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Pre-service Biology Teachers' Emotions towards Teaching

Challenges and Opportunities for Subject-specific Teacher Professional Development

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“We are not thinking machines that feel,

we are feeling machines that think”

- Antonio Damasio

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List of acronyms

α	Cronbach's Alpha
β	Standardized regression coefficient
CC	Climate change
CFA	Confirmatory factor analysis
CFI	Bentler Comparative Fit Index
COACTIV	Cognitive activation in the classroom
DESD	Decade of Education for Sustainable Development
EL	Environmental literacy
ESD	Education for Sustainable Development
H	Hypothesis
IUCN	International Union for Conservation of Nature
M	Mean
Mdn	Median
MGB	Model of goal-directed behavior
p	Probability value of statistical significance
PBC	Perceived behavioral control
PD	Psychological distance
PGD	Pre-implantational genetic diagnosis
r	Correlation coefficient
R^2	Explained variance

RMSEA	Root Mean Square Error of Approximation
RQ	Research question
SDG	Sustainable Development Goals
SEM	Structural Equation Model
SRMR	Standardized Root Mean Square Residual
SSI	Socioscientific Issue
UN	United Nations
UNEP	United Nations Environmental Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
USEPA	United States Environmental Protection Agency
WCED	World Life Issues on Environment and Development

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1 Introduction

In 2018, the *International Union for Conservation of Nature* (IUCN) celebrates its 70th anniversary. While its creation in 1948 marked the first step of the movement of environmental education[1], several global organizations such as the *United Nations Educational, Scientific and Cultural Organization* (UNESCO) and other environmental organizations[2] have established a wide variety of activities, all aiming for the sustainable use of planet earth's resources (Leicht, Combes, Byun, & Agbedahin, 2018). This activity has included the foundation of groundbreaking programs like the *United Nations Environment Programme* (UNEP, 1972), which later led to the Tbilisi Declaration in 1977, as the first global confession to environmental education under the consideration of social, cultural, and economic factors. After the *Agenda 21* (1992) and the *Decade of Education for Sustainable Development* (DESD, 2005–2014), these approaches have recently enabled the United Nations (UN) to agree on the *Sustainable Development Goals* (SDGs) in 2015 (United Nations, 2015). These 17 goals constitute an agenda of the most urgent social, economic, and ecological problems, which humankind aims to solve by 2030 (Box 1.1).

While all these longstanding efforts testify to the motivation of a significant number of individuals to protect the environment, humankind as a whole is still overstepping the planet's ecological boundaries (O'Neill, Fanning, Lamb, & Steinberger, 2018; Steffen et al., 2015). These boundaries define a frame for all living creatures on the planet, based on central planetary processes that ensure our planets' functioning on a global level (Rockström et al., 2009). But due to human activity, there has been a continuous alteration of these environmental processes (Crutzen, 2002; Waters et al., 2016). One of the core problems of this alteration is the decreasing biological diversity, which is a major driver of ecosystem change (Hooper et al., 2012). This change also affects ecosystem services and therefore also entails economic consequences (Chapin Iii, F Stuart et al., 2000). While biodiversity and climate change describe core boundaries for our planet (Steffen et al., 2015), human-caused extinctions have risen since the industrial age and are relentlessly increasing (Johnson et al., 2017). Despite these developments, public interest in biodiversity and the environment seems to be decreasing (Mccallum & Bury, 2013) and the most recent conservative reversion in politics may contradict prior efforts for species conservation and sustainable development.

[1] For a distinction between environmental education and education for sustainable development, see Box 1.2

[2] The English site of Wikipedia lists seven international and over 320 national organizations in 50 countries (retrieved from https://en.wikipedia.org/wiki/List_of_environmental_organizations; Accessed 20.07.2018)

Box 1.1 Overview of *Sustainable Development Goals* (SDGs).

