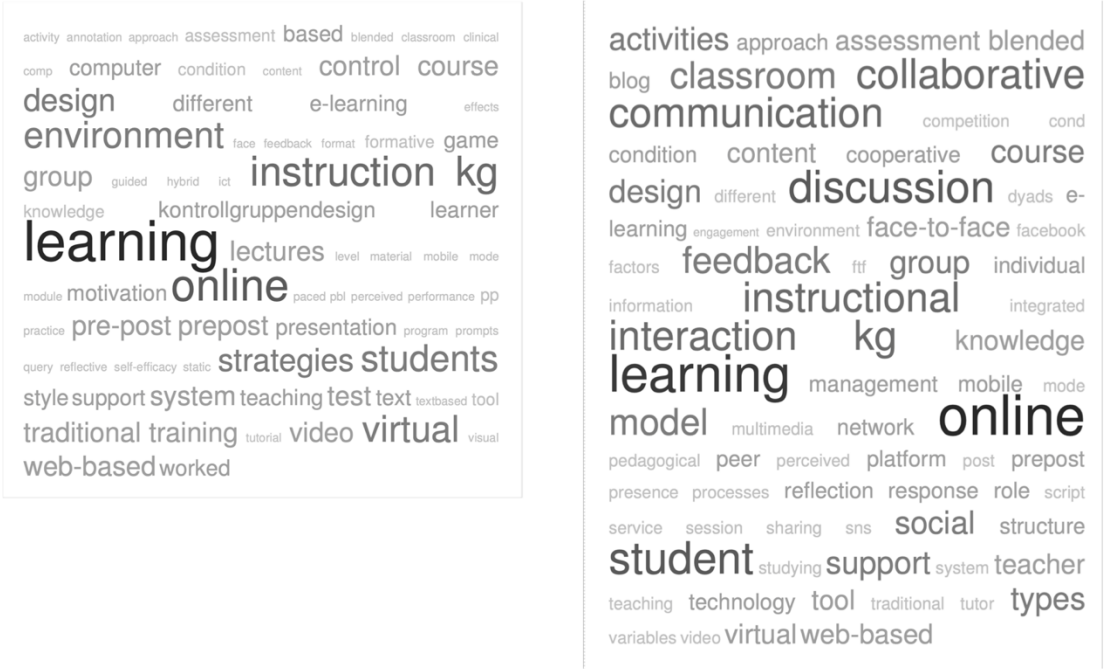
We first present the findings regarding the learning settings. Then we provide the results of the dependent variables used in the articles, that is, the measurements of learning outcomes. Finally, we present the findings regarding our general research question.

4.4.1 Learning Settings

As described above, we identified *n* = 246 articles with a clear description of a learning setting (see Figure 1). The digital learning setting of 159 articles revealed an individual orientation and 87 articles revealed a social orientation in their study design. Descriptions of the individual and social learning settings can be seen in Figure 5. These depictions show that studies with a social learning setting used more varied terms to describe variables. While more studies used an individual learning setting, the word cloud of the social settings include more as well as more diverse words.

Figure 5

Word Clouds for Individual (Left) and Social (Right) Learning Settings



The *n* = 246 articles were published in 14 different peer-reviewed journals. The journals *Computers & Education* (76), *BMC Medical Education* (31), and *Educational Technology & Society* (27) provided most of the identified articles. Studies from journals such as *Computers & Education* and *BMC Medical Education* used more individual than social learning settings, whereas studies in *The Internet and Higher Education* and the *Australasian Journal of Educational Technology* described more social than individual settings (Table 5).

Table 5

Learning Settings (Individual vs. Social) Represented in the Journals Considered for the Analysis

Journal	Learning Setting		Total
	Individual	Social	
Advances in Health Sciences Education	2	3	5
Assessment & Evaluation in Higher Education	0	3	3
Australasian Journal of Educational Technology	6	12	18
BMC Medical Education	35	9	44
British Journal of Educational Technology	13	11	24
Computers & Education	79	23	102
Educational Technology & Society	16	12	28
Educational Technology Research and Development	8	0	8
Instructional Science	5	1	6
Interactive Learning Environments	11	6	17
International Review of Research in Open and Distance Learning	6	2	8
Internet and Higher Education	8	12	20
Journal of Computer Assisted Learning	8	7	15
Journal of Science Education and Technology	7	1	8
	204	102	306

4.4.2 Measurements of Learning Outcomes

In total, raters identified *n* = 306 dependent variables for a measurement of learning outcomes from the *n* = 246 articles. Self-report (128) and elaboration (113) were captured most frequently as dependent variables in individual as well as social learning settings, while the least used measurements were personal initiative (1) and observable behavior (9) (Table 6). We provide examples of measures of learning outcomes from the identified articles. We also provide word clouds for the two most frequently used dependent variables self-report (Figure 6) and elaboration (Figure 7). The word frequencies of dependent variables that were used to measure learning outcomes are depicted in these visualizations.

Table 6

Absolute Frequency of Measures of Learning Outcomes (n = *306) in Individual and Social Learning Settings*

Learning setting	Learning outcomes							
	1	2	3	4	5	6	7	
Individual	79	7	17	86	0	14	1	204
Social	49	2	9	27	1	4	10	102
	128	9	26	113	1	18	11	306

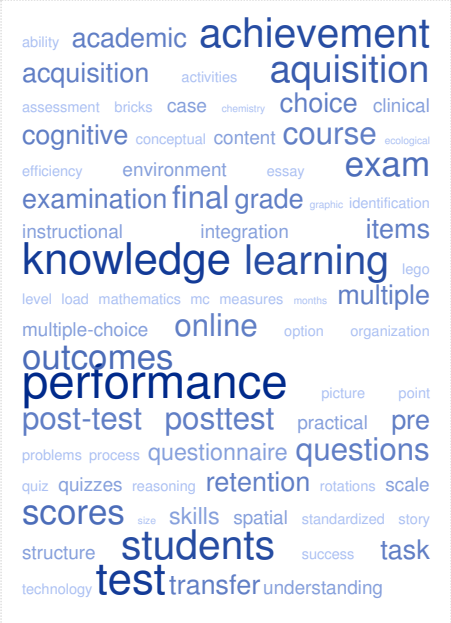
Note. Learning setting (individual vs. social) and measurement of learning outcomes (1 = *self-reports*, 2 = *observable behavior*, 3 = *learning skills*, 4 = *elaboration*, 5 = *personal initiative*, 6 = *digital activity*, 7 = *social interaction*).

Figure 6

Word Cloud for the Dependent Variables in the Category Self-Report

Figure 7

Word Cloud for the Dependent Variables in the Category Elaboration



An example of a study using self-report to measure learning outcomes reported self-efficacy beliefs and intrinsic motivation (Thai et al., 2017). Studies that measured learning outcomes through observable behavior used variables such as drop-out rates (Delgado-Almonte et al., 2010), number and duration of sessions (Maier et al., 2013), completion of exams (Hachey et al., 2015), or class attendance (Susskind, 2008). Examples of measures in the category learning skills were intercultural communicative competence, intercultural awareness and intercultural knowledge (Guillén-Nieto & Aleson-Carbonell, 2012), or learners' reflection levels (Chen et al., 2009). Examples of elaboration measures were exams on lecture content (McKinney et al., 2009) or problem-solving activities (Hou, 2011). We identified one measure of learning outcome that represented personal initiative on a social level: Shea et al. (2013) examined learning presence through social network analysis and quantitative content analysis in a student public class discussion (i.e., personal initiative), as well as private products of knowledge construction (i.e., elaboration). For digital activity, we identified tracking systems (Hoskins & van Hooff, 2005) and search activities (Zhou, 2015) as measures of learning outcomes. Studies rated

within the category social interaction used measures such as team-learning outcomes (Kim et al., 2011), mutual feedback (Barbera, 2009), or team discussions (Rooij, 2009).

4.4.3 Measures of Learning Outcomes in Individual and Social Learning Settings

Across all categories, a chi-squared test showed that measures of learning outcomes differed significantly between the chosen learning settings, $\chi 2$ (6, 306) = 25.89, $p < 0.001$ (Table 6 and Table 7). In social learning settings researchers used elaboration significantly less frequently than in individual learning settings, binom (27, 113, *prob* = 1/3), $p = .036$. Elaboration was the favorite measure of learning outcomes for researchers with an individual research approach. We also found that the category with studies that measured social interaction as a dependent variable was chosen for social as well as for individual learning settings, but that these social interaction measures were more frequently used in social than in individual learning settings, binom (1, 11, *prob* = 1/3), $p < 0.001$. There were no significant differences for the other categories (Figure 8).

Table 7

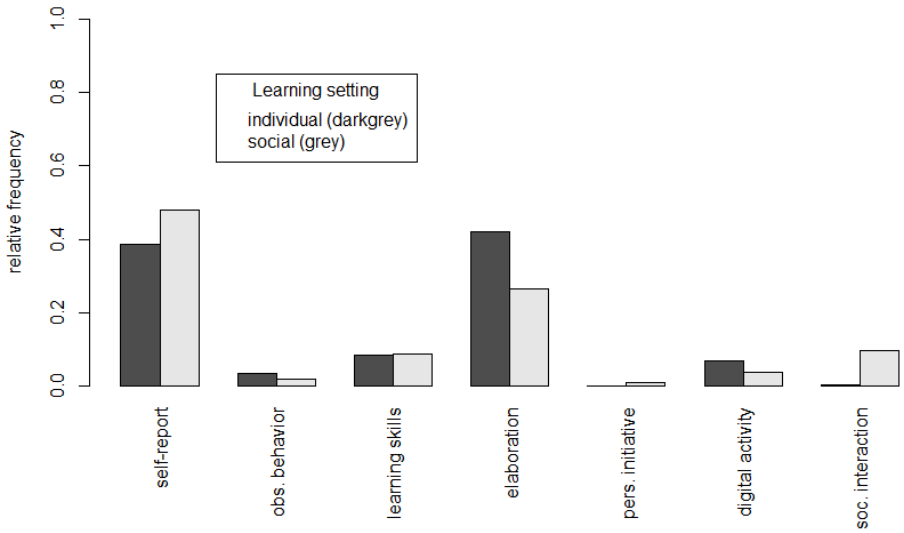
Relative Frequency of Measures of Learning Outcomes (n = 306) in Relation to Learning Setting in Percent

Learning setting	Learning outcomes						
	1	2	3	4	5	6	7
Individual	38.73	3.43	8.33	42.16	0	6.86	0.49
Social	48.04	1.96	8.82	26.47	0.98	3.92	9.80

Note. Learning setting (individual vs. social) and measures of learning outcomes (1 = *self-reports*, 2 = *observable behavior*, 3 = *learning skills*, 4 = *elaboration*, 5 = *personal initiative*, 6 = *digital activity*, 7 = *social interaction*).

Figure 8

Relative Frequency of Measures of Learning Outcomes in Individual and Social Learning Settings



4.5 Discussion

In the study presented here, we focused on cognitive and social approaches in existing empirical research in order to identify whether there was a relationship between the learning settings and the measurement of learning outcomes that were applied by researchers. In each study, we identified the general design of digital learning environment and, at the same time, considered the respective measures of learning outcomes that were used in that study. In total, there were more studies from researchers who used individual settings than studies with social settings. We also found that self-reports and elaboration were captured most often as measures of learning outcomes. We had hypothesized that there would be a relationship between the general perspective (individual vs. social learning setting) and the particular measurement of learning outcomes, which would indicate that researchers use different dependent variables depending upon their particular research approach. As hypothesized, we found that the measures of learning outcomes in studies with an individual learning setting differed from the measures in studies with a social learning setting. Researchers with an individual approach used different variables to

evaluate learning outcomes compared to researchers who used a social setting. The comparison of studies with individual and social settings revealed that the measure elaboration was used relatively more often in studies with individual settings than in studies with social settings. The measure social interaction, in contrast, was used less often in studies with individual settings than in studies with a social approach.

4.5.1 Heterogeneous Evaluation of Learning Outcomes

This literature review has generated a broad variety of performance criteria as indicators for measuring learning outcomes in higher education. The results regarding learning outcomes with digital media in higher education showed that the classification of learning outcomes is not consistent in previous studies. Even for the selected and narrow context of higher education, the terminology for learning outcomes is heterogeneous. However, the database search produced many results of high-quality studies. There seem to be overall favorite variables for measuring learning outcomes, like elaboration and self-reports.

4.5.2 Learning Outcomes in Learning Settings

Researchers with an individual perspective used elaboration relatively more often to evaluate learning than researchers with a social orientation. This is comprehensible, as learning activities in an individual learning setting often explicitly refer to recall, comprehension, or cognitive performance for predicting achievement or success. In addition, individual processes that are particularly relevant from an educational viewpoint are learning and memory processes in terms of selecting information and acquiring knowledge through encoding, storage, and retrieval of information. So individual learning is usually seen from a cognitive perspective (Scherer, Siddiq, & Sánchez Viveros, 2019). Our analysis disclosed a relative frequency of 42.16% to measure elaboration in studies with an individual learning setting. Nevertheless, the analysis also found the usage of variables to describe elaboration in studies that represented a social perspective with a relative frequency of 26.47%. Overall, 113 out of 306 ratings (36.93%) indicated measures

of elaboration. Elaboration appears to be a measure that is highly relevant for both individual and social approaches.

Self-report was also a very frequently used category. Altogether, in 41.83% of the studies, raters identified self-reports as outcome measures. Self-reports seem to be highly relevant for understanding what learners think about their abilities, the learning material, the digital learning environment, or the learning outcomes they wanted to achieve irrespective of whether researchers used an individual or social setting. In total, 241 out of 306 measurements belonged to the self-report or elaboration category. These two measurements do not seem to be particularly tailored to digital settings, however. Self-reports and elaboration are relatively traditional measures and do not really take digital characteristics into account.

We had expected to find more measures of learning outcomes in the activity category, which included personal initiative and digital activities as these have a specifically digital focus. These activities are supposed to be highly relevant in the digital world, but only 30 out of 306 measurements belonged to these categories. Network-specific access to learning institutions in higher education, digital learning material, and digital communication tools as well as digital learning environments have become more and more prevalent, and the need for research in this context has grown. Therefore, the low frequency of variables that measured digital activity in both individual and social learning settings was surprising. We hope that future studies will take these variables into account more frequently.

4.5.3 Limitations

Our findings may have been affected by the selection of the journals in our database search. We only included peer-reviewed studies, and peer-reviewed journals have specific aims and scopes. For example, BMC Medical Education focuses on training and evaluation of performance, such as grades, which may promote research about learning progress of individual learners. This focus on the individual level and the cognitive performance of learners could explain why there were more studies from an individual than from a social

perspective (Table 5). At the same time, however, this is a pity, because social settings are of course also very important for medical training (Bientzle et al., 2015). This applies, for example, to the field of doctor-patient communication (Bientzle et al., 2017; Griewatz et al., 2016) or to inter-professional cooperation (Grosser et al., 2019). Computers & Education is additionally interested in field studies with interventions in designs with pre- and post-tests of individual learners or control groups to compare digital vs. non-digital learning environments. Testing and comparing these pedagogical issues of digital technology as they pertain to individuals also could lead to publishing more studies of researchers with an individual than a social orientation. However, the focus on interventions should not prevent researchers from studying the role of social variables and settings in the future.

Furthermore, the gathered data resulted from identifying particular learning outcomes and did not take other potentially relevant aspects into account. For example, the data did not consider the discussions of the articles. Therefore, it could be a sensible next step to carry out more comprehensive analyses of empirical studies that would provide detailed descriptions of context, design, dependent and independent variables, statistics, and effects of the performance criteria in individual and social learning settings. Moreover, it could be promising to collect data about independent variables that tend to co-occur. Future studies could also analyze the structure of the studies and conduct statistical investigations to predict successful outcomes with digital media in higher education.

4.5.4 Balancing Perspectives

We argue for balancing research approaches that deal with learners' development on an individual level as well as the development of the social context in higher education. So far, many educational researchers have tended to examine either an individual or a social learning setting in their research. We hope that our results can be used in future research that aims to bring both approaches together. Furthermore, the interrelatedness between individual and social processes makes it sometimes difficult to distinguish among various knowledge-related activities, and researchers need to disentangle influencing effects and variables of interest. We postulate that this is an iterative process where

researchers should reflect upon their own perspective in a responsible manner and make it transparent to others.

With respect to interdisciplinary research and collaboration projects, it could be promising to define commonalities between different research approaches. According to O'Connor and Allen (2010), learning should take into account that learners aim to form an identity and to become community members. The authors emphasize that learning must be considered to be a relational phenomenon. As a result, it could be a goal of higher education to train students for a role within a professional network. From this point of view, it seems to be the social system and the individual learner who would benefit from an adequate fit of an educational system, a digital learning environment, and measurements of learning outcomes (Scherer, Siddiq, & Tondeur, 2019; Wilson et al., 2015, 2018). This could create a closer link between research and teaching, support the ongoing change process for institutional implementations of digital learning environments, and be a contribution to the ongoing challenge of adequately preparing teachers for digital teaching environments.

4.6 Conclusion

We provided an overview of empirical studies of digital environments in higher education and the learning outcomes they have measured. As hypothesized, results revealed overall that there was a relationship between the learning setting that was applied (individual vs. social orientation) and the variables used to measure learning outcomes. We found support for our categorizations of measuring learning outcomes in terms of self-reports, observable behavior, learning skills, elaboration, personal initiative, digital activity, and social interaction. The analysis revealed two particularly popular measures of learning outcomes (i.e., self-reports and elaboration).

Our approach of gathering and structuring a huge amount of data from high-quality empirical studies may enable practitioners and scientists to rely on and refer to the results. We identified variables and categorized measures of learning outcomes of students. The results provide first insights into frequently used measures. This study was a first step in

the direction of investigating this research topic. In sum, the goal of describing measures of learning outcomes was achieved, and the chosen categorization to describe evaluations of learning outcomes of individuals provide a foundation for further study. With respect to the properties of digital learning environments, future studies should try to elaborate on and potentially revise these categorizations.

For future research, we recommend more creative measurements of variables to evaluate learning outcomes in digital learning settings in the context of higher education. For this purpose, researchers need to carefully reflect upon their research subjects and study designs in digital learning environments and think about how to deal with measuring learning. Disentangling influencing effects and independent variables would be helpful to make interdisciplinary educational research sustainable for the future.

5 Study 2

The Interplay of a University's Self-Presentation and Applicants' Regulatory Focus on Student Engagement. In Study 1, I investigated measures of learning outcomes in digital learning environments in detail and developed a useful categorization of learning outcomes. The categorization provides one foundation for the studies which followed. I could prove that outcomes that measured observable behavior, personal initiative, digital activity and social interaction were used relatively rarely to evaluate learning outcomes. This was surprising, and for two reasons this finding represented a large gap of research on digital learning environments.

First, as described in the introduction, learning should not only involve cognitive tasks but more meaningfully, a life-long learning culture should be created that prepares students for a future workplace in a global as well as technological environment. But what does it mean to be prepared? Especially personal initiative, digital activity, and social interaction are becoming more and more important to succeed in digital learning environments, to activate student engagement or to endure a certain workload (Bada & Olusegun, 2015; Cela et al., 2016; Chee Meng & Werner, 2016; Chi & Wylie, 2014). An experimental investigation was an appropriate way to find regularities in the activity category from Study 1. To accomplish this, networking or digital activities were properties in digital learning environments that could be described or checked with concrete behavioral engagement.