SDG 1: No poverty
End poverty in all its forms everywhere

SDG 2: Zero hunger
End hunger, achieve food security and improved nutrition, and promote sustainable agriculture

SDG 3: Good health and well-being
Ensure healthy lives and promote well-being for all at all ages

SDG 4: Quality education
Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

SDG 5: Gender equality
Achieve gender equality and empower all women and girls

SDG 6: Clean water and sanitation
Ensure availability and sustainable management of water and sanitation for all

SDG 7: Affordable and clean energy
Ensure access to affordable, reliable, sustainable, and clean energy for all

SDG 8: Decent work and economic growth
Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

SDG 9: Industry, Innovation and Infrastructure
Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

SDG 10: Reduced inequalities
Reduce inequality within and among countries

SDG 11: Sustainable cities and communities
Make cities and human settlements inclusive, safe, resilient and sustainable

SDG 12: Responsible consumption and production
Ensure sustainable consumption and production patterns

SDG 13: Climate action
Take urgent action to combat climate change and its impacts

SDG 14: Life below water
Conserve and sustainably use the oceans, seas, and marine resources for sustainable development

SDG 15: Life on land
Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss

SDG 16: Peace, justice and strong institutions
Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable, and inclusive institutions at all levels

SDG 17: Partnerships for the goals
Strengthen the means of implementation and revitalize the global partnership for sustainable development

Note: The most relevant SDGs for this dissertation are marked with dark gray; Source: United Nations, 2017, p. 6.

One example for this political change may be the withdrawal of the United States of America from the Paris agreement. Consistent with his political agenda, US president Donald J. Trump has initiated a paradigm change in the historical role of the United States and exchanged the ecological prosperity of the planet for the pursuit of his economic interests to put "America first" (Trump, 2017). According to this changing agenda, environmental scientists and even governmental organizations such as the *United States Environmental Protection Agency* (USEPA) are imposed by severe restrictions (Tollefson, 2018). While this act may constitute an ideal case study for contradictions between economic and ecological interests, doubts regarding unrestricted environmental action have started to grow in other countries, for example in Germany (Klormann, 2018). Similar changes of public opinion and discourse have also affected other societal domains, such as critical voices in the global refugee crisis. While the increase of migration also has links between social, economic, and ecological reasons (Baldwin, 2017), the recent events are alarming. The human species is faced with a variety of social and ecological problems, which threaten critical planetary processes and communal life on a global level.

Therefore, a more sustainable development critically depends on the transformation to environmentally friendly societies (O'Neill et al., 2018).

These developments occur at an interesting time point, as the Western civilization marks a new culmination of prosperity for a large part of society and a new level of sophisticated scientific knowledge due to the easy access to information through the Internet. At the same time, the recent period is described as compromising times of "post-truth" (Sismondo, 2017). While this term generally denotes the neglect of facts in favor of emotions, commentators often described social media outlets as one source for this curse. The term was even selected as the word of the year 2016 by the Oxford dictionary (Higgins, 2016). Whereas some commentators seem to be surprised by the recent developments, research regarding the persuasive nature of emotions has a long history (Stearns, 2008). Catalyzed by neurobiological findings about the decisive role of emotions for decision-making (Damasio, 2001; Panksepp, 1998), researchers from fields such as psychology have generated rational explanations for effects of emotions for a wide variety of human behaviors (Dalgleish, 2004; Dolan, 2002).

Based on these developments, researchers from the field of environmental psychology have investigated the emotional side of nature experiences and their connection with pro-environmental behavior (Kals, Schumacher, & Montada, 1999). Later works have more explicitly examined how emotions affect learning about environmental topics (Fröhlich, Sellmann, & Bogner, 2013; Otieno et al., 2014) or compared specific behaviors for their impact of emotions such as recycling and public transportation (Carrus, Passafaro, & Bonnes, 2008; Passafaro et al., 2014). Although environmental psychological research has found extensive evidence for the importance of emotions for environmental behavior (Kals & Müller, 2012), environmental education has not yet fully integrated this affective dimension.

Generally, emotions have played a traditionally small role in the field of education (Pekrun, 2005). This aspect changed in the last century due to findings from educational psychology (Pekrun & Linnenbrink-Garcia, 2014a), which later led to an "affective turn" in educational research (Zembylas, 2016). But while research has shown the increasing interest in emotions in educational settings, the emotions of teachers have remained as a dark spot of research and teacher education (Frenzel, 2014; Fried, Mansfield, & Dobozy, 2015; Sutton & Wheatley, 2003). Because of teachers' impact on their students' learning (Hattie, 2009; Terhart, 2011) and emotional reactions (Frenzel, Goetz, Lüdtke, Pekrun, & Sutton, 2009), further knowledge about teaching emotions may constitute a significant step for the improvement of education. This knowledge particularly concerns education about topics of sustainable development, due to the importance of affect for environmental behavior. Therefore, this dissertation aims at better understanding the impact of emotions on teacher behavior and how these emotions are caused within teachers.

After further describing the relevant underpinnings and theoretical framework of the executed studies, this dissertation presents empirical evidence for two selected research foci. Because emotions

have been described to be a driver of human behavior, the first part of the empirical results investigates emotions as an antecedent of motivation for selected and educationally relevant behaviors (Research Focus I). To further investigate the causes of these emotional reactions, the second part of the dissertation focuses on the underlying appraisal processes, which cause emotions (Research Focus II). The concluding discussion will synthesize the results, discuss their relevance for teacher professional development and provide a focused explanation for the sketched phenomenon of "post-truth". Based on this, the dissertation closes with an idea on the advancement of teacher professional development as a holistic, subject- and partly even context-specific objective of biology teacher education about environmental socioscientific issues as part of *Education for Sustainable Development* (ESD).

1.1. Education for Sustainable Development (ESD)

The SDGs describe ambitious aims for the further development of humankind, and education is a key requirement for their achievement (United Nations, 2017). The required form of education to achieve these goals is *Education for Sustainable Development* (ESD; Leicht, Combes et al., 2018). In this view, ESD emerges as a distinct educational practice, based on its specific (1) aims, (2) procedures and (3) topics (see also Box 1.2).

Box 1.2 The history and definitions of *Education for Sustainable Development* (ESD).

Severe uncertainty exists around a clear definition of ESD and the distinction to similar terms such as environmental or sustainability education. Advocates of a clear-cut distinction between environmental education and ESD (Bolscho & Hauenschild, 2006) often state the more holistic approach of ESD as a main argument for the differentiation. But as mentioned above, environmental education was proposed with the integration of social and economic dimensions in the first place (UNESCO & UNEP, 1978). Therefore other researchers use the term interchangeably (Eilam & Trop, 2010).

Concerning the denomination, the usage of the term "sustainable development" started around the 1970`s in reaction to a feared third world war (Dryzek, 2013), and was in 1987 integrated as a phrase for the purpose of sustaining earth's declining resources in the final report of the *World Commission on Environment and Development* (WCED; later often called *Brundtland-Report*, based on the name of chairman Gro Harlem Brundtland).

This report defined *sustainable development* as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, p. 41). Based on this definition, ESD would include all educational endeavors aiming for the achievement of such sustainable development. This definition was later expanded by other aims, such as the SDGs (United Nations, 2017). Therefore, ESD recently can be described as all education aiming at fulfilling the SDGs using a specific integrative approach (Leicht, Heiss, & Byun, 2018).

Both terms are also subject to cultural trends, as the increasing popularity of the term sustainability shows. Due to its higher interdisciplinarity, the term is perceived as a more general and positive term (Bonnett, 1999; Yates, 2012).

This dissertation explicitly selects the term ESD as the recent main frame in biology education and locates it within the described educational approaches of distinct aims, procedures, and topics.

ESD (1) aims at developing a general *environmental literacy* (EL) on all educational levels. While the word "literacy" describes the general ability to read and write[3], an environmentally literate person has developed the required problem-solving and ethical skills, but also adopts environmentally responsible behaviors (McBride, Brewer, Berkowitz, & Borrie, 2013). Based on this aim, ESD is

[3] Literacy. (2018). In *Oxford English dictionary*. Retrieved from https://en.oxforddictionaries.com/definition/literacy (24.07.2018).

committed at developing learners' key competencies, which include the required knowledge and skills, but also values and motivations to enable environmental performance (Rieckmann, 2018b). To further describe these competencies, the United Nations have published tangible learning objectives, specified for cognitive, socio-emotional and behavioral outcome domains (United Nations, 2017).