Second, following the theory introduced above, there is a relation between alignment of topic, outcome statement (i.e., learning outcome), and learning activity. The first empirical investigation showed evidence for differences in research approaches that correlate with heterogenous outcome statements. I was aware that, if it was broken down to the smallest unit of investigation, alignment of topic meant investigating a special learning subject in a micro-system. I used individual vs. social perspectives of research on learning settings as my level of examination in the first study, to find any structural influence

in higher education. For the further studies I designed a university's self-presentation as a representative of alignment.

To fill the gap of research in digital learning environments presented above, the following study explored the relation between student engagement and university's self-presentation. The next two chapters tie in with theory from Chapters 2.3 to 2.4 and present the method and results of two empirical studies on structural influence in higher education. The study explored the role of different universities self-presentations and regulatory focus on student engagement. In this step of the project, I present my approach to find influencing factors of a university's self-presentation that effect student engagement from the perspective of applicants.

We transferred regulatory focus theory in the context of higher education and assumed that students' exploration of a university's self-presentation, or course of study for a sustainable career would be triggered by people's regulatory focus. Following Sun and Rueda (2012), who found that self-regulation affected student engagement, we hypothesized effects of self-regulation strategies (i.e., promotion or prevention focus) on student engagement. Students with a promotion focus would primarily be influenced by information about a course of study that implied gain or no-gain for their career progression and use strategies that support growth and self-realization. In comparison, students with a prevention focus would mainly be influenced by information that emphasized loss or non-loss for their career and use strategies that support needs for safety and security. The following studies provide more insights on the hypothesized interplay of regulatory focus and a university's self-presentation.

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-SHARE IN COLLABORATIVE PUBLICATIONS/ MANUSCRIPTS -

The subsequent chapters (Chapter 5.1 to 5.5) consist of a manuscript that is published in *Sustainability*. Prof. Dr. Joachim Kimmerle is co-author of this manuscript. The proportions of contribution to the manuscript are presented in the following table. The following chapters are written as separately readable manuscripts. This results in content that overlaps in the introduction, summary and empirical chapters.

Manuscript 2

Author	Author position	Scientific ideas %	Data generation %	Analysis & interpretation %	Paper writing %
Elke Kümmel	First author	90	100	100	70
Joachim Kimmerle	Second author	10	0	0	30
Title of paper:		The Effects of a University's Self-Presentation and Applicants' Regulatory Focus on Emotional, Behavioral, and Cognitive Student Engagement.			
Status publication process:		Published: MDPI Education Sciences, 10, 3, 78 https://doi.org/10.3390/su122310045			

5.1 Introduction

At the time of transition to a higher education institution, students have to make many decisions in order to choose a university and a study program that fit their individual career needs (Boghikian-Whitby & Mortagy, 2016; Briggs et al., 2012; Pascarella et al., 2016; Pascarella & Terenzini, 2005). In such situations, students act with uncertainty, not being fully aware of the universities' community or culture (Terenzini et al., 1996). Briggs et al. (2012), for example, reported students' difficulties in trying to imagine their upcoming studies. Universities, in turn, present information about their programs and characteristics in digital environments, such as websites or social media. This information implicitly promotes a university's vision of its students' way of life and learning at that institution. However, it is unclear how students perceive such presentations of universities. It also remains unknown whether students' perceptions influence their motivation and, as a consequence, their decisions, well-being, and their commitment as students.

5.1.1 Universities' Self-Presentation in Digital Environments

Sustainable digitalization plays an increasingly important role in academic teaching (Stepanyan et al., 2013). In addition to the successful implementation of academic teaching in digital learning environments, there are social and economic aspects of sustainability. Graham et al. (2013) pointed out that a university's culture provides structural and, at the same time, social alignment for lecturers and students. Students and lecturers increasingly collaborate at universities with the help of digital learning tools (Howard et al., 2016; Kümmel et al., 2020). Lewison and Hawes (2007) reported the necessity of marketing plans to attract future students, recommending a marketing approach that requires universities to emphasize relevant foci. It is important to understand how universities can present themselves clearly in digital environments.

For some universities, it may be more important to support the development of social identity (Sallee, 2016; Scholl et al., 2019; Stephens et al., 2012; Weidman & Stein, 2003), whereas others have a vision of structuring students' futures (O'Connor & Allen, 2010; Penuel & O'Connor, 2018), or others wish to invest in public relations and

comparative evaluations with other universities (Clermont & Dirksen, 2016). Overall, it is not clear how these particular foci of interest are experienced by student applicants from outside the university and how this affects their (future) student commitment and engagement.

5.1.2 Student Engagement

An engaged student displays a positive, work-focused psychological state (Halbesleben & Wheeler, 2008) that is characterized by vigor, dedication, and absorption (Bakker et al., 2008). From a psychological point of view, student engagement is a learner's motivational state of well-being that is represented by educationally productive activities (Bakker et al., 2008; Kuh, 2009). Such activities reflect the student's commitment to their own studies (Reeve, 2012) as well as how intense the experiences of learning activities, lecturer support or feedback are for that student (Reschly & Christenson, 2012). The National Survey of Student Engagement (Ewell, 2010) provides four factors that reflect student engagement: academic challenge, learning with peers, experiences with faculty, and campus environment. Mandernach et al. (2011) used similar indicators: level of academic challenge, student/faculty interaction, active and collaborative learning, and enriching educational experiences. Educationally productive activities can be, for example, motivation to work on projects together with other students, actively seeking feedback from tutors and lecturers, making self-created learning scripts available for other students, putting a concerted effort into their studies, not wasting time on things that are not relevant to their studies, or even finding out more about their professors' research interests. The NSSE provided benchmarks for assessing student engagement (*National Survey of Student Engagement NSSE, Engagement Indicators*, 2020). These were higher-order learning, reflective and integrative learning, learning strategies, quantitative reasoning, collaborative learning, discussions with diverse others, student–faculty interaction, effective teaching practices, quality of interactions, and a supportive environment. As part of the work presented here, we transferred these benchmarks of student engagement to the challenges of digital learning environments. The description provided by Bempechat

and Shernoff (2012), stating that student engagement can be seen “as the quality of temporal interactions with the learning activity, task, social companions, and other components of the proximal environment”, (p. 318), is helpful for describing student engagement in digital learning environments. However, more empirical research is needed to investigate student engagement in this context.

Previous research has shown that student engagement functions as a prerequisite for learning success (Finn, 1993; Handelsman et al., 2005; Maroco et al., 2016; Rumberger & Rotermund, 2012) and is therefore an indicator of the performance of learners (Kahu, 2013; Trowler & Trowler, 2010b). Student engagement also seems to depend on situational context and what role a learner plays in the higher education context (Fredricks et al., 2004; Kahn, 1990; Moloney & Oakley, 2010; Trowler & Trowler, 2010a). Fredricks et al. (2005); Fredricks et al. (2004) viewed student engagement as an antidote to low achievement, high levels of boredom, and high drop-out rates. To sum up, student engagement should provide learners in higher education with a high level of energy and strong identification (Bakker et al., 2008) to support their learning in these environments.

Research studies have emphasized different influences when distinguishing among the various dimensions of student engagement. Carini et al. (2006) measured significant correlations between student engagement and GPA measures for active and collaborative learning, student–faculty interaction, supportive campus climate, and student–faculty interaction concerning coursework. Appleton et al. (2006) emphasized the importance of cognitive and psychological dimensions beneath more conventional academic and behavioral dimensions. Gray and DiLoreto (2016) demonstrated the effects of learner interaction and instructor presence on student engagement. Handelsman et al. (2005) used a four-factor structure (skills engagement, participation/interaction engagement, emotional engagement, and performance engagement) to predict student engagement.

In the work presented here, we refer to studies (Kahu, 2013; Maroco et al., 2016; Sun & Rueda, 2012) that suggested measuring affect, cognition, and behavior as indicators of momentary student engagement in a situational context. Kahu (2013) reported a lack of

clarity in the selection and relationship of these three dimensions, so we aimed to address this research gap. In line with Kahu (2013), we set out to measure student engagement with regards to emotion, behavior, and cognition. As explained above, we defined student engagement as vigor, dedication, and absorption. We assumed that vigor, dedication, and absorption would provide learners in higher education with a high level of power, energy, and strong identification (Bakker et al., 2008; Duckworth et al., 2007; Duckworth & Quinn, 2009; Kuh, 2009). In addition, pro-active engagement requires considerable expenditure of effort, energy, and resources (Hoyne & McNaught, 2013; Strauss et al., 2017) and also predicts performance (Tornau & Frese, 2013).

In addition to investigating situational contexts that could affect student engagement (Fredricks et al., 2004; Lam et al., 2012), we also took an individual approach (Anderman & Patrick, 2012). We assumed that students with a sense of psychological fulfillment and personal significance, combined with a willingness to invest, would demonstrate a high level of student engagement. In the following section, we provide the theoretical background on regulatory focus theory (Higgins, 1997; Higgins, 1998), which predicts individual effects on student engagement.

5.1.3 Regulatory Focus Theory

People tend to seek particular psychosocial experiences and feel pleasure when they have these experiences (Prentice et al., 2014). According to regulatory focus theory (Higgins, 1997; Higgins, 1998), there are two distinct and independent self-regulatory orientations for seeking these experiences: a promotion focus is driven by the need for growth, and a prevention focus is driven by the need for security. The theory suggests that performance and goal achievement are either driven by a motivational tendency to approach success or to avoid failure. A person with a promotion focus, for example, focuses more strongly on information about gain or no-gain while pursuing their goal to approach success. In contrast, a person with a prevention orientation processes information on loss or non-loss while pursuing the goal of avoiding failure (Lockwood et al.,

2002). Promotion and prevention focus affect attention and perception (Higgins & Silberman, 1998; Lockwood et al., 2002; Shah et al., 1998).

5.1.4 Regulatory Fit with a University's Self-Presentation

Higher education faculties should sustainably foster the learning of students and ensure that their students belong to the community of a faculty: a community that supports growth, challenges students' viewpoints, builds long lasting relationships and well-being, and focuses on academic as well as personal success (Penuel & O'Connor, 2018; Wilson et al., 2015, 2018). Hassanzadeh et al. (2012) transferred these considerations into a digital learning environment. They demonstrated the effects of content and information quality on students' satisfaction and behavioral intention. In the research presented here, we hypothesized that a university's self-presentation has an impact on regulatory fit (Lee & Aaker, 2004), which in turn should affect students' emotional responses (Sassenberg & Hansen, 2007; Sassenberg et al., 2007), behavior (Hamstra et al., 2014; Sassenberg & Hamstra, 2017; Werth & Förster, 2007), and cognitive performance (Keller & Bless, 2006).

A university's self-presentation—on a website, for example—that emphasizes eagerness or self-realization should fit the promotion focus of students who wish to pursue achievement and success. Such self-presentation would make these students feel a sense of significance, combined with the willingness to invest effort to achieve their hopes and aspirations. In other words, this regulatory fit of a university's self-presentation would in turn lead students to express higher levels of student engagement.

On the other hand, for regulatory fit with students with prevention focus, pursuing non-loss and avoiding mistakes or failure, a university's self-presentation should describe possible vigilance behavior, or behavior fostering certainty—by following the rules, for example. Students with this regulatory fit should also feel a sense of significance combined with willingness to invest effort to fulfill their responsibilities, so these students would also show a boost of student engagement.

5.1.5 Research Question and Hypotheses

The research question here was whether there is an effect on student engagement in the interplay between a university's self-presentation and people's regulatory focus. This experiment was pre-registered on the pre-registration platform *aspredicted.org* (pre-registration number #24702). We hypothesized that there would be an interaction effect between a university's self-presentation (chances vs. obligations) and participants' promotion and prevention focus on student engagement. In particular, we hypothesized that there would be higher student engagement scores for participants with a promotion focus in the chances condition and higher engagement scores for participants with a prevention focus in the obligations condition. We hypothesized that this interaction effect would occur on (a) emotional, (b) behavioral, and (c) cognitive levels.

5.2 Material & Methods

We tested the interaction hypothesis in a laboratory study. Participants put themselves in the role of a university applicant. We examined the impact of (a) the university's self-presentation in emphasizing chances for students vs. emphasizing obligations and (b) participants' regulatory focus score on student engagement. We manipulated the university's self-presentation by presenting two different descriptions of its programs and character. We also measured the participants' regulatory focus by capturing promotion and prevention focus independently (Sassenberg et al., 2012). The dependent variable was student engagement, as measured on three levels: (a) emotion, (b) behavior, and (c) cognition. In order to develop valid material and reliable measures of behavioral student engagement, we conducted a pre-study.

5.2.1 Pre-Study

We recruited N = 56 participants (44 females, 12 males, zero third gender) aged from 19 to 65 years old (M = 25.21, SD = 8.40) for this pre-study. The objective was to validate (a) the manipulation of a university's self-presentation and (b) the items to measure behavioral student engagement.

Validation of Self-Presentation. We utilized two self-presentations of a university in a within-design. To analyze the suitability of the self-presentation texts, we conducted a randomized study with participants' perception of the two types of self-presentation (chances vs. obligations) as dependent variables. Participants were to imagine that they had applied to a university and been accepted. After reading the university's self-presentation, participants rated the description of the study program at that university. They rated six statements on a 7-point Likert scale (1 = *does not apply at all* to 7 = *applies completely*). There were three items in each case, each representing either an emphasis on chances (a) or an emphasis on obligations (b).

The chances-related items specified that the study program provided students with a lot of freedom for learning experiences, offered graduates many professional opportunities, and aimed to ensure that their students were among the best. The obligations-related items referred to a rigid structure of how students should learn, represented a clear vision of how the course of study should proceed, and aimed to ensure that their students were monitored and accompanied.

The results revealed an interaction effect, $F\,(3, 664) = 44.38$, $p < 0.001$, $\text{eta}^2 = 0.063$ (Table 8, Figure 9), indicating that our texts were valid operationalizations for the self-presentation of chances vs. obligations.

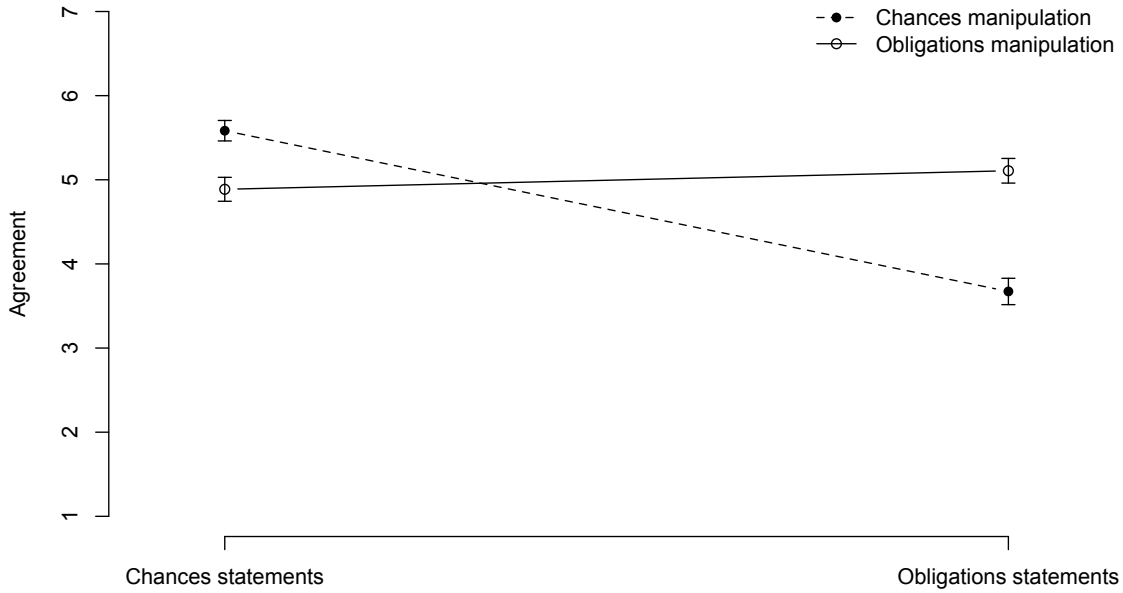
Table 8

Pretest Self-Presentation

Statement/ Condition	Chances Mean (*SD*)	Obligations Mean (*SD*)
Chances	5.58 (1.58)	3.67 (2.03)
Obligations	4.89 (1.84)	5.10 (1.90)

Figure 9

Evaluation of Two Types of a University's Self-Presentation (Chances vs. Obligations)

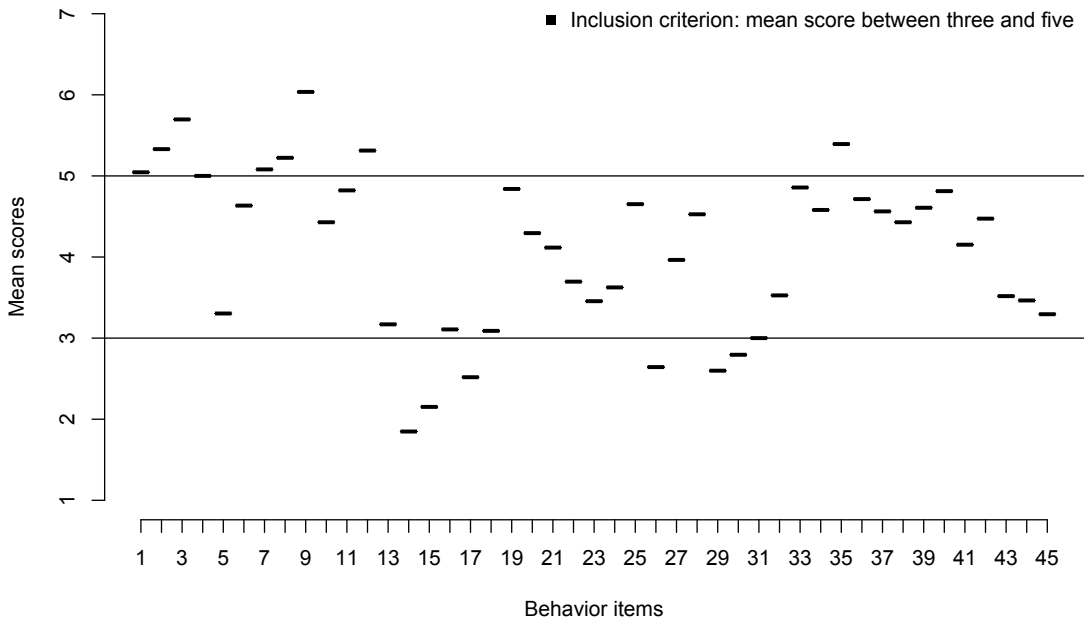


Note. Error bars indicate standard errors.

Validation of the Behavioral Student Engagement Measurement. We also examined 45 items to measure behavioral student engagement in this pre-study. Participants were asked what they would do next and to what extent they would find themselves carrying out the behavior described in these items. We used a 7-point Likert scale (1 = *does not apply at all* to 7 = *applies completely*). The participants rated the items twice (Cronbach α = 0.90, Cronbach α = 0.93) in the context of the within-design. They first rated all of the items after reading one self-presentation and a second time after reading the other self-presentation. For our main study, we aimed to obtain items with mean values between 3 and 5, so that our items would be informative with respect to a representative and sensitive middle field, without outliers (Figure 10). This procedure resulted in 31 items for the measurement of behavioral student engagement.

Figure 10

Items to Measure Behavioral Student Engagement: 31 Items with a Mean Score Between Three and Five were Selected for the Main Study



5.2.2 Procedure

For the main study, we recruited adult participants through the Online Recruitment System for Economic Experiments (ORSEE) to take part in a laboratory experiment with a duration of 45 min. Participants were welcomed, and after they had signed the declaration of consent, they started the study on a laptop. The survey ran on the XM Platform™ Version October 2019 of Qualtrics (Copyright © 2020 Qualtrics, Provo, UT, USA. https://www.qualtrics.com), and participants received compensation of six Euros. Participants answered demographic questions about their age, gender, and whether they were university students. Then, we presented a questionnaire to determine the individual promotion focus and individual prevention focus of each participant and continued with a manipulation of the university's self-presentation. Participants were instructed to imagine that they were applicants for a master's program. They were randomly assigned to one of two experimental conditions (chances vs. obligations), in which they read one of the

university's self-presentations (see below). After reading the text, we presented three chances statements and three obligations statements with the same procedure as in the pre-study as a manipulation check. Then, participants filled in the emotional student engagement questionnaire. After this, participants rated their behavioral intentions in terms of what they would do next. Finally, they were asked to write an essay about the personal relevance of the self-presentation of this university (cognitive student engagement).

5.2.3 University's Self-Presentation

The independent variable was self-presentation, with the conditions of chances vs. obligations, as validated in the pre-study. We manipulated descriptions of student life at the university with reference to the goals, tasks, and professional fields of a fictitious master's degree program in Bioeconomy. We provided two different self-presentations of a university and that particular degree program. One self-presentation emphasized independence and individual choices, whereas the other self-presentation described a rigid structure with predefined choices (see Appendix 4).

The text of the chances condition suggested a high level of freedom, allowing students to use their own learning styles and choose their preferred learning environments. This assumed that students wanted to decide on their own in a responsible manner and receive support or information in order to find their own way. In the chances version of the university's self-presentation, we used the following wording, for example, "Our students are partners in our learning community and choose their own learning groups… Students can choose seminars in which they can realize themselves and which are interesting to them." Such a presentation would establish a regulatory fit with promotion focus by pointing out potential gains and opportunities for a student's future career.

The university's self-presentation in the obligations condition emphasized a rigid structure for students, with clear norms, demands, and predefined courses and learning groups. Participants in this condition read about a clearly defined and structured way of studying with a lot of supervision. In the obligations condition the text emphasized obligations with wording like "The university organizes learning groups that prevent our

students from feeling left alone… Students are assigned to seminars that are adapted to their course content." A regulatory fit with prevention focus would occur with such a self-presentation that emphasized security and non-loss.

5.2.4 Measures

Regulatory Focus. We used a questionnaire with two subscales to determine each participant's individual promotion focus and prevention focus (Appendix A1). Participants answered 12 items to assess promotion focus ("If I really want to achieve a goal, I'll find a way.") and ten items to assess prevention focus ("For me, safety is an important criterion when making important decisions."). They rated the extent to which the items applied to them on a 7-point Likert scale from 1 = *does not apply at all* to 7 = *applies completely*.

Emotions. We used eight subscales with a total of 24 items (adjectives) to assess the participants' affective states (Krohne et al., 1996; Sassenberg & Hansen, 2007; Watson et al., 1988). Sassenberg and Hansen (2007) reported that with a particular regulatory focus, individuals experience specific predominant emotions. We therefore integrated items to evaluate positive and negative emotions with respect to promotion and prevention focuses. In addition, we integrated four subscales from the Positive and Negative Affect Schedule (PANAS) (Watson et al., 1988) to provide a comprehensive spectrum of an individual's affective states. The eight subscales integrated were positive promotion, negative promotion, positive prevention, negative prevention, hope, threat, fear, and anxiety. The emotions involved in student engagement were based on these subscales, with higher scores representing greater student emotional commitment (see Appendix A2). Participants were to imagine that they were considering taking part in the master's program at the university and to indicate which adjectives described what they felt (7-point Likert scale: 1 = *does not apply at all* to 7 = *applies completely*).

Behavior. Student engagement on a behavioral level included concrete behavioral intentions. The 31 items identified in the pre-study represented concrete behavioral intentions on three subscales: personal initiative (8 items), digital networking (11 items), and goal-orientated learning activities (12 items; see Appendix A3). Participants were

asked to what extent these concrete behavioral intentions matched their own current intentions, with higher scores representing greater student behavioral engagement (7-point Likert scale: 1 = *does not apply at all* to 7 = *applies completely*).

Personal initiative is supposed to be beneficial for individual learning. The personal initiative subscale was represented by pro-active participation in a learning setting. The following items are examples of personal initiative: “I would like to start my studies immediately” and “I don’t intend to waste time on things that are not relevant to my studies.”

The digital networking subscale referred to active usage of digital tools (Kümmel et al., 2020). This facet of behavior focused in particular on the social aspects of networking in a digital environment. Pro-active behavior in this subscale was therefore represented by active contributions to a corresponding digital environment. We used the following items, for example: “I am motivated to look for new peers in my existing social networks” and “I am motivated to register in existing social media groups in order to establish contact with other students at the university.”

Goal-orientated learning activities represented self-regulatory aspects of learning in digital learning environments. This implied cognitive processing, selection, evaluation, cooperation, and reflection. We described these activities with items like “I am highly motivated to differentiate between important and unimportant study sessions” and “I am motivated to create my own learning scripts”.

Cognition. Participants had to write an essay to answer this question: “Which statements from the description of the university were personally relevant to you with regard to your studies, university, or future professional life?” There were no restrictions regarding the length of the participants’ texts. We analyzed the texts with Linguistic Inquiry and Word Count (LIWC) 2015 software (Pennebaker et al., 2015) in the German Version DE-LIWC2015. Output variables of the psychological dimension drives from the software’s dictionary (Meier et al., 2019; Pennebaker et al., 2015) were used. The drives dimension in LIWC2015 includes achievement, power, risk, and reward. These variables fit our theoretical definition of student engagement and regulatory focus theory and include

thinking about power in the form of passion and perseverance (Duckworth, 2016). Asking participants for a statement about their own studies, the university, and their future made them reflect on relevant goals, on self-assessment, and on self-regulatory strategies. In addition, writing an essay made them think about their willingness to dedicate time and effort.

5.2.5 Statistical Analysis

We conducted a power analysis for significance level α = .05 and power of .80. We determined our hypothesized interaction of university's self-presentation, promotion and prevention focus with a medium effect size of f2 = .15 and an effect size of f2 = .20 for the regulatory fit condition which resulted in a sample size of N = 120.

We examined the impact of the university's self-presentation (emphasizing chances for students vs. emphasizing obligations of students) and participants' regulatory focus on student engagement. To accomplish this, we designed a multiple linear regression model with the three predictors university's self-presentation, participants' promotion focus, and participants' prevention focus. We then regressed the predictors to each level and each subscale of student engagement linear regression model (dependent variable ~ self-presentation * promotion * prevention), $\alpha = 0.05$. We conducted a manipulation check at participant level and overall. We used the same statements as in the pre-study. Participants rated six statements on a 7-point Likert scale (1 = *does not apply at all* to 7 = *applies completely*), with three statements each representing an emphasis on chances or an emphasis on obligations. For the individual manipulation check, we calculated the mean differences of each participant. In the chances condition, agreement was supposed to result in a positive difference score, whereas the obligations condition was supposed to result in a negative score. Participants who rated the statements in the "wrong" direction were not included in the analysis. For the overall manipulation check, we conducted an analysis of variance (ANOVA) that was supposed to result in an interaction effect of a university's self-presentation in the chances vs. obligations conditions.

5.3 Results

We obtained 124 complete datasets and had to exclude five participants who were non-native speakers and three participants who did not pass the participant's manipulation check. The remaining N = 116 participants (85 females, 31 males, and zero third gender participants) were aged from 18 to 73 years old (M = 26.25, SD = 9.67) and were assigned in equal numbers to the conditions (58 participants each).

The ANOVA for the overall manipulation check showed a significant interaction effect of condition (chances vs. obligations) and statements (chances vs. obligations), F (1, 114) = 93.22, $p < 0.001$, $eta^2 = 0.45$. Participants in the chances condition scored higher on the chances statements than on the obligations statements and vice versa (Table 9, Figure 11).

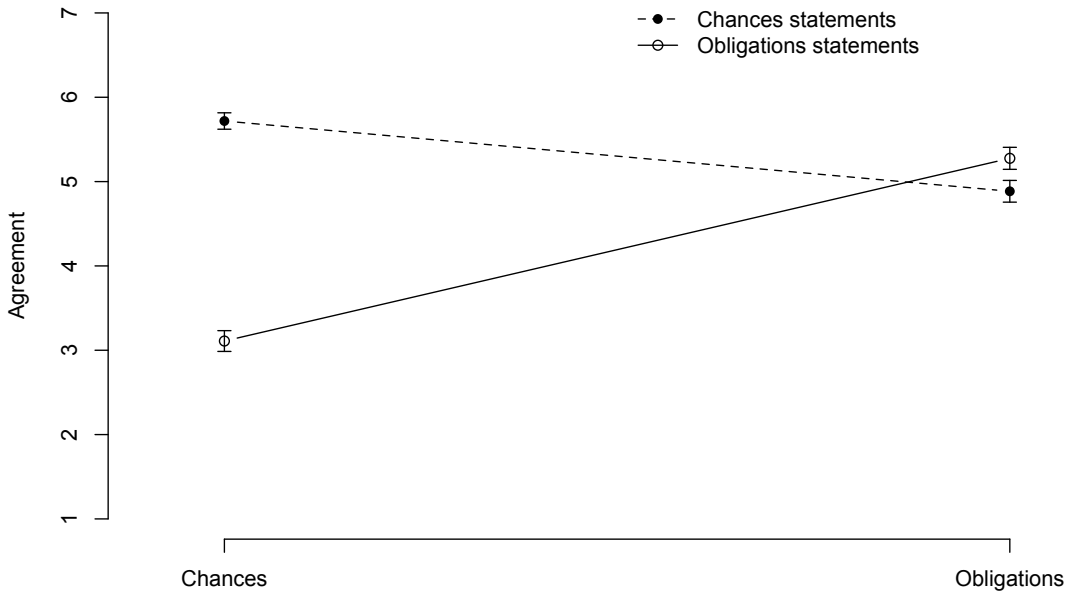
Table 9

Manipulation Check of the University's Self-Presentation

Statements/ Condition	Chances Mean *(SD)*	Obligations Mean *(SD)*
Chances	5.72 (1.28)	3.11 (1.63)
Obligations	4.89 (1.70)	5.28 (1.72)

Figure 11

Manipulation Check: Interaction Effect Indicating Successful Manipulation of the University's Self-Presentation, With Error Bars Indicating Standard Errors



5.3.1 Individual Regulatory Focus

The internal consistencies of both of the subscales, promotion and prevention focus, were acceptable: promotion-focus subscale, Cronbach α = 0.78, *M* = 4.89, *SD* = 0.74; prevention-focus subscale, Cronbach α = 0.70, *M* = 4.68, *SD* = 0.75 (Table 10). The assessment of participants' promotion focus and prevention focus revealed a significant difference, *t (*115) = 2.34, *p* = 0.021. In line with regulatory focus theory, our results indicated two independent self-regulatory orientations.

Table 10

Promotion and Prevention Focus

Regulatory Focus	Mean (*SD*)
Promotion	4.89 (0.74)
Prevention	4.68 (0.75)

5.3.2 Emotions

The reliability of emotion measurement was excellent overall, Cronbach α = 0.97. The linear regression model (emotions ~ self-presentation * promotion * prevention) resulted in a three-way interaction effect for the positive promotion emotion subscale, β = 0.96, *SE* = 0.48, *p* = 0.048, R^2 = 0.165, *F* (7,108) = 3.04, *p* = 0.006, and for the hope subscale, β = 0.94, *SE* = 0.46, *p* = 0.044*, R^2 = 0.167, *F* (7,108) = 3.10, *p* = 0.005 (Table 11). As hypothesized, there was an interaction effect between the condition and promotion focuses for positive promotion emotion. That is, the university's self-presentation had an impact on participants' positive promotion emotion, depending upon their regulatory focus: the higher participants' promotion focus was, the higher they rated their positive promotion emotions in the chances condition (Figure 12). The same applied to the emotion hope. The higher participants' promotion focus was, the higher they rated their sense of hope about their studies in the chances condition (Figure 13). The subscales negative promotion emotion, positive and negative prevention emotion, threat, fear, and anxiety did not show any effects.

Table 11

Emotional Student Engagement

Emotion	β	*SE*	*T*	*p*
Positive promotion emotion [a]				
Intercept Chances	−1.63	7.47	−0.22	0.828
Condition	19.01	10.60	1.79	0.076
Promotion	1.05	1.44	0.73	0.469
Prevention	1.05	1.64	0.64	0.525
Condition x promotion	−4.45	2.16	−2.05	0.042 *
Condition x prevention	−4.26	2.36	−1.80	0.074
Promotion x prevention	−0.15	0.31	−0.49	0.627
Condition x promotion x prevention	0.96	0.48	2.00	0.048 *
Hope [b]				
Intercept Chances	4.23	7.18	0.59	0.557
Condition	17.75	10.20	1.74	0.085
Promotion	−0.005	1.38	−0.004	0.997

Emotion	β	*SE*	*T*	*p*
Prevention	−0.042	1.58	−0.03	0.979
Condition x promotion	−4.39	2.08	−2.11	0.037 *
Condition x prevention	−3.93	2.27	−1.73	0.086
Promotion x prevention	0.05	0.30	0.17	0.868
Condition x promotion x prevention	0.94	0.46	2.04	0.044 *

Note. [a] Regression model: F (7,108) = 3.04, p = 0.006, R^2 = 0.165.

[b] Regression model: F (7,108) =3.10, p = 0.005, R^2 = 0.167.

* $p < 0.05$.

Figure 12

Interaction Effect of a University's Self-Presentation (Chances vs. Obligations), Promotion Focus, and Prevention Focus on Positive Promotion Emotions

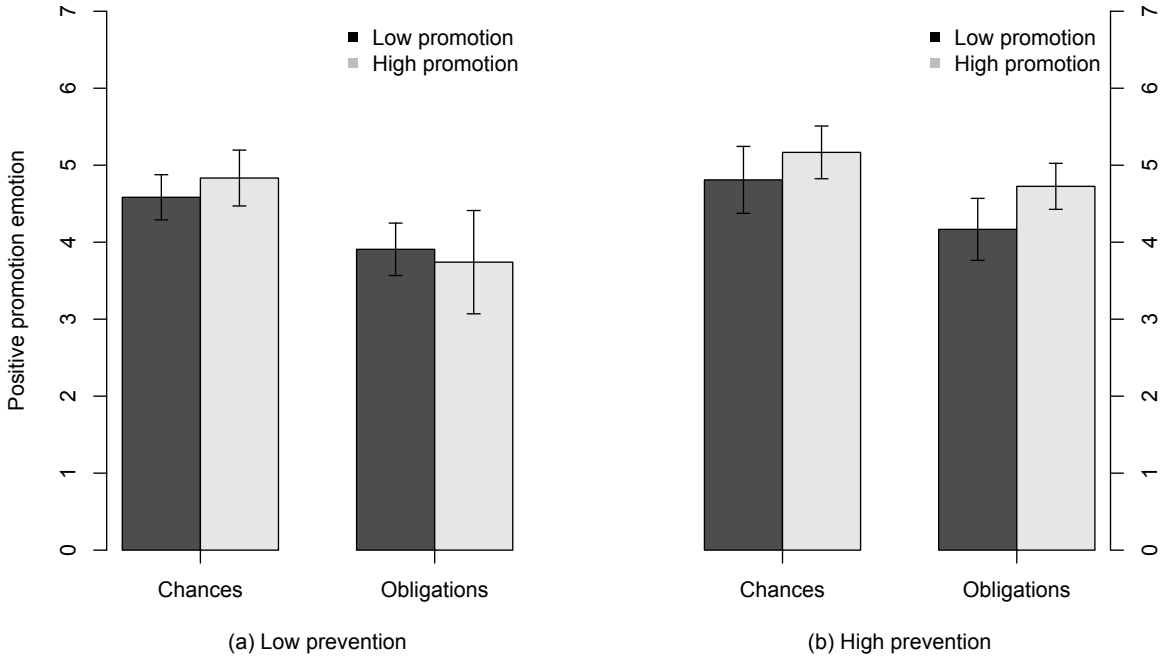
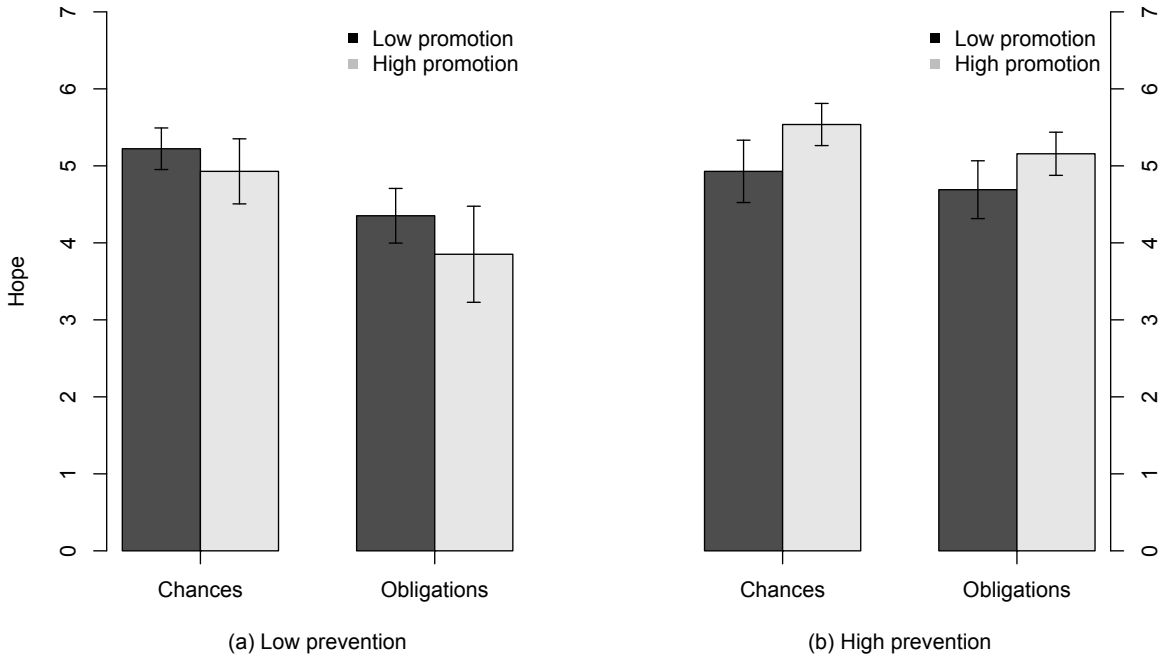


Figure 13

Interaction Effect of a University's Self-Presentation (Chances vs. Obligations), Promotion Focus, and Prevention Focus on Hope



5.3.3 Behavior

The reliability of the behavior measurement was good (Cronbach α = 0.82). The linear regression model (behavior ~ self-presentation * promotion * prevention) resulted in a three-way interaction effect for the subscale personal initiative, β = 0.80, *SE* = 0.24, *p* = 0.001*, R^2 = 0.260, *F* (7,108) = 5.43, *p* < 0.001 (Table 12). As hypothesized, a university's self-presentation had an impact on the behavioral level of student engagement depending on participants' promotion and prevention focus. The higher participants' promotion focus was, the higher they rated their personal initiative for their university studies, in particular in the chances condition. Participants indicated the highest personal initiative in the chances condition with a high promotion focus and the lowest in the obligations condition with a low promotion focus (Figure 14). The subscales digital networking and goal-orientated learning activities did not show any effects.