To achieve these aims, ESD educators (2) utilize a specific set of procedures. Synthesizing from Rieckmann (2018b), ESD is learner centred, action oriented and uses transformative learning as a key pedagogical approach. In this view, learners should be engaged in concrete learning experiences with a high amount of personal involvement. In a similar manner, Eilam and Trop (2010) review student-centered learning, minds-, and hands-on learning, as well as active participation as characteristics of ESD. Utilizing these approaches, teachers may engage learners in collaborative real world projects, vision-building exercises for example in future workshops, or analyze complex environmental systems in case studies, stakeholder analyses or system games (Rieckmann, 2018b). Furthermore, *transformative learning* integrates these activities and aims for the modification of "problematic frames of reference (mindset, habits of mind, meaning perspectives) (…) to make them more inclusive, discriminating, open, reflective and emotionally able to change" (Mezirow, 2009, p. 92). In the face of ESD, such a transformation denotes the modification of the individual to more sustainable frames of reference and has to include non-rational factors such as emotions and values (Mezirow, 2009). Finally, transformative learning and ESD also utilize critical and reflective thinking, which may be fostered through discussions or reflective journals (Rieckmann, 2018b). Such methods and approaches to education require specific topics, to ensure legitimate subjects for debate and systematic analysis.

Therefore, several (3) key themes have emerged as central topics for ESD. Rieckmann (2018a) proposes climate change, biodiversity, sustainable production and consumption, as well as the reduction of poverty as such themes. All of these topics are related to the SDGs and allow to translate them into education (Rieckmann, 2018a). Inside these key themes, several different contexts might be utilized for educational purposes[4]. Using relevant contexts in education has been found to increase learner interest and motivation (Bennett, Lubben, & Hogarth, 2007; Menthe & Parchmann, 2015; Stuckey, Hofstein, Mamlok-Naaman, & Eilks, 2013). In the subject of biology, particularly contexts with ecological backgrounds provide interesting learning contexts, as the required background knowledge directly translates into other contents of the subject curricula (Hofstein, Eilks, & Bybee, 2011). For example, contexts of biodiversity or climate change could lead to synergies with content knowledge about ecology. Therefore, the German national educational standards in biology define societal issues as possible contexts of sustainable development in the competence dimension of decision-making (KMK, 2005; Steffen & Hößle, 2014). Argumentation and reasoning about suitable topics will then enable students to increase their decision-making competence (Bögeholz, Böhm, Eggert, & Barkmann, 2014). Similarly, curricula from other countries also include topics of sustainable development, like the *Next*

[4] For a further description of the term *context*, see chapter 1.4.2

Generation Science Standards in the United States (National Research Council, 2013), which also cover topics like climate change and biodiversity (Feinstein & Kirchgasler, 2015).

The final cross-sectional principle of the aims, procedures, and issues is the integration of social, cultural, and economic considerations into the ecological underpinnings of the environmental issues (Leicht, Combes et al., 2018; United Nations, 2017). As described in Box 1.2, this integration was already inherently inserted from the start into all approaches of environmental education (UNESCO & UNEP, 1978). Nonetheless, recent approaches of ESD emphasize this integration, by more explicitly integrating different dimensions and disciplines of sustainable development into the specific contexts. ESD approaches are multi-disciplinary and multidimensional, combining different disciplines with a systematic view on all dimensions of sustainable development (Eilam & Trop, 2010). Finally, ESD pays attention to non-rational dimensions of learning, by taking account of the affective nature of constructivist learning (Eilam & Trop, 2010). These last two categories particularly challenge teachers, as for example the social dimensions of sustainable development and emotions about the topics are context- and sometimes even situation specific (Frenzel, Becker-Kurz, Pekrun, & Goetz, 2015; Lehtonen, 2004). Therefore, educators require a sufficient amount of content-specific competencies in the selected environmental topics.

1.2. Teacher professional development

While teachers have high obligations based on the relevance of education for the citizens in todays' societies (Farmer, Lines, & Hamm, 2011; Hargreaves, D. H., 1998), teacher education and teaching itself are perceived as ambitious endeavors. This perception is partly illustrated by the famous George Bernard Shaw quote appearing above Lee Shulman's historical article about knowledge growth in teaching[5]. While Shulman later resolved this quote, the article established a new approach to teacher education, which finally led to the establishment of teaching as a profession and teacher education as professional development.