Table 12

Student Engagement on a Behavioral Level

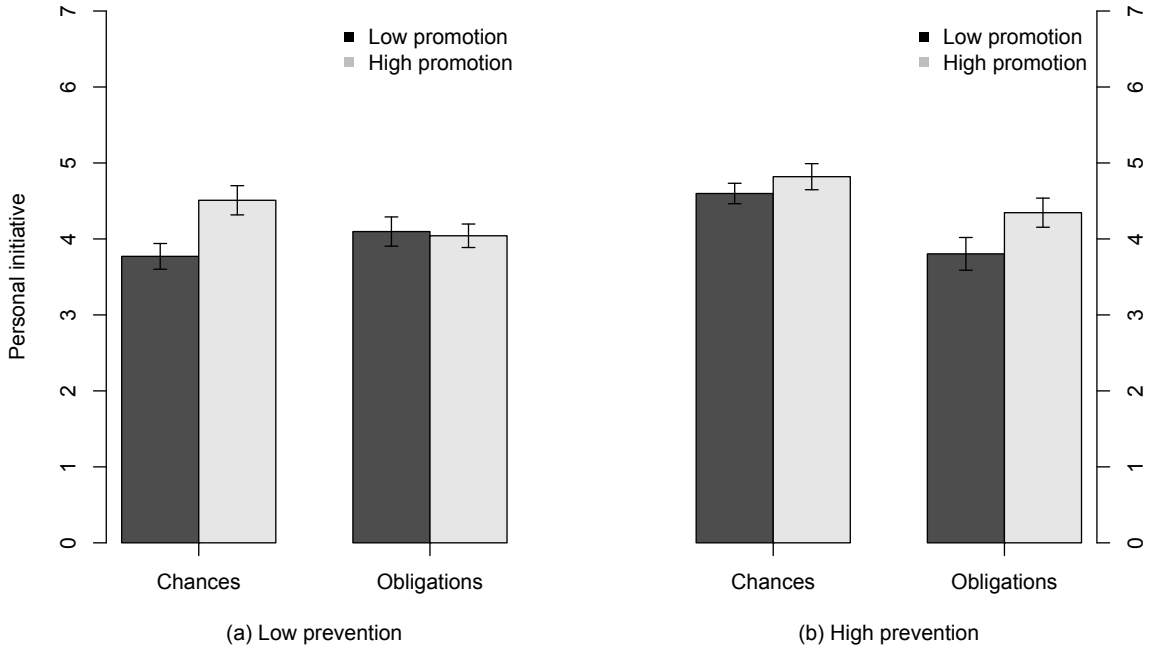
Behavior	β	*SE*	*t*	*p*
Personal initiative [a]				
Intercept Chances	−7.09	3.68	−1.93	0.057
Condition	18.95	5.23	3.63	0.0004 ***
Promotion	1.95	0.71	2.76	0.007 **
Prevention	2.24	0.81	2.77	0.007 **
Condition x promotion	−3.78	1.07	-3.54	0.0006 ***
Condition x prevention	−4.11	1.16	-3.54	0.001 ***
Promotion x prevention	−0.37	0.15	-2.39	0.018 *
Condition x promotion x prevention	0.80	0.24	3.40	0.0009 ***

Note. [a] Regression model: F (7,108) = 5.34, $p < 0.001$, $R^2 = 0.261$.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Figure 14

Interaction Effect of a University's Self-Presentation (Chances vs. Obligations), Promotion Focus, and Prevention Focus on Personal Initiative



5.3.4 Cognition

We measured the cognitive level of student engagement based on participants' essays. On average, the essays consisted of *M* = 144.96 words (*SD* = 73.05). The linear regression model (cognition ~ self-presentation * promotion * prevention) resulted in a three-way interaction effect for the LIWC category power (β = 1.19, *SE* = 0.42, *p* = 0.005*, R^2 = 0.109, *F* (7,108) = 1.891, *p* = 0.078; Table 13). As hypothesized, a university's self-presentation had an impact on the cognitive level of student engagement, depending on the participants' promotion and prevention focus. The higher the participants' promotion focus, the lower the number of words in participants' essays that represented power in the obligations condition. The same applied to prevention focus: the higher the participants' prevention focus, the lower the number of words in participants' essays that represented power in the obligations condition (Figure 15).

Table 13

Student Engagement on a Cognitive Level

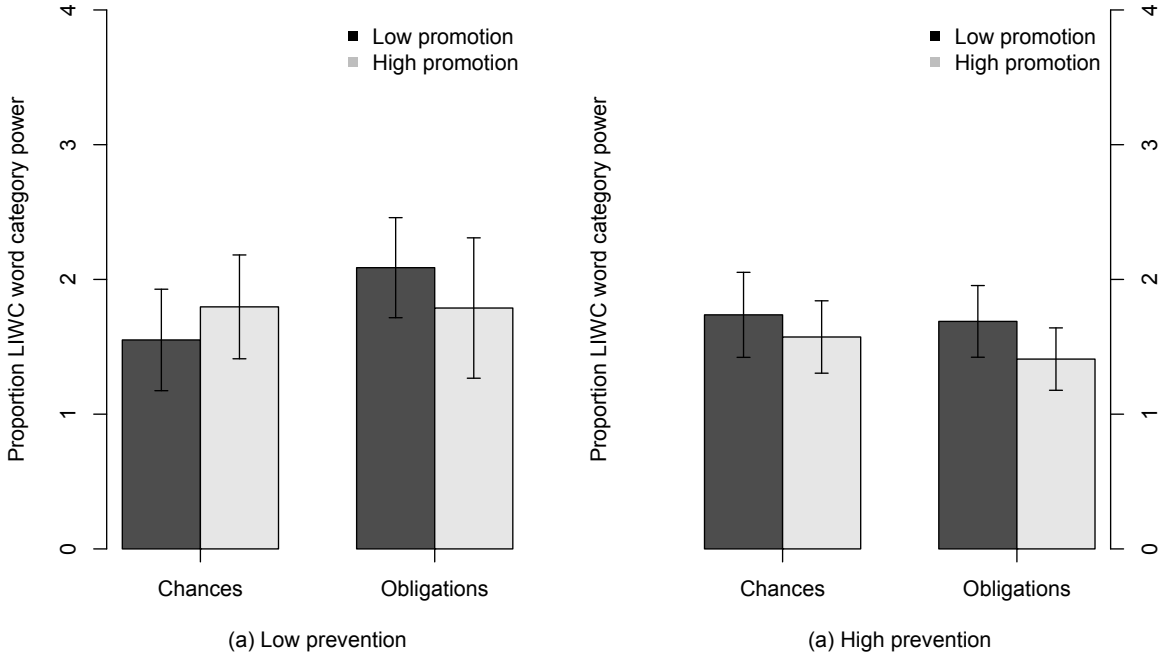
Cognition	β	*SE*	*t*	*p*
LIWC Word category power [a]				
Intercept Chances	−40.68	14.60	−2.79	0.006 **
Condition	28.07	9.25	3.03	0.003 **
Promotion	8.53	2.88	2.96	0.004 **
Prevention	9.11	3.22	2.82	0.006 **
Condition x promotion	−5.64	1.89	−2.99	0.004 **
Condition x prevention	−5.91	2.06	−2.88	0.005 **
Promotion x prevention	−1.83	0.63	−2.90	0.005 **
Condition x promotion x prevention	1.19	0.42	2.85	0.005 **

Note. [a] Regression model: *F* (7,108) = 1.89, *p* = 0.078, R^2 = 0.109.

** *p* < 0.01.

Figure 15

Interaction Effect of a University's Self-Presentation (Chances vs. Obligations), Promotion Focus, and Prevention Focus on the Linguistic Inquiry and Word Count (LIWC) Category Power



5.4 Discussion

In trying to assess what influences student engagement, we found interaction effects indicating a regulatory fit between a university's self-presentation and participants' regulatory focus for emotion, behavior, and cognition. This applied to the subscales of positive promotion emotions, hope, personal initiative, and power words. In particular, we found the regulatory fit we had hypothesized for promotion focus in the chances condition. The self-presentation of a university that focused on chances resulted in a bigger boost of positive promotion emotion, hope, and personal initiative compared to the self-presentation of a university that focused on obligations for people with a high promotion focus. As hypothesized, we also found a regulatory fit for prevention focus in the obligations condition on the use of power words.

The low scores in the obligations condition for participants with a high promotion focus fit our assumption that a rigid structure does not encourage student engagement for those people. However, for the university's self-presentation that emphasized obligations, we had expected higher scores of student engagement for people with a high prevention focus. The obligations condition was supposed to trigger security aspects and strategies to succeed, which in turn should have activated hope for people with a high prevention focus. In this study, no negative emotions, such as feelings of threat, fear, or anxiety were triggered. It is possible that the topic of our cover story was connotated positively (Dejonckheere et al., 2019) so that it did not induce any stress (Scott et al., 2017) or negative feelings.

What is also interesting is the comparison of the two conditions regarding personal initiative. Restrictions and obligations emphasized in the obligations condition led to lower personal initiative than in the chances condition. Participants in the obligations condition might have been more dispassionate. Participants in the chances condition may have experienced support and opportunities, resulting in initiative for their future studies. Being dispassionate, in contrast, would be considered a bad starting point to achieve high performance (Bong & Skaalvik, 2003; Cho & Heron, 2015; Eitam & Higgins, 2014). Being hopeful or expecting a good course of study, however, may support personality development and a stable future for applicants. Hope is known to provide positive expectations, dedication, and energy. So, our results are in line with the approach of Maroco et al. (2016), who found that student engagement is a prerequisite to learning success. If a university wants to support their students in developing positive emotions and hope with regards to their studies, it should present itself as providing many chances and opportunities.

We had similar findings for student engagement on a behavioral level. As expected, applicants with a stronger promotion focus indicated higher personal initiative in the chances condition than in the obligations condition. Participants with low prevention focus showed more personal initiative after reading the university's self-presentation in the

obligations condition. A stronger prevention focus, however, led to less personal initiative in the obligations condition. High prevention focus and chances-oriented self-presentation led to higher expressions of personal initiative than in the obligations-oriented self-presentation. The effects on student engagement measured as personal initiative were multifaceted and worth investigating. We used concrete behavioral intentions to describe personal initiative in a digital learning context. However, there are also other approaches to describe such personal initiatives, like pro-activity or grit (Duckworth, 2016; Strauss et al., 2017), that could be transferred into the context of learning at the university. Interestingly, there is little research that has implemented personal initiative as a variable, although personal initiative is a core characteristic for initiating interaction with digital media (Kümmel et al., 2020). The subscales digital networking and goal-orientated learning activities did not reveal any effect. Maybe the shift to explicitly using digital technologies is obvious and independent of situational student engagement and individual regulatory focus.

We found significant results for student engagement on a cognitive level in the category power that were not entirely straightforward. Essays included more power words with a prevention focus in the obligations condition. It was the self-presentation of the university that led to a regulatory fit on a cognitive level of student engagement depending on a low promotion focus. We assume that with a low promotion or prevention focus, participants were not engaged very much at all in the chances condition. Even a high promotion and prevention focus did not lead to high scores for student engagement. Maybe writing an essay was not an optimal measure for cognitive effort. For further studies, we recommend focusing more strongly on meta-cognitive learning skills, attitude, and values in concrete cognitive tasks (Reschly & Christenson, 2012). Another idea for further studies is to add writing an essay in a real application situation so that applicants' statements are more meaningful.

5.4.1 Limitations

We limited our work to positive student engagement to elaborate on empirical evidence for the three dimensions of student engagement. On an emotional level, we could compensate this by measuring negative emotions as well. Our results supported this theory testing and revealed that student engagement addressed momentary aspects (affects) as well as intentions (behavior) and writing skills (cognition). Accordingly, future research could monitor student engagement in a multidisciplinary approach. An aspect that we did not follow was considering student engagement as a potential mediator. We decided to investigate student engagement as an outcome variable and have broken it down into small research units. We are aware that the self-presentation of a university in digital learning environments includes more than just reading texts. The website of a university also includes pictures, videos, hyperlinks, or reports from peers and alumni. However, as a first step, it was useful to exclude such aspects of processing information to explore distinctive results.

Another limitation is that people's regulatory focus was the only individual difference factor that we addressed in this study. It is conceivable that a number of other aspects, such as interest, social value orientation (Kimmerle et al., 2011), and social comparison orientation (Kimmerle & Cress, 2009), and also demographic factors, such as age or educational background, may play a role in student engagement. In addition, it may be problematic that we have used a large number of varied measures, which are not necessarily on the same level and therefore may have very different variances, which are not always easy to interpret. We must also note that the scenario used here was rather artificial. It involved the profiles of fictional universities, which meant that the research setting lacked authenticity. Finally, it must be noted that the generalizability of the findings is limited due to the lack of representativeness of the sample.

5.5 Conclusion

There was empirical evidence for the impact of a regulatory fit on all three levels of student engagement, which supports our approach of measuring student engagement on

emotional, behavioral, and cognitive levels. This supports the approach of Kahu (Kahu, 2013). We also found that the results were not generalizable or additive over these levels: emotional, behavioral, and cognitive student engagement seemed to be rather different aspects of student engagement that should be investigated separately.

We investigated whether the situational context of a university's self-presentation could possibly influence student engagement, depending on the regulatory focus of the participants. Our results revealed a situational influence on student engagement that supported the approach of Bempechat and Shernoff (2012) and Kahu (2013), but results may vary under real conditions Dejonckheere et al. (2019); Scott et al. (2017). For all three levels, individual regulatory focus was considered as well. We found an effect in the interplay of a university's self-presentation with people's regulatory focus on student engagement. In support of regulatory focus theory, we found the hypothesized regulatory fit for a university's self-presentation for single subscales. However, regulatory focus theory does not explain all of our results. Especially in combination with regulatory focus, we found different effects on student engagement. Further research is needed in order to arrive at a more accurate picture of this interplay.

We measured emotions at one point in time, and it is possible that situational effects on an emotional level were not long-lasting, as affects tend to fade away quickly. Further research on universities' self-presentation that focuses on positive emotions, like hope and positive promotion emotions, and on personal initiative seems to be promising. In our opinion, experience sampling studies could describe emotional student engagement more sustainably. We found that digital networking and goal-orientated learning activities did not lead to any differences in student engagement. Maybe these behavioral intentions represent common practice among students.

We conclude that a university that focuses on predefined ways of learning and on concrete conceptions of their students' professional careers will prevent the development of student engagement. Our recommendation for universities is to provide support, ideas for chances, and opportunities for applicants and students. This is important because,

currently, universities often rely on predefined curricula. Universities should be willing to dedicate time and effort to designing a clear idea of their self-presentation in a digital context and to implement digital learning environments and online universities.

6 Study 3

The Interplay of a University's Self-Presentation and Situational Regulatory Focus on Student Engagement. Study 2 examined structural influence of universities (situational context of a university's self-presentation) and personal facts (applicant's regulatory focus) that possibly influenced student engagement on the emotional, behavioral, and cognitive level. I could prove the hypothesized interaction effect for single subscales of emotional, behavioral, and cognitive student engagement. I measured applicants' regulatory focus (chronic promotion and prevention focus), and this measurement mapped the actual values of participants' goal pursuit orientation. An active manipulation of individuals goal pursuit orientation with the induction of regulatory focus (situational promotion and prevention focus) is the usual theoretical approach in research on regulatory focus theory which should be followed. Furthermore, the subscales of student engagement revealed quite different results. It is not clear whether this was due to the nature of student engagement or due to the interacting factors. A follow-up study could provide further findings to clarify this, and it could provide further understanding of the three levels of student engagement as quite different level.

Personal initiative was affected, so that I assumed that even though the review of Study 1 showed that it has rarely been operationalized as a learning outcome in research, it was worth using again. I could prove that emotions like positive promotion emotion or hope vary significantly depending on the situational context, especially for applicants with chronic promotion focus.

Study 2 included the alignment of a university that described a path of goal-pursuit manner and that was predefined in a university's self-presentation of a study-program. Applicants should be sensitive to their preferred strategy of chronic promotion or prevention focus. But especially in combination with regulatory focus, there were different effects of university self-presentation on student engagement. Regularities and mechanisms that are necessary for a uniform explanation of findings are not yet robust and need further investigation. For example, the weighting of the factors university self-presentation,

promotion and prevention focus remained unclear. This may be due to the fact that applicants' regulatory focus as a personal fact is not as sensitive as a situational promotion or prevention focus for a situational impact on student. This needs to be clarified. For an overall picture of the role of regulatory focus, a study that manipulated situational regulatory focus had to follow. Fostering student's sensitivity to a situational context should result in a higher boost of student engagement. Therefore, I induced goal-pursuit orientation (situational regulatory focus) and again manipulated manner of goal-pursuit (university's self-presentation).

This was my strategy in Study 3, I will present in the following subchapters. The study is an experimental study which is largely based on the preceding Study 2 from Chapter 5. For reasons of consistency and comparability I used the same materials. For in-depth descriptions I refer to Study 2 to avoid redundancy.

DECLARATION ACCORDING TO § 5 ABS. 2 NO. 8 OF THE PHD REGULATIONS OF THE FACULTY OF SCIENCE

-SHARE IN COLLABORATIVE PUBLICATIONS/ MANUSCRIPTS -

The subsequent chapter (Chapter 6.1 to 6.5) consist of a manuscript that is in preparation for submission. Prof. Dr. Joachim Kimmerle is co-author of this manuscript. The proportions of contribution to the manuscript are presented in the following table. The following chapters are written as separately readable manuscripts. This results in content that overlaps in the introduction, summary and empirical chapters.

Manuscript 3

Author	Author position	Scientific ideas %	Data generation %	Analysis & interpretation %	Paper writing %
Elke Kümmel	First author	90 %	100 %	100 %	100 %
Joachim Kimmerle	Second author	10 %	0 %	0 %	0 %
Title of paper:		University's Self-Presentation and Situational Regulatory Focus Affected Emotional and Behavioral Student Engagement			
Status publication process:		Ready to submit			

6.1 Introduction

Universities are continuously adapting their websites to provide society and applicants online with diverse information. The proportion of school graduates who go on to study at university is rising steadily. Beyond that, digital opportunities and heterogeneity of a student population calls for flexibility and openness in higher education institutions. Potential students explore what study programs offer. They initially think about their educational goals and build their own vision of a future career. A self-presentation, therefore, should among other things, match the needs of a prospective student population. However, it is largely unclear what kind of university's self-presentation affects the subjective perception and the engagement of applicants. It is also unclear whether a presentation of flexible student pathways with multiple opportunities, as opposed to obligatory pathways with tight structures affects student engagement. A previous study resulted in interaction effects that indicated a regulatory fit between a university's self-presentation and participants' chronic regulatory focus, for the single subscales of emotion, behavior, and cognition. This follow-up study investigated the interplay of the participants' situational regulatory focus and the university's self-presentation.