Constituted by this development, teaching started to be perceived as a *profession*, constituted by a specific set of features such as service to others, the necessity of a deep understanding, and professional communities (Shulman, 1998). In the profession of teaching, teachers represent experts, constituted by a specific set of required skills and competencies for teaching in a specific subject (Sternberg & Horvath, 1995). Viewed in an historical perspective, the expert view of teachers emerges as a new paradigm and integrates prior approaches such as the personality- or process-product-paradigm (Krauss & Bruckmaier, 2014).

[5] "He who can, does. He who cannot, teaches." (Shulman (1986, p. 4)

Box 1.3 Paradigms of teacher professionalization research.

	Personality paradigm	Process-product paradigm	Process-mediation-product paradigm	Expert paradigm
Time	About 1900 – 1960	About 1960 – today	About 1975 – today	Since 1985
Influenced by	Trait-oriented personality	Behaviorism	Cognitively expanded Behaviorism	Cognitivism
Research methods	Tests and questionnaires	Classroom observations, concentrated on teacher behavior	Classroom observation, later often student questionnaires	Integration of existing methods, Development of professional-knowledge-test
Comments	Only few and weak connections	First robust findings, lessons become measurable	Student cognition as mediator	Systematic view, concentrated on person, professional knowledge essential

Source: Krauss & Bruckmaier, 2014, p. 242.

When teaching is viewed as a profession, *teacher professional development* describes teachers' professional learning and aims for the facilitation of this process to strengthen student learning (Postholm, 2012). Exposure to professional development activities in teacher education should contribute to the development of professional competencies (Darling-Hammond, 2000; Großschedl, Harms, Kleickmann, & Glowinski, 2015).

1.2.1. Teachers' professional competence

The specification of teacher professional competence shows many similarities to the aforementioned development of a general environmental literacy. While historical definitions of good teachers have often focused on knowledge as a main contributor to professional teachers (Shulman, 1986), teacher professional development also involves other dimensions of personal and social development (Bell & Gilbert, 1994). This wider definition is in line with a broader understanding of the term *competence* as a collective term for a variety of skills, including further affective and motivational aspects (Klieme, Hartig, & Rauch, 2008). Thus, the last years have seen a remarkable development of other components of teachers' professional competence, including beliefs, identity, and self-efficacy (Beauchamp & Thomas, 2009; Fives & Buehl, 2012; Zee & Koomen, 2016).

In response to these developments, researchers proposed a variety of different teacher competence models (Frey, 2014; Harms & Riese, 2018). One prevalent model is the *model of professional competence*, which emerged from the *Cognitive Activation in the Classroom* (COACTIV) project (Kunter, Baumert et al., 2013). This models includes specific forms of knowledge, professional values, beliefs and goals, motivational orientations, as well as professional self-regulative functions as components of professional competence (Baumert & Kunter, 2013). While the model was constructed for the specific project, it enabled important insights into connections of teacher competence and student learning (Kunter, Klusmann et al., 2013) and later affected a series of further studies, based on

specific components of the model (Keller, Neumann, & Fischer, 2017). Furthermore, it connected different strands of research, by synthesizing research about teachers' beliefs, values, and self-efficacy.

Speaking of these components, the first and fundamental competence of teachers is professional knowledge (Baumert & Kunter, 2013). This knowledge is further subdivided by knowledge about the respective subject-based contents (*content knowledge*) and general knowledge about teaching and learning in pedagogical contexts (*pedagogical knowledge*). Between those knowledge domains, the final domain of knowledge synthesizes both prior forms into the knowledge about teaching within the specific subject (*pedagogical content knowledge*). Other forms are organizational and counseling knowledge. While several studies have investigated the structure, connections, and implications of these forms of knowledge (Großschedl et al., 2015), only relatively little research has systematically investigated other parts of the model.