6.1.1 University's Self-presentation

The independent variable university's self-presentation had two conditions (chances vs. obligations) that were validated in a pre-study. We used descriptions of student life at the university with reference to the goals, tasks, and professional fields of a fictitious master's degree program in Bioeconomy. We provided two different self-presentations of a university and that particular degree program to manipulate the university's self-presentation. One self-presentation emphasized independence and individual choices, whereas the other self-presentation described a rigid structure with predefined choices. Further details about the validation of the material have already been presented in Chapter 5.2.3. The stories of the manipulation of university's self-presentation can be found in Appendix A 4. Nevertheless, we will briefly introduce the operationalization of university's self-presentation for a better readability.

The text of the chances condition suggested a high level of freedom, allowing students to use their own learning styles and choose their preferred learning environments. This assumed that students wanted to decide on their own in a responsible manner and receive support or information in order to find their own way. For an ambitious student, such a presentation would establish a regulatory fit with promotion focus by pointing out potential gains and opportunities for a student's future career.

The university's self-presentation in the obligations condition emphasized a rigid structure for students, with clear norms, demands, and predefined courses and learning groups. Participants in this condition read about a clearly defined and structured way of studying with a lot of supervision. A regulatory fit with prevention focus would occur for vigilant students with the self-presentation that emphasized security and non-loss.

6.1.2 Regulatory Focus

A person with a promotion focus is open to new challenges and behaves more eagerly which should result in high level of student engagement. That should differ from the behavior of a person with prevention focus who is more cautious and shows more due diligence. The manipulation of a student's self-regulation mechanism aimed to shift attention to the different strategies of the two regulatory foci (promotion vs. prevention), either go goal-pursuit for the promotion focus or to a special situational context for the prevention focus. Situational promotion or prevention focus was induced by requesting participants to write about strategies they had already used in their past, depending on the conditions promotion vs. prevention (Table 14). We used the procedure described by Hamstra et al. (2014).

Table 14

Manipulation of Regulatory Focus

	Please write about a situation in which…
Promotion Focus	
Success	…you felt you made progress toward being successful in your life.
No Success	… compared to others, you felt like you were unable to get what you wanted out of life.
Success	… a situation in which you wanted to attain something that was very important to you personally, and in which you were able to do as well as you ideally would like.
Prevention Focus	
Non-loss	… being careful enough avoided you getting into trouble.
Loss	… when growing up, you did not restrain from doing something that your parent's thought was objectionable.
Non-loss	… you were careful not to get on your parent's nerves.

Note. The implementation to induce a participant's situational regulatory focus was specified by Hamstra et al. (2014).

6.1.3 Research Question and Hypotheses

The research question here was whether there is an effect on student engagement in the interplay between a university's self-presentation and a participant's regulatory focus. This experiment was pre-registered on the pre-registration platform *aspredicted.org* (pre-registration number #29085). We hypothesized that there would be an interaction effect between a university's self-presentation (chances vs. obligations) and the regulatory focus (promotion vs. prevention) on student engagement. We hypothesized that this interaction effect would occur on (a) emotional, (b) behavioral, and (c) cognitive levels as well as on every subscale. In particular, we hypothesized that there would be higher student engagement scores for participants under promotion focus induction in the chances condition and higher engagement scores for participants under prevention focus induction in the obligations condition. Based on the previous study, we hypothesized that emotional, behavioral, and cognitive student engagement are different levels of student engagement.

Furthermore, and to underpin results of the previous study, participants overall should show lower student engagement scores in the obligations condition.

6.2 Method

To test the interaction hypothesis, we used a 2 x 2 design with the independent variables university's self-presentation and situational regulatory focus. We examined the impact of (a) the university's self-presentation (emphasizing chances for students vs. emphasizing obligations), and (b) regulatory focus (situational promotion focus vs. situational prevention focus) on student engagement. We manipulated the university's self-presentation by presenting two different descriptions of its programs and character in the same way as in the previous study. Compared to the previous study where we measured regulatory focus, we manipulated situational promotion and prevention focus. The dependent variable was student engagement, which we measured on three levels: (a) emotion, (b) behavior, and (c) cognition.

6.2.1 Procedure

We recruited participants by using a local participant pool ORSEE to take part in a laboratory experiment lasting approximately 30 min. Participants who had participated in the previous study weren't recruited. The survey ran on the XM Platform™ Version October 2019 of Qualtrics (Copyright © 2020 Qualtrics, Provo, UT, USA. https://www.qualtrics.com), and participants received a compensation of four Euros.

Participants put themselves in the role of an applicant for a university place. They were welcomed, and after they had signed the declaration of consent, they started the study on a laptop. Participants were randomly assigned to one of four experimental conditions: University's self-presentation of a study-program emphasizing chances with induction of a situational promotion focus; University's self-presentation of a study-program emphasizing chances with induction of a situational prevention focus; University's self-presentation of a study-program emphasizing obligations with induction of a situational promotion focus; University's self-presentation of a study-program emphasizing obligations with induction of a situational prevention focus.

First, we induced promotion focus or prevention focus. For this, participants were asked to write about three situations in their life depending on the condition of situational regulatory focus (promotion vs. prevention), with a subsequent manipulation check. After this, participants were instructed to imagine that they were applicants for a fictitious master's program. We presented a university's alignment in which they read one of the university's self-presentations of a study-program (chances vs. obligations). After reading the text, we presented the manipulation check. Then, participants filled in the emotional and behavioral student engagement questionnaires and wrote an essay. They were asked to write about the university that had been presented to them with reference to their future professional life, social aspects, learning support and collaboration and learning platforms. The survey ended with overall questions, demographic questions about their age and gender, and whether they were university students.

6.2.2 Measures

We measured emotional and behavioral student engagement on a 7-point Likert scale from 1 = *does not apply at all* to 7 = *applies completely* with higher values representing higher student engagement as already described in Study 2.

Emotions. To determine emotional student engagement, we used 24 items with the eight subscales positive promotion, negative promotion, positive prevention, negative prevention, hope, threat, fear, and anxiety (see Appendix A 2, $\alpha = 0.83$).

Behavior. We used 31 items with the three subscales personal initiative, goal-oriented learning activities, and digital networking to measure behavioral student engagement (see Appendix A 3, $\alpha = 0.83$).

Cognition. Participants wrote an essay that we analyzed according to the length of the essay and with the German Version DE-LIWC2015 (Pennebaker et al., 2015). Based on the data of the first study, we measured cognitive student engagement with the output variables of the category drives (power and reward) from the software's dictionary (Meier et al., 2019; Pennebaker et al., 2015). We also included items to measure participant's evaluation of the university's self-presentation overall (how they rated the university

described from 1 = *negative* to 7 = *positive*), and to measure whether they could imagine putting themselves into the situation of a universities' applicant (from 1 = *does not apply at all* to 7 = *applies very much*).

6.2.3 Statistical analysis

We conducted a power analysis for significance level α = .05 and power of .80. I determined the hypothesized interaction of university's self-presentation and situational regulatory focus with a medium effect size of f = .25 which resulted in a sample size of *N* = 128 participants (Faul et al., 2007).

Our objective was to examine the impact of the university's self-presentation and situationally induced regulatory focus on student engagement. To accomplish this, we designed a two-factor analysis for each level and each subscale of student engagement for regulatory focus measurements dependent variable ~ regulatory focus * university's self-presentation, α = 0.05. We conducted an ANOVA that was supposed to result in an interaction effect of a university's self-presentation in the chances vs. obligations conditions and regulatory focus in the promotion vs. prevention conditions. For the manipulation checks, participants rated statements on a 7-point Likert scale (1 = *does not apply at all* to 7 = *applies completely*), with a statement that checked current focus on obligations (Fay et al., 2019), and with two statements each representing either an emphasis on chances or an emphasis on obligations.

6.3 Participants and Results

We obtained 128 datasets. Seven participants were excluded, because they stated that their mother language wasn't German. Two participants were excluded due to incomplete data sets so that our final sample resulted in *N* = 119 participants (82 female, 35 male, 2 third gender) with ages from 18 to 67 years old (*M* = 24.71, *SD* = 5.51). 112 participants specified that they were students (number of semesters *M* = 7.71, *SD* = 4.24).

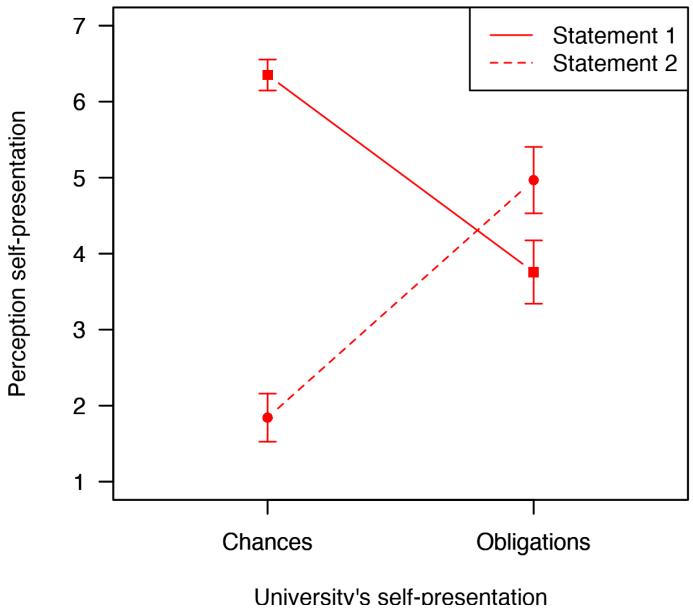
The manipulation of regulatory focus and university's self-presentation for our sample was successful. The ANOVA for regulatory focus induction (promotion vs. prevention) resulted in F (1, 115) = 6.69, $p < .0109$ in a momentary effect of externally set

goals with an attempt to meet obligations (Fay et al., 2019). Ratings of participants with the promotion focus (M = 5.48, SD = 1.21) were significantly higher compared to the ratings of participants with the prevention focus (M = 4.81, SD = 1.58). Participants' statements on the question whether their actions were influenced by the expectations of others depended on the induction condition.

The ANOVA of the manipulation check for university's self-presentation (chances vs. obligations) showed an effect F (1, 115) = 143.70, p < .001. Participants' answers were significantly different for the question whether the university described leaves students a lot of freedom for learning experiences (statement emphasizing chances) and the question whether the university described a rigid structure for how students should learn (statement emphasizing obligations). From this we concluded that our manipulation of the self-presentation of a study-program was successful (Figure 16).

Figure 16

Manipulation Check of a University's Self-Presentation (Chances vs. Obligations)



Note. Participants' ratings of the statement 1 emphasizing chances, (*M* = 6.35, *SD* = .77; *M* = 1.84, *SD* = 1.19), and of the statement 2 emphasizing obligations (*M* = 3.76, *SD* = 1.64; *M* = 4.97, *SD* = 1.72) were significantly different and indicated a successful manipulation. Error bars indicate standard errors.

6.3.1 Emotions

We conducted an ANOVA for each subscale with the model emotions ~ regulatory focus * self-presentation that resulted in a main effect for university's self-presentation on seven subscales. The subscales positive promotion emotion, F (1, 115) = 12.22, p = .0006, $\eta 2$ = .10; negative promotion emotion, F (1,115) = 11.40, p = .001, $\eta 2$ = .09; negative prevention emotion, F (1,115) = 4.75, p = .031, $\eta 2$ = .04); hope ,F (1,115)= 11.30, p = .001, $\eta 2$ = .09; threat, F (1,115) =11.89, p = .0007, $\eta 2$ = .09; fear, F (1,115)=6.08, p = .015, $\eta 2$ = .05; and anxiety, F (1,115) =11.77, p = .0008, $\eta 2$ = .09 showed a significant effect of university's self-presentation on emotional student engagement (Table 15, see Appendix

A5 Figure 17). Unexpectedly, promotion and prevention focus did not influence emotional student engagement on any subscale.

Table 15

Mean Table for Emotional Student Engagement Depending on University's Self-Presentation (Chances vs. Obligations)

Emotional Student Engagement	University's Self-Presentation	
	Chances *M (SD)*	Obligations *M (SD)*
Positive promotion emotion	5.38 (.97)	4.54 (1.46)
Negative promotion emotion	1.36 (.74)	2.11 (1.54)
Positive prevention emotion	4.85 (1.40)	4.41 (.1.57)
Negative prevention emotion	2.54 (1.28)	3.11 (1.64)
Hope	5.63 (.83)	4.87 (1.42)
Threat	1.67 (.95)	2.33 (1.16)
Fear	1.89 (1.19)	2.46 (1.48)
Anxiety	1.42 (.78)	2.13 (1.43)

The university's self-presentation had an impact on participants' positive promotion emotion: participants rated their positive promotion emotions higher in the condition changes compared to the condition obligations. The same applied to hope and participants showed higher hope in the chances condition. The impact of a university's self-presentation on negative promotion emotion was the other way around: participants rated their negative promotion emotions lower in the changes condition than in the obligations condition. This applies equally to the negative emotion subscales. Participants rated the negative prevention emotion, threat, fear, and anxiety lower in the condition changes than in the condition obligations. The subscale positive prevention emotion did not show any effect.

6.3.2 Behavior

The ANOVA with the model behavior ~ regulatory focus * self-presentation did not show the hypothesized interaction effect of situational regulatory focus with university's self-presentation on behavioral student engagement. In contrast to the previous study,

results revealed a main effect for regulatory focus on the subscale personal initiative F (1,115) = 8.88, p = .004, $\eta 2$ = .07 (Figure 18), and for university's self-presentation on the two subscales digital networking F (1, 115) = 6.83, p = .01, $\eta 2$ = .06, and goal-oriented learning activities F (1,115) = 4.83, p = .03, $\eta 2$ = .04 (Table 16, Figure 19).

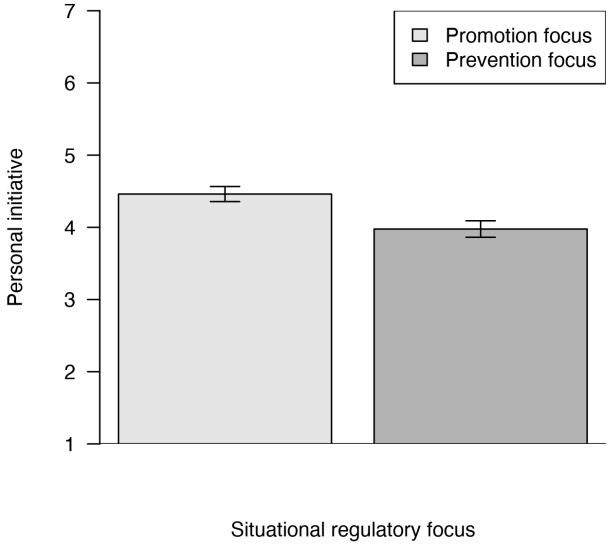
Table 16

Mean Table Behavioral Student Engagement Depending on the Condition of the Influencing Factor

Behavioral Student Engagement	Universities' Self-Presentation	
	Chances *M (SD)*	Obligations *M (SD)*
Digital networking	4.67 (.84)	4.21 (.93)
Goal-oriented learning activities	4.71 (.54)	4.44 (.68)
	Regulatory focus	
	Promotion *M (SD)*	Prevention *M (SD)*
Personal initiative	4.46 (.82)	3.98(.87)

Figure 18

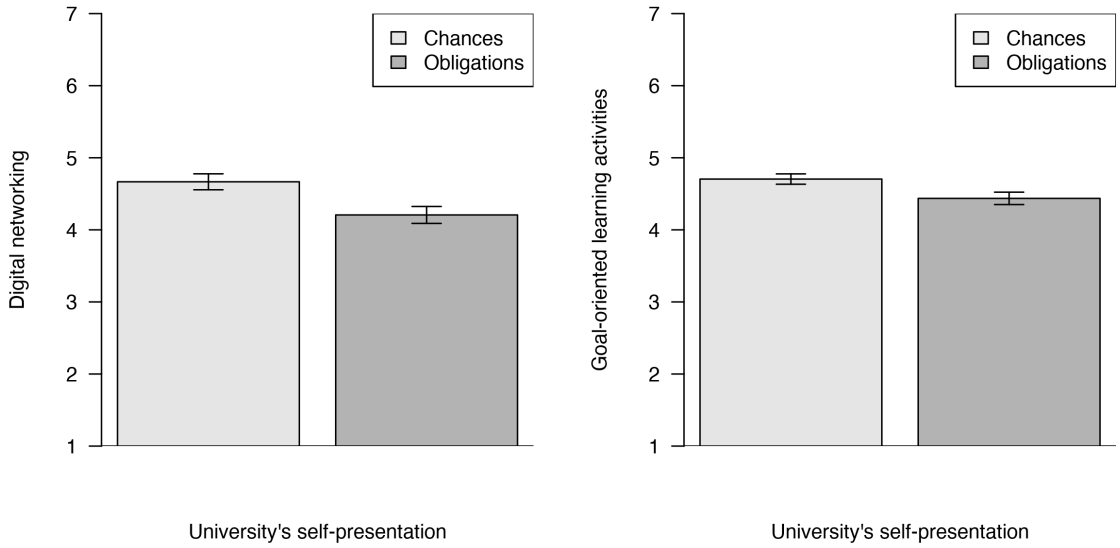
Personal Initiative was Significantly Higher for Applicants With a Promotion Focus Compared to Applicants With a Prevention Focus



Note. Error bars indicate standard errors.

Figure 19

Digital Networking and Goal-Oriented Learning Activities of University Applicants were Significantly Higher for Applicants who Read the Self-Presentation That Emphasized Chances



Note. Error bars indicate standard errors.

Regulatory focus had an impact on participants' personal initiative in the same way that participants with a promotion focus showed significantly higher ratings than participants under prevention focus. Digital networking depended on university's self-presentation. Participants in the condition chances stated a significantly higher amount of digital networking than in the condition obligations. The same applied to goal-oriented learning activities, with higher ratings for participants in the condition chances.