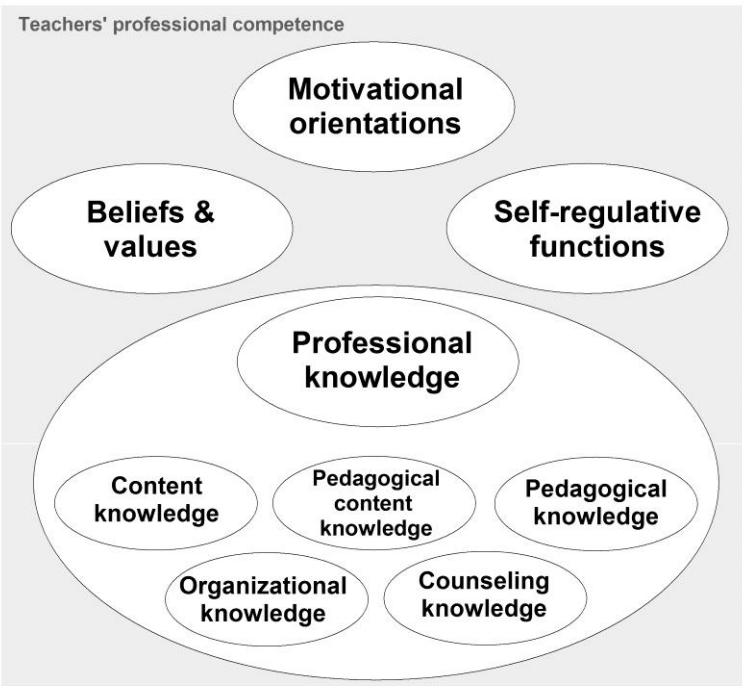

Figure 1.1 Simplified model of professional competence with different knowledge domains (Baumert & Kunter, 2013, p. 29).

With respect to these other parts, the original model of Baumert and Kunter (2013) includes values and beliefs as further components of teacher professional competence. The original conceptualization describes beliefs about the structure, development, and validation of knowledge (*epistemological beliefs*), beliefs about learning in a specific area (*subjective theories of learning*), beliefs about teaching of the subject (*subjective theories of teaching*) and beliefs of the self in the context of learning and teaching of that subject (*self-related ability cognitions*) as parts of teachers' professional competence. In the COACTIV project, these belief dimensions later were integrated into a constructivist as well as a transmissive belief orientation, which both showed indirect effects on

students' mathematics achievement through cognitive activation and learning support as mediators (Voss, Kleickmann, Kunter, & Hachfeld, 2013).

Another non-knowledge based part of the professional competence concerns teaching motivation. The component of motivation in the COACTIV project included teacher enthusiasm, describing "an individual orientation reflecting a habitual positive affective experience of one's professional activities" (Kunter, 2013, p. 277). This variable of teacher enthusiasm can be distinguished into enthusiasm towards the subject and enthusiasm towards teaching (Kunter, 2013). While the first concentrates on enthusiasm about a specific subject, the latter focuses on the activity of teaching in a specific class (Kunter, Frenzel, Nagy, Baumert, & Pekrun, 2011). Concerning connections with other relevant variables, teacher enthusiasm is connected to student learning outcomes as well as internal variables such as job satisfaction or burnout (Keller, Hoy, Goetz, & Frenzel, 2016; Kunter, 2013; Kunter et al., 2011).

As a final part of the model, self-regulation refers to teachers' management of their own resources in teaching (Klusmann, 2013). In the COACTIV study, Kunter, Baumert et al. (2013) were able to differentiate four different teacher types according to their resource management. These teacher types differed based on teacher behaviors such as emotional exhaustion and job satisfaction (Klusmann, 2013).

1.2.2. Constructing the professional ESD teacher

While the model of professional action competence illustrates facets of professional teachers, it was originally constructed to investigate mathematics teachers' competencies (Kunter, Baumert et al., 2013). While several studies have applied components of the model to the subject of biology (Großschedl et al., 2015; Schumacher, Großmann, Eckes, Hüfner, & Wilde, 2018), these analyses adapted the categories such as content knowledge to the subject, but did not investigate further subject-specific components. In the context of teaching ESD, an adaptation might be interesting because competent teaching about environmental topics requires a specific set of deeper personality factors as well as motivations (Borg, Gericke, Höglund, & Bergman, 2012; Rieckmann, 2018b). While teachers are faced with a diverse set of learning objectives to promote ESD in schools (Box 1.4), the components of competent teachers for ESD could also be described in the framework of professional action competence.

The first barrier may be the availability of sufficient specific knowledge (Robelia & Murphy, 2012), with environmental issues requiring a high amount of specialized content knowledge (Aksit, McNeal, Gold, Libarkin, & Harris, 2018). This issue might be especially problematic in topics such as biodiversity, due to the complex nature and different preconceptions of the concept (Fiebelkorn & Menzel, 2013). This part of teachers' professional competence is sufficiently captured by the model of professional action competence. Knowledge about the topics of biodiversity and climate change might be seen as content knowledge, while knowledge regarding teaching these topics constitutes specific

pedagogical content knowledge. This adaptation of the model was already suggested by several researchers to strengthen teacher education for topics of ESD (Bertschy, Künzli, & Lehmann, 2013). But in particular, the other parts of the model may capture only a small part of the needed competencies for teaching in ESD.

Box 1.4 Learning objectives for teachers to promote ESD.

Know about sustainable development, the different SDGs and the related topics and challenges

Understand the discourse on and the practice of ESD in its local, national and global context

Develop their own integrative view of the issues and challenges of sustainable development by taking into account the social, ecological, economic and cultural dimensions from the perspective of the principles and values of sustainable development, including that of intergenerational and global justice

Take disciplinary, interdisciplinary and transdisciplinary perspectives on issues of global change and their local manifestations

Reflect on the concept of sustainable development, the challenges in achieving the SGDs, the importance of their own field of expertise for achieving the SDGs and their own role in this process

Reflect on the relationship of formal, non-formal and informal learning for sustainable development, and apply this knowledge in their own professional work

Understand how cultural diversity, gender equality, social justice, environmental protection and personal development are integral elements of ESD and how to make them a part of educational processes

Practice an action-oriented transformative pedagogy that engages learners in participative, systemic, creative and innovative thinking and acting processes in the context of local communities and learners' daily lives

Act as a change agent in a process of organizational learning that advances their school towards sustainable development

Identify local learning opportunities related to sustainable development and build cooperative relationships. Evaluate and assess the learners' development of cross-cutting sustainability competencies and specific sustainability-related learning outcomes

Source: United Nations, 2017, p. 52.

First of all, the component of values and beliefs may be interesting for further investigation. Different to fact-driven subjects such as mathematics, teaching about sustainable development is challenging for teachers because they need to act coherent to the overall aims of ESD. This need also requires teachers' underlying affective traits based on coherent beliefs, attitudes, values, and ultimately pro-environmental behaviors (Rieckmann, 2018b). All these variables may therefore be connected to teaching relevant components of professional competence in ESD topics (Fives & Buehl, 2012). While some studies have investigated for example the occurrence and development of teachers' attitudes for the context of climate change, there is only scarce knowledge about the impact of these non-cognitive parts of teacher behavior within other contexts. Prior studies have found connections between teachers' attitudes towards climate change and their denial of the scientific consensus about the anthropogenic causes of such change (Liu, Roehrig, Bhattacharya, & Varma, 2015; Plutzer et al., 2016). Similar effects might be possible for the environmental topic of biodiversity because attitudes and their foundation in universal values determine how learners approach contents (Raveendran & Chunawala, 2015).

Possible values might be included in the basic human value framework (Schwartz, 1994). Prior studies have shown how specific values from this theory were connected to pro-environmental motivations (Menzel & Bögeholz, 2010; Schultz, 2005). Besides this general value framework, more

pronounced values could be relevant when teaching about more specific topics. One example such more pronounced topics may be biodiversity protection, including local wildlife issues. Prior studies showed wildlife value orientations as the foundation for the motivation to protect the species (Fulton, Manfredo, & Lipscomb, 1996; Hermann & Menzel, 2013a; Hermann, Voß, & Menzel, 2013). Therefore, these values could also be relevant for teaching behavior. Furthermore, specific components of motivational regulations and self-regulative functions might differ for teaching topics of ESD and the general subject. Therefore, further research about these components of competent ESD teachers is required.