6.3.3 Cognition

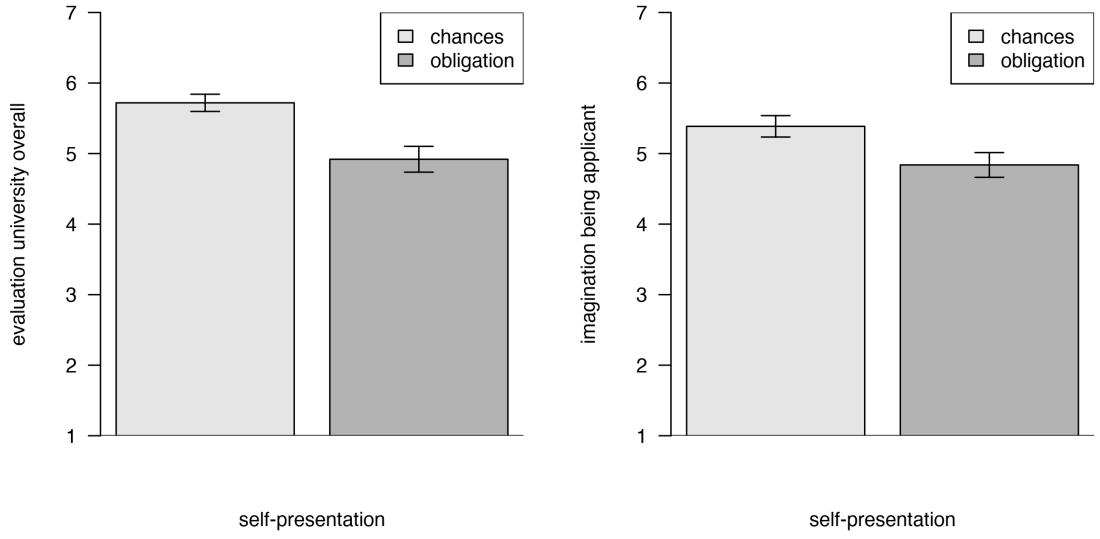
Participants' statements resulted in M = 123.18 words (SD = 71.95) per essay. The ANOVA model cognition ~ regulatory focus * self-presentation did not reveal the expected interaction effect for length of essays (i.e., word count), F (1, 115) =1.10, p = .30. The same applied to the LIWC dimension drives: power, F (1, 115) = .006, p = .94, and reward, F (1,

115) = 3.50, p = .06. While we found an interaction effect in the category power in the previous study, neither regulatory focus nor university's self-presentation had an impact on cognitive student engagement in this study.

The evaluation of universities self-presentations was overall positive with significantly higher values in the condition chances than in the condition obligations, F (1,115) =13.54, p = .0004, $\eta 2$ = .11, M = 5.72, SD = .92, M = 4.92, SD = 1.44. Participants stated that they were able to imagine being an applicant with significantly higher values in the condition chances than in the condition obligations F (1, 115) = 4.59, p = .03, $\eta 2$ = .04, M = 5.39, SD = 1.15, M = 4.84, SD = 1.38 (Figure 19).

Figure 20

Participants Evaluated University's Self-Presentation Significantly Different



Note. Error bars indicate standard errors.

6.4 Discussion

The aim of the research in this paper was to identify effects which influenced student engagement in the interplay between regulatory focus and university's self-presentation.

We hypothesized that there would be an interaction effect between a university's self-presentation (chances vs. obligations) and its regulatory focus (promotion vs. prevention) on student engagement. Compared to the Study 2 where we measured participant's chronic regulatory focus, in this third study we used a manipulation of situational promotion and prevention focus. It was expected that this would result in stronger interaction effects compared to the previous study. Contrary to expectation, the results didn't reveal any interaction effect. Results of the Study 3 suggest that the influence of the university's self-presentation is dominant compared to the motivational tendency of regulatory focus. Another explanation may be that the situational context of a university's self-presentation overwhelmed the manipulation of situational promotion and prevention focus. A future design with a reversed order or with a varying manipulation (for example mouse labyrinth) could clarify the interaction effect.

Applicants' emotion depended on a university's self-presentation. This applied to seven out of eight subscales for emotional student engagement. To be precise, we found that a university's self-presentation influenced emotional student engagement on the subscales positive promotion emotion, negative promotion emotion, negative prevention emotion, hope, threat, fear, and anxiety. On the one hand, and this result underpinned the results of the Study 2, the self-presentation of university that emphasized chances resulted in significantly higher positive promotion emotions and hope than the self-presentation of university that emphasized obligations. On the other hand, the university's self-presentation that focused on obligations generated significantly higher negative promotion emotion, negative prevention emotion, threat, fear, and anxiety compared to the university's self-presentation that focused on chances. This main effect was new, and we conclude that a self-presentation of a university that emphasized obligations evoked higher negative emotions than a self-presentation of a university that emphasized chances which evoked higher positive emotions.

For emotional student engagement we used well-founded subscales. The strength of this approach was to be able to assess positive and negative emotions, as well as

regulatory focus specific emotions. Results revealed that beginning a new course study had a positive connotation overall, while negative emotions showed low values overall. In both our studies we found that hope and positive promotion emotion were sensitive. As hypothesized, the self-presentation that proposes a high level of freedom, allowing students to use their own learning styles and choose their preferred learning environments, elicited significantly higher values for positive promotion emotion and hope. Compared to the previous study which implied an interplay between a university's self-presentation and regulatory focus for emotional student engagement, we found a main effect for university's self-presentation. Results of this study lead to the assumption that the description emphasizing a rigid structure for students, with clear norms, demands, and predefined courses and learning groups generated significantly higher negative emotions in applicants. This comprised negative promotion emotion and negative prevention emotion. The effect on emotional student engagement was independent of regulatory focus.

Accordingly, we conclude that using the presented method of measuring student engagement on the emotional level is useful, and it varied depending on a university's self-presentation. In consequence, we assume that emotional student engagement influenced learning and achievement as described in the framework student engagement of (Kahu, 2013). Examination of this influence should be deepened in future research.

The self-presentation that focused on chances resulted in higher digital networking and in higher goal-oriented learning activities than the self-presentation that focused on obligations. Whereas in the Study 2 we couldn't prove an any effect on digital networking and higher goal-oriented learning activities, a university's self-presentation influenced the two subscales of behavioral student engagement in this follow-up study. The regulatory focus induction revealed a main effect on behavioral student engagement and resulted in higher personal initiative for participants with a promotion focus compared to participants with a prevention focus. Interestingly in the previous study, personal initiative was the only subscale of behavioral student engagement that depended on chronic regulatory focus and university's self-presentation. This Study 3 provided evidence that digital networking and

goal-oriented learning activities significantly influenced behavioral student engagement even in a rather artificial scenario. These two subscales refer to an interactive and social aspect of behavioral student engagement compared to personal initiative. In this case, we recommend studies with, for example, social network analyses or learning analytics to provide further objective data on behavioral student engagement. Future research is necessary to refine assumptions about behavioral student engagement.

The strength of this approach of measuring behavioral student engagement lies in the connection to a situational context, which is especially relevant in the situation of being an applicant. We used three subscales that picked up relevant activities in a digital learning environment that we had taken over from our review. For personal initiative, a hypothesized interaction effect was found in the previous Study 2, where participants demonstrated the highest personal initiative in the chances condition with a high promotion focus and the lowest personal initiative in the obligations condition with a low promotion focus. In this Study 3, we found that only situational regulatory focus induction had a main effect on personal initiative. We assumed that personal initiative depended on regulatory focus. This is in line with regulatory focus theory which proposes that persons with a promotion focus demonstrated eager strategies which resulted in high scores for personal initiative. Interestingly, this was the only effect of regulatory focus on student engagement in the Study 3. Results suggest that the personal initiative seems to be more sensitive to regulatory focus compared to a university's self-presentation. And results also suggest that personal initiative is a more individual level of behavioral student engagement compared to digital networking and goal-oriented learning activities in digital learning environments.

We could not prove any interaction effect on cognitive student engagement, compared to the previous Study 2 which implied an interplay between university's self-presentation and regulatory focus for cognitive student engagement. As already discussed in the previous Study 2, results may vary in situations with more authentic tasks, and a cognitive level of student engagement should be more evident in more special settings. Cognitive student engagement may be relevant for most research on teaching and learning

with digital media in higher education with an emphasis on concrete courses or special settings in a microsystem of higher education, but would not be as relevant for application situations involving applicants. Therefore, we had added corresponding questions in Study 3. For application situations an overall evaluation may be more appropriate. To counteract this possibility, we integrated additional questions in this follow-up Study 3 (see Chapter 6.3.3). Participants in the condition with a self-presentation that emphasized chances gave a higher rating overall in their evaluations compared to participants in the condition with a self-presentation that emphasized obligations. Participants could significantly better imagine the cover story of being applicant after reading the self-presentation in the condition chances. Nevertheless, for cognitive student engagement we could not prove an effect of university's self-presentation or of regulatory focus on writing an essay. But our cover story came across and participants stated that they could put themselves into the situation of being an applicant. However, the evaluation and empathy for a university's self-presentation that emphasized chances was significantly higher than the evaluation and empathy of the university's self-presentation that emphasized obligations. We conclude from this that another approach to assess cognitive student engagement is needed. One possibility is to focus more on meta-cognitive aspects that are especially interesting in applicant situations. We recommend a promising approach that has come up in the meantime, and that is to measure perseverance and grit as critical for learning success (Duckworth, 2016; Roberson, 2020).

Based on the Study 2, we sought to find an interaction between a university's self-presentation and situational regulatory focus for emotion, behavior, and cognition, but we found no ground for confirming this. Nevertheless, as hypothesized, this Study 3 contributes to the understanding of three different levels, emotion, behavior and cognition of student engagement, to underpin the framework of student engagement.

In any case, both studies showed supportive evidence that a university's self-presentation impacts university applicants and led to significantly different outcomes for student engagement. Results revealed main effects of a university's self-presentation on

emotion and behavior. We implemented different goals, tasks and visions of a professional future in the self-presentation of a university's study-program that affected student engagement The results lead me to assume that a university's meaning in their value guidance and student incentives influenced students' performance.

6.4.1 Limitations

We note that the induction of a promotion or prevention focus was strong but possibly did not outlast the reading of the university's self-presentation. Furthermore, we are aware that the procedure of the study where we asked participants to write about life situations at the beginning and to write an essay at the end may have been boring. It may be more appealing and more fun for participants to go through a manipulation of situational promotion and prevention focus with a short game of a mouse that navigates through a labyrinth in further studies.

It may be problematic that we decided to implement the same measurement of cognition as in the previous Study 2. In Study 2, we already concluded that the measurement of cognition for student engagement was not optimal. But for reasons of theory testing, we provided a similar procedure so that we could compare results of student engagement on the three levels over both studies. Accordingly, our results provide support for student engagement as a multidimensional construct that addresses affect, behavior and cognition.

Another limitation is the lack of authenticity and of representativeness of the sample. We conducted a laboratory study with a fictious cover story of being a university applicant to explore empirical evidence for the framework student engagement and for influence of a university's alignment in a higher education institution. Nevertheless, we have been able to present first insights. Results showed that it is worthwhile to investigate more deeply the structural influence of higher education with digital learning environments. Future research should focus more on existing situations involving university applicants and enlarge on real application scenarios or monitor prospective and enrolled students.

6.5 Conclusion

This Study 3 on student engagement contributes to the understanding of the framework student engagement proposed by Kahu (2013). We measured student engagement on the three levels emotion, behavior and cognition, and the results suggest a conceptualization as meta construct that underpins to encompass three distinctive levels of student engagement.

Our studies provided empirical evidence that student engagement is highly influenced by the situational context of a university's self-presentation. We especially found effects of positive *and* negative emotions even for this overall positively connotated topic of my cover story. Furthermore, differences in digital networking and goal-oriented learning activities contrasted with the Study 2.

We investigated the role of situational regulatory focus in the context of student engagement in higher education. Study 2 showed that the chronic regulatory focus interacted with the situational context of a university's self-presentation. We couldn't prove the hypothesized interaction effect again, but we found an impact of situational regulatory focus on behavioral student engagement on the subscale personal initiative. However, effects of the motivational boost of a regulatory promotion focus from the first study weren't replicated for emotional and cognitive student engagement. This may be due to the lack of participants' situational interest or the lack of authenticity in the cover story. Nevertheless, and as in Study 2, personal initiative depended on person's regulatory focus.

We conclude that the results of these studies provide evidence for my assertation that a university's alignment in a higher education institution (university's self-presentation of a study-program with the condition chances vs. obligations) may be critical for an applicant's choice of profession. The structural influence of a university's self-presentation should not be underestimated. Higher education institutions should carefully think about their university's self-presentation because they can initiate student engagement just through a written description. Moreover, further research is needed because this influence

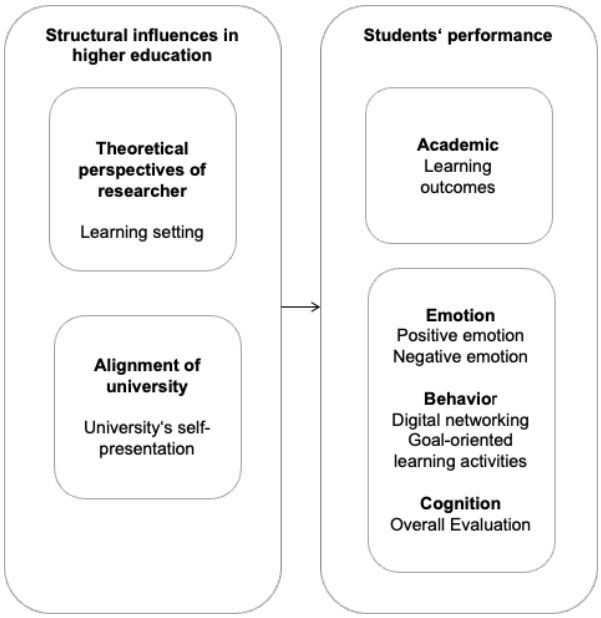
may also be critical for aspects of information processing, satisfaction or well-being in real web application.

7 General Discussion

My dissertation project explored different facets of structural influence to answer the research question (“Is there a structural influence of higher education on student’s performance?”). My working definition of structural influence in higher education institutions in digital learning environments comprises evaluation of learning outcomes, alignment of value and incentives of a university in study programs, characteristics and design of digital learning environments, perspectives on learning, and teaching and learning processes in the situational context of a university. However, the studies of the project are limited to structural influence of researchers’ theoretical perspectives on learning and university’s alignment (Figure 20). I found evidence for this influence across all of my studies. I discuss the results in detail in the following chapters.

Figure 21

Facets of Structural Influences in Higher Education



Note. Main results of the three studies indicate a structural influence of higher education institutions on students’ performance.

7.1 Impact of Researchers' Perspective on Learning Outcomes

An evaluation of learning outcomes serves as a basis for describing students' performance. My findings provide evidence that the evaluation of learning outcomes correlated with learning settings in the structural context of the university. Furthermore, this work add the observation, that researchers use creative designs in innovative learning scenarios but have obviously failed to rethink their evaluation of learning outcomes. Study 1 showed that there is a relationship between the general perspective of researchers (individual vs. social) and the learning outcomes they chose. I found support for this assumption in the way that a researcher used different dependent variables in their learning settings due to their particular perspectives. In individual learning settings, researchers preferred learning outcomes that measured elaboration compared to social learning settings in which self-report to evaluate learning outcomes was preferred. Study 1 focused on the sub question of how learning outcomes have been measured in empirical studies on learning with digital media in higher education. I answered this question by showing the variety of heterogeneous measurements of learning outcomes (see Table 4). I suggested the three categories of method, cognition, and activities to distinguish measurements, with seven selective subscales self-report, observable behavior, learning skills, elaboration, personal initiative, digital activity, and social interaction. Additionally, results revealed that measurements like self-report and elaboration were preferred measurements, compared to personal initiative, digital activity, or observable behavior. I conclude that an evaluation of learning outcomes is a powerful instrument for describing students' performance and that researchers should not only digitalize learning settings but also rethink their approach to measure learning outcomes from a student-centered point of view. Recent studies have already taken up this idea of redesigning the assessment of students' performance. They focus, for example, on learning from mistakes (Rico Lugo et al., 2018), creating and assessing learning outcomes in relation to librarians' activities (Blummer & Kenton, 2018), or on information management, communication management, wearable technology management and organizational aspects in relation to complex thinking (Valenzuela

Fernández et al., 2021). My results may encourage scientists and practitioners to orchestrate the assessment of learning outcomes creatively.

7.2 Effects of Alignment in a University's Self-Presentation on Student Engagement

In Study 2, I showed that the self-presentation of a university's master program that was associated with independence and individual choices (e.g., emphasizing chances) enhanced student engagement (e.g., on the three levels emotion, behavior, and cognition), with a regulatory fit for a participant's promotion focus. This was in comparison with the self-presentation of a university's master program that was associated with rigid structures and predefined choices (e.g., emphasizing obligations). Participants' chronic regulatory focus (e.g., promotion or prevention) interacted with the manner of goal-pursuit described in a university's self-presentation (e.g., emphasizing chances versus obligations) and affected student engagement. This interaction occurred on the subscales positive promotion emotion (emotional student engagement), personal initiative (behavioral student engagement), and power words (cognitive student engagement). Results revealed regulatory fit for promotion focus, but only partial support for prevention fit. Participants with a high promotion focus showed significantly higher student engagement after reading the self-presentation that emphasized chances, compared to the self-presentation that emphasized obligations. The results that participants with a high prevention focus did not show any significantly higher student engagement after reading the self-presentation that emphasized obligations, compared to the self-presentation that emphasized chances, went against the hypothesis.

In Study 3, a participant's situational regulatory focus (e.g., promotion or prevention) did not interact with a university's self-presentation (e.g., emphasizing chances and emphasizing obligations). Against the hypothesis, results could not provide any regulatory fit effect. Instead, I found main effects of a university's self-presentation and of situational regulatory focus. Participants showed significantly higher positive promotion emotion, positive prevention emotion, and hope (emotional student engagement) after reading a

self-presentation that emphasized chances than when they read a self-presentation that emphasized obligations. Additionally, participants showed significantly higher negative promotion emotion, negative prevention emotion, threat, fear, and anger (emotional student engagement) after reading the self-presentation that emphasizes obligations than when they read the self-presentation that emphasized chances. Participants who read the self-presentation that emphasized chances stated significantly higher digital networking and goal-oriented learning behavior (behavioral student engagement) compared to those who read the self-presentation that emphasized obligations. Interestingly, participants with a promotion focus showed significantly higher personal initiative than participants with a prevention focus. Therefore, personal initiative seems to be more sensitive to regulatory focus than digital networking and goal-oriented learning behavior. For example, Frese and Fay (2001) assumed that “personal initiative is a work behavior defined as self-starting and proactive that overcomes barriers to achieve a goal” (p. 133). And Fay and Frese (2001) presented environmental support as helpful for personal initiative. This underpins the assumption about digital activity that we had elaborated in the review. Furthermore, the authors implicitly suggest a relation to goal-pursuit manner and motivational parameter (Fay & Frese, 2001), which is in line with regulatory focus theory and the presented results. Results revealed an effect of situational regulatory focus on behavioral student engagement. Participants’ cognitive student engagement was independent of university’s self-presentation or situational regulatory focus. The findings suggest that the alignment of university that is implemented in a study-program influences the performance and commitment of future students in an overall positive connotated application situation. Liberman et al. (1999) for example suggested that a person with a promotion focus prefers to start new tasks and show greater openness for new challenges than with a prevention focus. According to regulatory focus theory, this is overall a positive connotation the favorable evaluation for promotion focused participants (Lee & Aaker, 2004). This is an explanation for the results of Study 1 that mainly revealed a regulatory fit for promotion focus, but not for prevention focus.

Study 2 and Study 3 confirm an effect of a situational context on student engagement. Based on the data, both studies suggest that the situational context in the self-presentation takes the lead compared to the motivational tendency of regulatory focus. As discussed in the studies above this may be due to a fading manipulation of situational regulatory focus or due to a dominant role of the situational context of university alignment in the self-presentation. The two studies demonstrate that a self-presentation of a study-program affects applicants' positive and negative emotions, and situational relevant behavior. It would be interesting to examine how students' incentives and the value guidance of a university's alignment affect students' performance during a student's course of study. For example, Rees (2021) already found that an entrepreneurial approach in higher education supports critical academic inquiry. I am aware that the variables of participants who were currently in a course of study were difficult to disentangle. Their current academic success, their satisfaction with the course of study and with the university, and their general mental well-being might have influenced measurement of their student engagement as well. This was the reason for my rather fictitious study setting of an application situation. Nevertheless, an investigation at the time of application in a real setting would be interesting, too. However, an investigation into a university's self-image and alignment also affects activity and emotion in the presented form, and I recommend that psychological research to go more deeply into this issue.

7.3 Describing Students' Performance: Learning Outcomes and Student Engagement

I included in my investigations student engagement and learning outcomes that are good indications of students' performance. These indicators contribute to the discussion of how to define learning outcomes, learning processes, or learning activity. Results of my studies on the structural influence in higher education suggest that this separation is relevant, but research has not yet yielded a selective definition of learning activity. Former research has shown that learning outcomes are learning statements that are pre-defined by teacher and researcher. My findings showed differences with respect to researchers'

perspectives on learning and measurements of learning outcomes. The increase in research on teaching and learning with digital media in higher education showed innovative learning settings (Figure 5) with constant measurements (e.g., elaboration and self-report). As discussed, the increase in research has not responded to the necessity of using the evaluation of specific activities more often in a digital learning environment (Ecclestone et al., 2010; Ecclestone & Pryor, 2003). It is already known that students demonstrate their knowledge in assignments or achievement of learning outcomes where they deliver the right knowledge at the right time. But less is known about the path and the relevant learning activities to reach this goal. Recent research already showed that learning behavior of students is important for success (Bosch et al., 2021). A higher education institution is a social system that is among others available via internet with websites or through (not only) a digital environment. And my results suggest that teachers, professors, staff, and researchers as well as students, applicants, or PhD students (i.e., learners) carry out the situational influence of a university's structure, affecting a learner. These actors provide value and guidance, feedback and institutional support (Menz et al., 2021) in a course of study that implicitly is in line with university's alignment. They also equip a university's learning environments, learning materials, and learning situations

- with worldwide data bases or literature accessibility
- with e-learning technology tools that may vary in interactivity, synchronicity, adaptivity or self-regulation
- with further enriching and integrating digital elements, like for example augmented reality, virtual reality, or artificial intelligence

Altogether, learning materials invite learners to participate, to interact and to engage in learning activities that lead to the desired learning outcomes. It is important to keep in mind that learning activities encompass a wide range of activities as "foundation of skills and dispositions people need to live a productive, satisfying life after college." (Kuh, 2009, p. 5). This project explored learning activities by means of student engagement. In my studies, behavior in digital learning environment was especially sensitive to structural

influences in higher education and will be discussed in Chapter 7.4. Educational research has already implemented ideas about learning goals and how to reach these goals from the learner-centered perspective. This is not surprising, because a student-centered approach is predominantly offered in subject areas that focus on best-practices and didactical education. The presented findings are in line with Bosch et al. (2021) and confirm that it is worthwhile to focus on learning activities as a prerequisite for successful learning outcomes in psychological research as well. The ICAP framework is an example where psychological research has already linked engagement and outcomes (Chi & Wylie, 2014). The authors use the term *learning activities* to describe how learners engage with their learning material from a student-centered perspective (Chi et al., 2018). Chi and Wylie (2014) explicitly focus on cognitive processes (see Table 3) and activity outcomes that manifest in four modes of engagement. With this framework, research has already found a promising connection between student engagement and learning outcomes that may distinguish deep processing and shallow processing (Chi et al., 2018). The authors showed that an investigation into the interplay of these variables helps to understand learning.

Refining the Framework for Student Engagement. In addition to the initial research question my work also contributed to refining the framework for student engagement. I introduced student engagement in higher education from a psychological perspective as an educationally productive activity with a high level of energy and strong identification with the task. My approach to framing student engagement with antecedents and consequences of a situational context was essential in the presented work and results support this assumption. The presented studies add insights for student engagement on an emotional, behavioral and cognitive level. My findings support measuring student engagement on three levels (emotion, cognition, behavior). I assumed that these levels were not additions to each but instead distinctive. I measured emotional student engagement with well-established measurements and could prove positive and negative emotions. Both studies showed that the structural influence of a university's self-presentation with chances led to higher positive emotions than a university's self-

presentation with obligations (also partially influenced by regulatory focus). Nevertheless, I am aware that I measured emotions as such, and the nature of emotional student engagement remains unclear. The same applied to the nature of cognitive student engagement. This may be due to the lack of a missing learning task and to the fact that the artificial scenario of an application situation doesn't correspond with a real learning situation. I suggest that the cognitive aspects of student engagement should focus more on meta-cognitive strategies, such as grit and determination(Duckworth, 2016), and on self-regulatory aspects (Tibken et al., 2021). I used a self-created questionnaire to measure behavioral student engagement and created items that were context specific. The items referred to the categories of learning outcomes that I found in Study 1. And as discussed, the categories represent relevant aspects of learning activities in digital environments. Based on the data, the mere behavioral intention and usage of digital networking (i.e., registering in existing social media groups in order to establish contact with other students at university, or to follow the latest public information of the university) represented higher student engagement depending on this situational context. This is interesting for further studies, because following the framework of student engagement (Figure 1), this should lead to higher learning outcomes, like a certain level of digital maturity or active usage of digital tools through sourcing and searching behavior. However, whether there is any selectivity of behavioral student engagement and learning outcomes remains unclear. Based on my findings, I assume that the framework of student engagement does not yet have the potential to be a well-founded psychological theory but may provide a concept for organizing research and development within the complex situational context of higher education.

7.4 Learning Behavior in Digital Learning Environments

Empirical research has evaluated learner's behavior through enrollment or final completion of lectures or seminars. The results of Study 1 revealed that researchers have neglected to measure digital activity. This was surprising because actual discourse on how to learn often relies on habits, profiles (Scherer et al., 2017) and behavior. Furthermore, a

design of a digital learning environment should match student's lived reality (Nguyen et al., 2014). This is in line with my discussion on digital networking and digital activity. Even more important, my study findings indicate that the personality trait of chronic regulatory focus influenced personal initiative. And situational regulatory focus affected personal initiative as a main effect. This is enough reason to take a closer look. In the systematic review of the literature, I defined personal initiative as the mere participation or pro-activeness of a learner, which could be measured, for example, by the number of contributions to discussions or frequency of use. Furthermore, the items of behavioral student engagement to measure personal initiative in the experimental studies testified to a profound and determined engagement with learning materials (e.g., to read the examination regulations of the course of study carefully, to start studies immediately). I conclude that these categories all include motivational and cognitive aspects that are difficult to disentangle but relevant nevertheless, and I found a promising explanation in Roberson (2020): "The link stretching across students' orientations to school[4], the meaningfulness of behaviors on display while engaging in the learning environment, and their overall success in earning acceptable grades or completing assignments is student *persistence*." (p. 86). The author proposes a new concept of persistence. He emphasized the importance of helping students to understand and monitor themselves based on motivational theories. Again, it is not the structure in a university per se which determines students' performance but rather the interrelation between the two actors in higher education institutions (for example teacher and student) that improves students' individual learning repertoire. Making actors in higher education aware of this interplay contributes to empowering students and their learning behavior in digital learning environments.

7.5 Transferability

I found evidence that the situational context of a higher education institution influenced student's performance on different levels. Although my studies were

[4] in this case higher education

exploratory, my results are interesting for two reasons. First, my theoretical approach to rate and categorize current evaluations of learning outcomes, based on a theoretical discourse about research in digital learning environments, and based on empirical results, starts the discourse about what constitutes a useful evaluation of learning outcomes. Although descriptive, my data indicate that any comparison of learning outcomes needs further investigation to compare students' equivalency, or to be clear about the quality of respective learning outcomes with or without digital media, or to be specific about the context (Pontefract & Wilson, 2019). As described in the introduction, existing learning theories may provide useful information. Expanded psychological research is required to test the transferability of the presented results in the context of teaching and learning from a subject-specific and interdisciplinary point of view. My results confirm approaches with student learning experiences (Awidi & Paynter, 2019), best-practice models (Power & Handley, 2019), and didactical research that should be expanded into the context of higher education (Moate & Cox, 2015). It would be wise to provide more studies on teachers' evaluation of learning outcomes that is the basis for grading as well. The situational context of a higher education institution influenced students' performance on different levels, and a student-centered approach may provide a powerful screw- especially if it is scientifically based (Kim et al., 2020). Together with the discussion about equal chances for every student and students' heterogeneity, research would raise the possibility that learning outcomes were not fixed but needed more variety and creative approaches. Single universities have already included aspects like inquiry-based teaching and learning, or heterogeneity in their mission statements. Therefore, I assume that the above presented results underpin this existing awareness with concrete data from a psychological point of view.

Second, for example, Gale and Parker (2014) call for structures and procedures in higher education that take account of the diversity of students' lives of those that enter university. But the vision of a pathway to objectives and career does not automatically take a student's experiences into account unless there are concrete empirical results. Now, my

studies have yielded such results from a psychological perspective. I found that the different alignments of universities (i.e., self-presentation that emphasized chances vs. that which emphasized obligations) influenced an applicant's engagement. The presented results were interesting, because especially in the Germane higher education system there are two main and competing pathways: state universities versus private institutions. Whereas universities focus more on free research and independence, private institutions are said to have rigid and predefined alignments (Iost & Iost, 2021; Philip, 2018). Despite these alignments, private institutions seem to be more attractive for applicants (Absolventa.de, 2019) depending on the discipline (Jacques & Langmann, 2016). Furthermore, applicants have difficulties in career orientation decisions (Ertl, 2020; Lebedowicz, 2019; Rosales, 2019). Therefore, the topic of my investigations raises a lot of questions (Müller & Schneider, 2013), and empirical studies that have investigated differences or difficulties are rare. This work contributes data that are in contrast with the presented consensus, and I confirm that further empirical research is needed. It would be interesting to investigate career orientation seriously. Higher education systems should be aware of their influential power and create structural change to guide both institutional and students' needs towards a sustainable capability to navigate change and professional career.

7.6 Methodological Implications and Future Research

The systematic review in this paper was limited to descriptive statistical analyses. Nevertheless, the undertaking provided a well-founded procedure with elaborated insights on categories to evaluate learning outcomes. It was one of the first reviews that showed quantitative data of the actual landscape of evaluating learning outcomes in higher education. Even more important, the project compares prevailing perspectives of research on learning settings, proves structural influences in higher education, and points to subsequent gaps in digital learning environments that should be addressed by future research. Therefore, future research can build on these results, and must analyze interrelationships in more detail. It might be wise for future research to keep an eye on the

evaluation of learning outcomes for two reasons: to counteract an evaluation of student's learning outcomes that is not comparable or equal, and to foster heterogeneous evaluation of learning outcomes that may orchestrate students' diversity.

The studies on student engagement lacked authenticity, and the artificial scenario of being an applicant does not necessarily imply personal relevance and cognitive engagement. However, I used LIWC for this exploratory investigation, and results already proved to be promising. There were structural influences in the self-presentation of a university on student engagement, which points out that it seems worthwhile to deepen the research. As outlined above, future research is required that will additionally investigate, for example, on metacognitive competencies of applicants, or real engagement scenarios.

7.7 Practical Implications and Conclusion

Results of Study 1 reveal that an evaluation of learning outcomes is a consequence of student's learning that not only depends on student's learning activities but rather seems to be determined by the situational context of the higher education institution (e. g., theoretical research perspectives). Studies 2 and 3 investigated potential effects of the situational context of a university's self-presentation (chances vs. obligations) as an initial condition for the learning activity of university's applicants. My findings suggest that the alignment of even a fictitious study program will influence student engagement already in the stage of being an applicant. Therefore, I answer the research question I posed at the beginning ("Is there a structural influence in higher education on students' performance?") with "yes". I found evidence that there is a structural influence of higher education institutions on students' performance.

I used a research approach with a systematic literature analysis and laboratory methods. This included an exploration of the situational context of a higher education institution (e.g., structural influence) from different perspectives. These were the antecedents and indirect consequences from a student-centered point of view (evaluation of learning outcomes and university's self-presentation); existing research perspectives on learning with digital media (individual and social perspective on learning) and teaching and

learning at universities in digital learning environments (characteristics and design). This project was a first step toward investigating the structural effects of higher education on a student-centered approach. The project gives insights into the interrelation of a university's self-presentation, researchers' perspectives, student engagement, and learning outcomes in digital learning environments. Results showed that researchers' theoretical perspectives and university's alignment determine learning outcomes and student engagement. Reflecting upon such knowledge basically prepares educators and researchers in higher education to provide a balance what students have learned, and what they should have learned in order to cope with challenges in a digital world or in future professions.

8 Summary

A digital learning community of a university has to offer their students high-quality teaching, independent research and efficiently usable results in an environment that is becoming more and more digital. However, it is largely unclear how universities assure continuity as well as creativity and change, and whether such structural influence in higher education empowers students in their performance. This dissertation project [5] examined the impact of researchers' theoretical perspectives in the learning settings and alignment of value and incentives of a university with students' personal objectives in a university's self-presentations on students' performance (learning outcomes and student engagement) with three studies.

Research on digital learning environments has traditionally applied either an individual perspective or a social perspective to learning. Based on a literature review, we examined to what extent individual or social perspectives determined the learning outcome variables that researchers have used as measurements in existing studies. We analyzed prototypical approaches to operationalizing learning settings (individual vs. social) published in peer-reviewed journals and identified their relation to several measures of learning outcomes. We rated n = 356 articles and included n = 246 articles in the final analysis. A total of 159 studies (64.6%) used an individual learning setting, while 87 studies (35.4%) used a social learning setting. As learning outcome measures, we observed self-reports, observable behavior, learning skills, elaboration, personal initiatives, digital activity, and social interactions. The two types of learning settings differed regarding the measurement of elaboration and social interactions. We discuss the implications of our findings for future research and conclude that researchers should investigate further measures of learning outcomes in digital learning settings.

A university's presentation of its programs to the public should provide potential students with information about what they can expect as students at that university. However,

[5] The summary has overlapping content with abstracts of the published manuscripts, and I used the term "we" in the whole summary for a better readability.

it is largely unclear what kind of self-presentation affects different applicants and their commitment. In a laboratory experiment with *N* = 116 participants, we examined the emotional, behavioral and cognitive impact of a university's self-presentation (either emphasizing chances for students or emphasizing their obligations) on student engagement. We also measured the participants' regulatory focus (promotion and prevention focus). We found interaction effects of the university's self-presentation and participants' promotion and prevention focus on student engagement. There was a regulatory fit for promotion focus with the chances condition for emotions and behavior. There was also a regulatory fit for prevention focus with the obligations condition for cognitive processes.

Universities' alignment with various student goals may be presented as value guidance and student incentives in a self-presentation of universities' study-programs. In a 2 x 2 design with *N* = 119 participants we manipulated university's self-presentation (either emphasizing chances for students or emphasizing their obligations) and regulatory focus (either inducing promotion focus or inducing prevention focus) in a laboratory experiment. Our intention war to replicate the interaction effects on emotional, behavioral and cognitive student engagement of a previous study. We found main effects of university self-presentation for emotion and behavior. We found overall higher student engagement scores in the chances condition on the sub scales of positive promotion emotion, negative promotion emotion, negative prevention emotion, hope, threat, fear, anxiety and for digital networking, goal-oriented learning activities. Additionally, there was a main effect of situational regulatory focus on personal initiative (behavioral student engagement).

The findings suggest that learning outcomes are determined by the structural context of the theoretical perspective that is held by researchers. Researchers' perspectives caused them to use different evaluations of learning outcomes. Furthermore, I submit that researchers have used creative designs in innovative learning scenarios but have obviously failed to rethink their evaluation of learning outcomes. Further research should keep an eye on the evaluation of learning outcomes for two reasons: to counteract

an evaluation of students' learning outcomes that is not comparable or unequal, and to foster heterogeneous evaluation of learning outcomes that may orchestrate students' diversity. The results also indicate that the alignment of a fictitious study program influenced student engagement already in the stage of being an applicant. I conclude that universities should dedicate time and effort to creating a clear presentation of their offerings in the implementation of digital learning environments. Therefore, I answer the research question of whether there is a structural influence of higher education on student's performance with yes. I found evidence that higher education institutions do have structural influence on a students' performance. However, it is not the structure of a university per se which determines students' performance but rather the interrelation between the two actors (higher education institutions and students) that improves students' learning repertoire. Making actors in higher education aware of this interplay contributes to empowering students and improving their learning behavior in digital learning environments.

9 Zusammenfassung

Das Dissertationsprojekt setzt sich mit Einflüssen im Kontext von Hochschulstrukturen auseinander und prüft Zusammenhänge von strukturellen Einflüssen in einer Hochschule mit Studierendenleistung. Hochschulen bieten verstärkt digitale Lehre an und haben sich zu hochwertiger Ausbildung und unabhängiger Forschung verpflichtet. Ein Großteil der bestehenden Forschung zu Lehren und Lernen mit digitalen Medien untersucht die Verwendung von einzelnen Technologien zur Unterstützung von Lernen aus Sicht der Lehrenden, oder prüft den Einfluss von Eingangsvoraussetzungen wie zum Beispiel sozioökonomischen Status der Eltern oder Einstellungen und Vorwissen von Studierenden. Neben den Herausforderungen, die eine Digitalisierung mit sich bringt, ist jedoch weitgehend unklar, wie Strukturen in einer Hochschule von Studierenden wahrgenommen werden oder vergleichbar gemacht werden können. Das Dissertationsprojekt untersucht Facetten von strukturellen Einflüssen in Hochschulen. Die vorliegende Arbeit verwendet und untersucht dabei theoretische Perspektiven von Forschenden auf Lernen sowie die Ausrichtung einer Hochschule genauer.

Die theoretischen Perspektiven von Forschenden wurden in der ersten Studie transparent gemacht. Forschende verwenden vorwiegend eine individuelle oder eine soziale Perspektive auf Lehren und Lernen mit digitalen Medien, die sich in Studiensettings zu Lehren und Lernen mit digitalen Medien widerspiegelt. In einer Literaturanalyse wurden solche Studiensettings analysiert (individuell vs. sozial), und ein Zusammenhang mit verwendeten Maßen für Lernergebnisse geprüft. Die Messungen, die den Bewertungen von Lernergebnissen zugrunde liegen, wurden strukturiert. Es wurden n = 356 Artikel bewertet, die in Fachzeitschriften mit Peer-Review veröffentlicht wurden. Es wurden n = 246 Artikel in der Abschlussanalyse eingeschlossen. Davon verwendeten insgesamt 159 Studien (64.6%) ein individuelles Setting und 87 Studien (35.4%) ein soziales Setting. Die Lernergebnisse wurden als Selbstbericht, beobachtbares Verhalten, Skills, Elaboration, persönliche Initiative, digitale Aktivität und soziale Interaktion gemessen. Zwischen den

beiden Settings ergaben sich signifikante Unterschiede bei der Messung von Elaboration und sozialer Interaktion.

Die Werte und Anreize, die der Ausrichtung einer Hochschule zugrunde liegen, wurden als Selbstpräsentation eines Studienprogrammes operationalisiert. Es wurde untersucht, ob die Selbstpräsentation einer Hochschule (Chancen vs. Verpflichtungen) einen Einfluss auf Studierendenengagement (Emotionen, Verhalten, und Kognition) hat, und welche Rolle der regulatorische Fokus (Promotion vs. Prävention) dabei spielt. In den Laborstudien versetzten sich die Teilnehmenden in die Rolle eines Studienbewerbenden und erhielten ein Studienprogramm, das entweder Freiheiten und vielfältige Möglichkeiten im Studium betonte (Chancen), oder eine starre Struktur mit vielen Vorgaben enthielt (Verpflichtungen). In Studie 2 mit N = 116 Teilnehmenden interagierte die Selbstpräsentation einer Hochschule mit dem chronischen regulatorischen Fokus der Teilnehmenden. Die Ergebnisse zeigten ansteigende Werte für Emotionen und Verhalten für Teilnehmende mit Promotionsfokus in der Bedingung Chancen. In der Bedingung Verpflichtungen ergab sich eine Interaktion mit Präventionsfokus. In Studie 3 mit N = 119 Teilnehmenden wurden die Selbstpräsentation einer Hochschule und der regulatorische Fokus manipuliert. Die Interaktionseffekte auf Studierendenengagement wurden nicht repliziert. In der Bedingung Chancen führte die Selbstdarstellung zu höheren Emotionen und engagierterem Verhalten, während der regulatorische Promotionsfokus die persönliche Initiative der Teilnehmenden verstärkte.

Das Dissertationsprojekt hat verschiedene Facetten zur Beschreibung von strukturellen Einflüssen in Hochschulen transparent gemacht, und die Bewertung von Lernergebnissen vor dem Hintergrund digitaler Lehre strukturiert. Die Ausrichtung einer Hochschule mit Werten und Anreizen, die sich implizit in der Selbstdarstellung einer widerspiegelt, kann Studienleistung nachhaltig fördern. Die Ergebnisse deuten insgesamt darauf hin, dass die Messungen von Lernergebnissen in empirischen Studien durch die Perspektive von Forschenden bestimmt werden. Übertragen auf die Hochschulpraxis sollen die vorliegenden Ergebnisse Forschende und Lehrende dazu anregen, auf

heterogene Maße für Lernergebnisse zurückzugreifen. Neben favorisierten Messungen sollen zukünftig auch innovative Maße eingebracht werden, die den Anforderungen einer digitalen Lernumgebung entsprechen. Die vorgestellten Ergebnisse belegen auch, dass an Hochschulen bereits im Stadium der Studienbewerbung über die Darstellung von spezifischen Werten und Anreizen Einfluss auf Studierendenengagement ausgeübt werden kann. Die gefundenen Ergebnisse liefern einen wichtigen Beitrag zur Erforschung von strukturellen Einflüssen in Hochschulen. Zum einen ist die Auswahl von Messverfahren ein mächtiges Instrument zur Bewertung der Leistung von Studierenden, und zum anderen beeinflusst die Ausrichtung einer Hochschule Leistungen ihrer Studierenden. Studierende sollten in ihrer Ausbildung gezielt geführt werden, um sicher in einer digitalen Lernumgebung zurecht zu kommen und für das spätere Berufsleben vorbereitet zu sein. Die Sensibilisierung der Akteure in der Hochschulbildung für die gefundenen Zusammenhängen trägt dazu bei, Studierende gezielt zu unterstützen und ihr Lernverhalten in einer digitalen Lernumgebung zu stärken.

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13 Appendix A

13.1 A1 Regulatory Focus Questionnaire

Items to measure participants' promotion and prevention focus

Promotion focus

My motto is "nothing ventured, nothing gained".

I want to achieve a great deal.

I am very productive.

If I really want to achieve a goal, I will find a way.

The big picture is more important to me than the details.

I am striving for success in live.

I am guided by my ideals.

At times I am fanatic about achieving my goals.

I like trying out new things.

I am ready to take risks.

I am striving for progress.

I wholeheartedly go for my goals.

Prevention focus

Success sets me at ease.

I am literally always following rules and regulations.

If I do not reach my goal, I am becoming nervous.

Every now and then I violate rules and regulations, to reach my goals. *

I am not a cautious person. *

In case of important decision security is a core criterion I care for.

In my studies, thoroughness is important to me.

I take care to carry out my duties.

My Motto is "slow and steady wins the race".

My Motto is "cobbler, stick to your last".

* inversed item

13.2 A2 Emotion Items

Items to measure student engagement on an emotional level

When I think about the degree program at the university…

Promotion positive

- I am excited.
- I am enthusiastic.
- I am optimistic.

promotion negative

- I am disappointed.
- I am sad.
- I am depressed.

prevention positive

- I am cool.
- I am calm.
- I am relaxed.

prevention negative

- I am nervous.
- I am worried.
- I am concerned.

hope

- I am hopeful.
- I am in good spirit.
- I am confident.

threat

- I am helpless.
- I feel I have no control.
- I feel threatened.

anxiety

- I am scared
- I am frightened
- I am afraid

anger

- I am hostile.
- I am annoyed.
- I am angry.

13.3 A3 Behavior Items

Items to measure student engagement on a behavioral level

Personal initiative

I would like to start my studies immediately.

I don't intend to waste time on things that are not relevant to my studies.

I am motivated to study in small groups.

I have decided to read the examination regulations for the course of study carefully.

I am motivated to read the module manual for the study program carefully.

I have the intention to take my time for my studies, as I do not need to reach the degree quickly. *

I get myself assigned to seminars when the time comes. *

I'm only interested in module contents in the semester in which a module takes place*.

Digital networking

I am motivated to look for new peers in my existing social networks.

I am motivated to register in existing social media groups in order to establish contact with other students at the university.

I am motivated to find fellow students from higher semesters.

I intend to subscribe to the newsletter of the university.

I follow latest public information of the university (for example on Twitter or Instagram).

I have the intention to inform myself on the university's website about their staff to become familiar with university's network.

I am motivated to find out the main research topic of my future professors and lecturers.

I have the intention to search for adequate job advertisements (for example Stepstone, Monster) that would fit to my degree.

I am motivated to search for websites and information about my future profession.

I do not yet need to know the research interests of lecturers and professors, because they are not yet relevant for me. *

I am not more engaged in my university network than necessary. *

Goal-orientated learning activities

I am highly motivated to differentiate between important and unimportant study sessions.

I intend not to take part on a discourse about tests and written exams that are too difficult but to focus on things relevant for my studies.

I am highly motivated to collect my learning material myself in the online area of the university.

I am motivated to ask lecturers questions via e-mail directly.

I am highly motivated to search for the right contact person in the university network in case of learning-related problems.

I intend to actively approach lecturers and tutors.

I am motivated to create my own learning scripts.

I have the intention to make my self-created learning materials available to other peers.

I am motivated to do project work together with other fellow students.

I have the intention not to question given software tools and learning materials. *

I intend to get learning materials from peers. *

I have the intention to ask for task solutions within social media groups. *

* inversed item

13.4 A4 A University's Self-Presentation

Manipulation of a University's self-presentation of a fictitious study-program Bio Economy Master (Condition chances vs. condition obligations)

Chances

Our students are given the opportunity to complete voluntary internships at one of the university's own experimental stations. They have, for example, via laboratory work and field trials to research fertilizers or in the cultivation of barley, a valuable additional gain in practical components to the rather theoretical university education.

[goals chances] Our students are partners in our learning community and select their own learning groups. This allows them to come into contact with many fellow students. In small groups, particularly innovative projects are developed and awarded prizes at the university. They often work in teams at different locations via the Internet, choose necessary links or programs themselves and thus have the opportunity to work particularly effectively. In addition, support is available from the IT office for individual solutions to software or computer problems.

The university focuses on independent knowledge transfer. Students' queries to tutors or professors are handled reliably and quickly. Our students receive adaptive feedback that is extremely beneficial to their further development. Students can determine their own learning progress. They are supported to process new content quickly, even beyond the examination requirements.

[task chances] Students can choose seminars in which they can realize themselves and which are interesting for them. Learning materials for exam preparation are flexible and quickly available, for example as e-books or links. Students can use these to achieve top grades in seminars and exams. The university offers numerous learning spaces so that students can flexibly adapt their learning times to their own schedules, needs and free time plans. Students can take courses at Studium Generale for credit as key qualifications after passing an examination at the end of the semester and receiving a certificate.

[professional future chances] As graduates of the university, students can realize their own personal ideas for the future. They can take advantage of up to three consultations at Career Service to gather creative ideas for their future career before deciding on a career option. Our graduates find employment within a short period of time after graduation and are recruited in the job market as tomorrow's leaders. The university cooperates, among others, with numerous national and international research institutions where interested students can pursue their own

academic careers. At the Institute of Apiculture, for example, there are opportunities to graduate a PhD program. There are numerous dissertation projects to choose from, dealing with impact assessment of mite infestations in bees and risk analyses in beekeeping.

Obligations

In addition to their studies, our students go through internships on laboratory work and field experiments to research fertilizers or the cultivation of barley in a university-owned experimental station. The practical parts offer a good deepening of the solid university education so as not to get stuck on the theoretical level.

[goals obligation] The university organizes learning groups that prevent our students from feeling left alone. In small groups, students can overcome learning difficulties and work to ensure that the quality standard of our university is not lost. They regularly work in teams at different locations via the Internet and are provided with links or programs by the university for this purpose. Providing these materials prevents them from getting lost in the information available online. In addition, an IT office provides safe guidance so that students do not fail with software or computer problems.

The university focuses on independent knowledge transfer. Student queries to tutors or professors are handled reliably and expeditiously. Our students receive adaptive feedback to improve mistakes. Their learning progress is monitored, and they are supported. Students can engage with learning content repeatedly and in greater depth, minimizing the risk of not meeting exam requirements.

[tasks obligation] Students are assigned to seminars that are adapted to their study content. Learning materials for exam preparation are flexible and quickly available, for example as e-books or links. Students can use these to avoid failing seminars and exams. The university requires regulated learning times. Students should sign up for course schedules on time and ensure that private appointments do not clash with their learning times. Students have the obligation to acquire key qualifications through courses at Studium Generale, in addition to the content of their studies. The study effort is not really higher, associated examinations do not have to be taken.

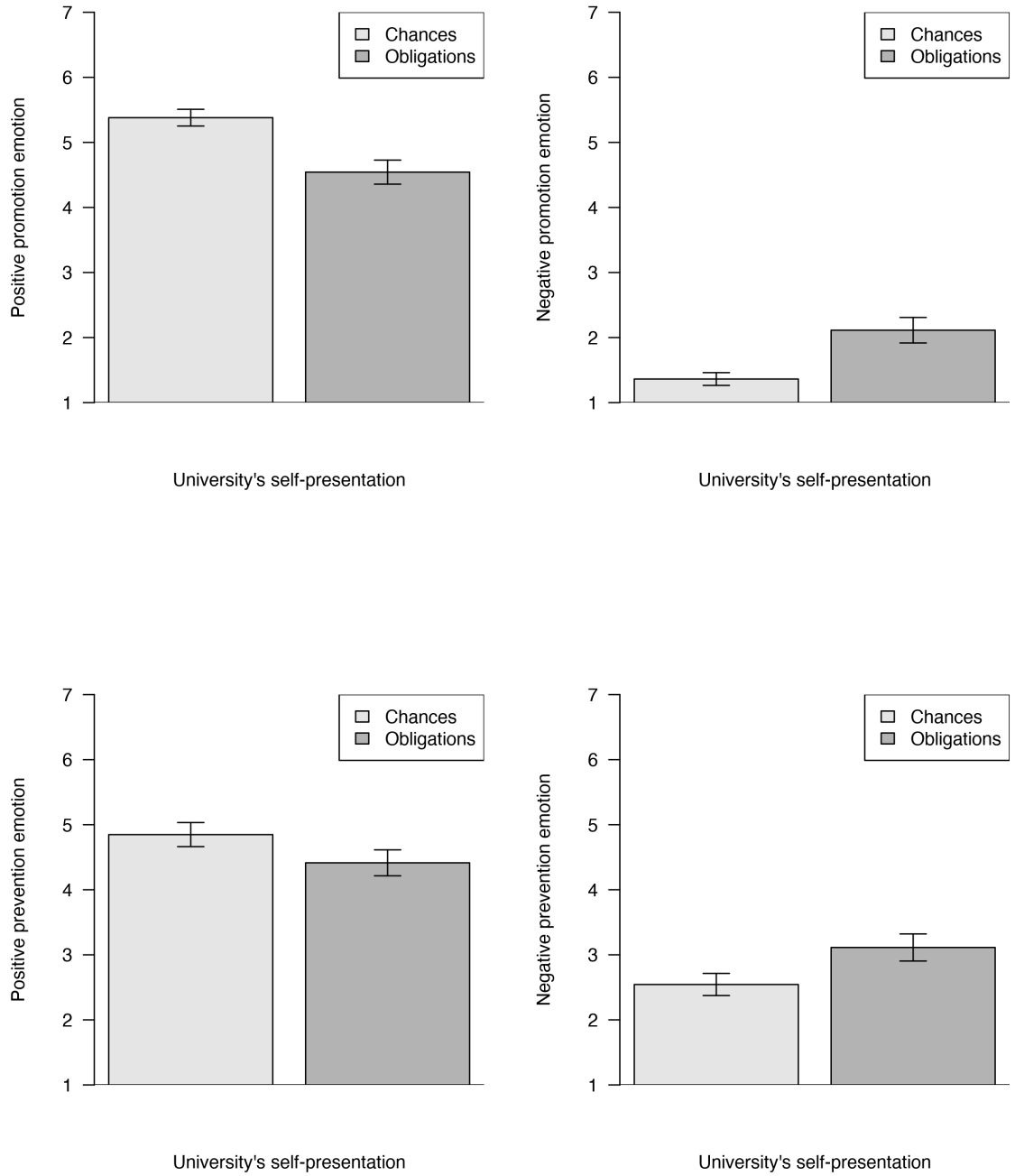
[professional future obligation] Our graduates are required to undergo up to three consultations at the Career Service in order to plan their professional career. The consultations prevent graduates from not knowing where they want to work later or from making the wrong decision. Students also receive address lists with contacts for their applications. Career Service advisors monitor and arrange current job offers so that our graduates do not end up with poorly rated employers or being

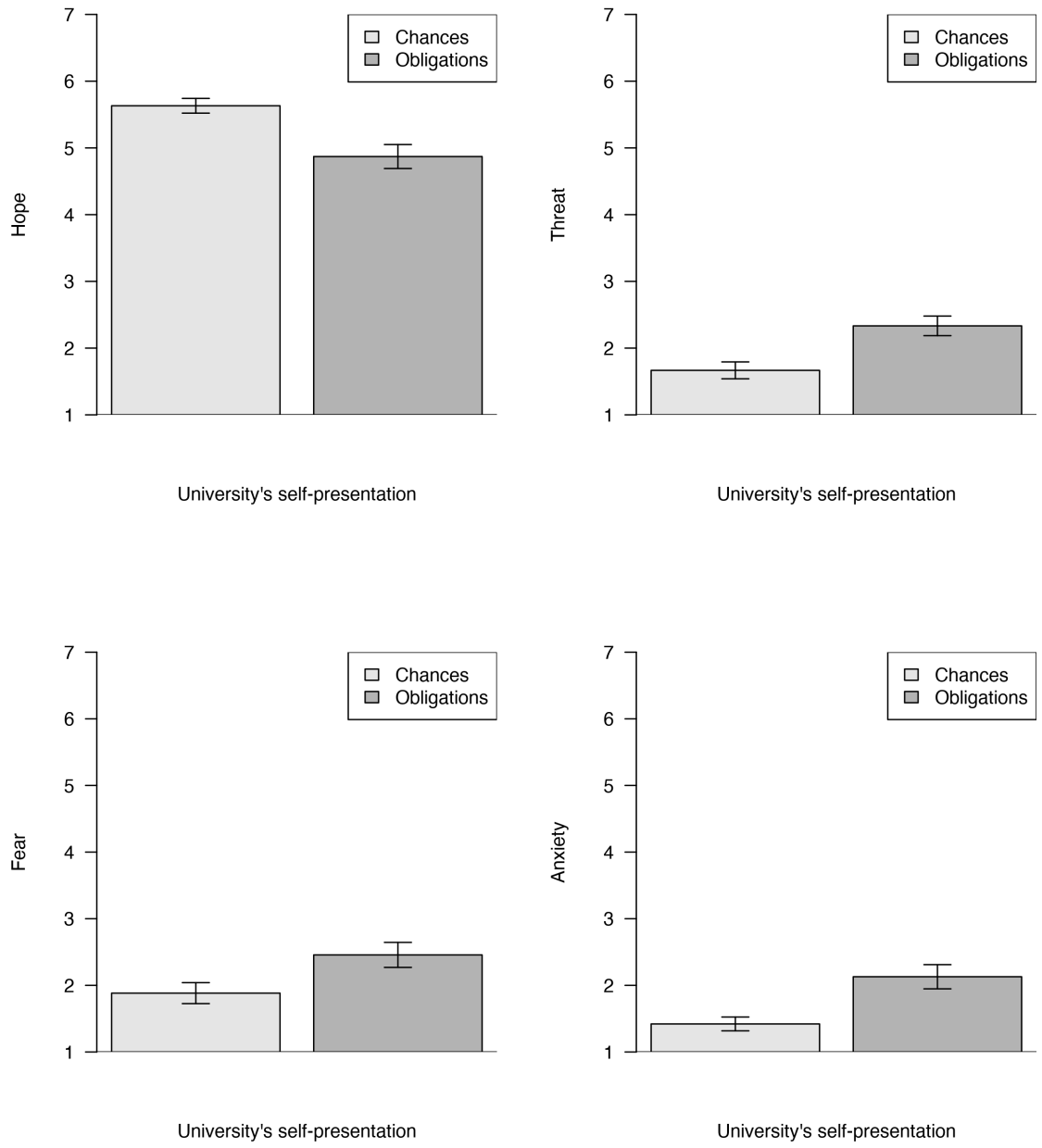
exploited. National and international research collaborations are happy to recruit graduates from our university. The opportunity to work here as a trainee prevents being overstrained when starting a career. Current projects at the Institute of Apiculture, for example, deal with impact assessment of mite infestation in bees and risk analysis in beekeeping, and the institute is always looking for graduates it can support through mentoring programs.

13.5 A5 Figures

Figure 17

Eight Barplots of Emotional Student Engagement for Each Subscale Depending on University's Self-Presentation





Note. University's self-presentation influenced ratings of university applicants' emotional student engagement. Each barplot shows the effect of university's self-presentation (chances vs. obligations) for one subscale, and each subscale of emotional student engagement is plotted on the y-axis. Error bars indicate standard errors.