To summarize, (hypothetically) competent ESD teachers need sufficient specific content, pedagogical and pedagogical content knowledge about the relevant issues, but also a beneficial underlying set of values and beliefs in concordance with the aims of ESD as well as the adequate intrinsic motivational orientations and self-regulatory skills to teach the issues. In prior studies, this intrinsic motivational component was integrated with enthusiasm towards teaching (Baumert & Kunter, 2013). Enthusiasm regarding teaching describes the observable enthusiastic teacher behavior and is determined by the underlying positive appraisal process within teachers (Keller et al., 2016). To better understand this appraisal process, there is a need for a better understanding of teaching emotions.

1.3. Emotions

While philosophers started to investigate emotion-like states in ancient Greece (Solomon, 2008), a more theoretically justified approach to emotions began with Charles Darwin, who advocated for a functional approach to emotions (Darwin, 1872). But while the investigation of emotions has a long history, it still includes many open questions. This issue is illustrated by the very diverse use of metaphors for and descriptions of emotions by laypersons (Kövecses, 2017; Scherer, Wranik, Sangsue, Tran, & Scherer, 2004) as well as the missing consensus on a clear definition between researchers (Ekman, 2016; Izard, 2010).

On the most basic level, emotions describe "a strong feeling deriving from one's circumstances, mood, or relationships with others"[6]. But this definition is clearly oriented towards a general comprehensibility because many theories of emotions propose "feeling" as only one dimension of an emotion (Moors, 2009). This subjective feeling is only the final part of the process (Shuman & Scherer, 2014), which begins with the initial cognitive appraisal. *Appraisal* describes the often unconscious evaluation process of emotional situations based on prior experiences, individual identity factors and momentary goal structure (Moors, 2009; Russell, 2009; Scherer, 2005). This appraisal process entails specific physiological reactions and subsequent action tendencies. Finally, a specific set of motor activities transports the emotional reaction to the external world and the internal state may be consciously aware based on the subjective feeling (see also Table 1.1).

[6] Emotion. (2018). In *Oxford English dictionary*. Retrieved from https://en.oxforddictionaries.com/definition/emotion (31.07.2018).

Table 1.1 Emotion components from Shuman and Scherer (2014, p. 16) and Scherer (2005, p. 698).

Component	Description	Function
1) Appraisal	Cognitive evaluation of objects and events	Meaning-making
2) Physiological	Bodily reaction aiming for system regulation	Support
3) Action tendency	Intrinsic preparation and direction of action	Motivation
4) Motor activity	Communication of reaction through facial and vocal expression	Communication
5) Subjective feeling	The explicitly available experience of an emotion	Monitoring of internal state

Besides this multidimensionality, researchers agree about the connection of emotions to specific events as triggers of emotions (Moors, 2009), also termed *emotional episodes* (Scherer, 2005). To describe the emotional reactions within these emotional episodes, two distinct approaches may be utilized. Using a *dimensional* approach, emotional episodes can be described in two dimensions as either positive/negative and with high control/low control (Shuman & Scherer, 2014; Watson, Wiese, Vaidya, & Tellegen, 1999). Besides this, emotions can be differentiated as *discrete* emotions (for example enjoyment, interest, anger, anxiety). Discrete emotions allow for a more nuanced view and further differentiate between similar emotions (Izard, 2007).

Furthermore, Pekrun (2006) describes emotions as either referring to the momentary emotional perception when the event is occurring (*state emotion*) or as general habitual preconceptions with similar characteristics within the individual (*trait emotion*). Finally, the triggered emotions are of highly limited duration, differentiating them from similar psychological variables such as attitudes (Shuman & Scherer, 2014). While the duration of an emotional episode depends on factors like the eliciting event, the nature of the emotion itself or specific personal characteristics, even very short emotions may affect behavior (Verduyn, Delaveau, Rotge, Fossati, & van Mechelen, 2015).

1.3.1. Drivers of human behavior and environmental motivations

Throughout history, emotions have often been described as an negative antagonist of reason (Solomon, 2008). But findings from neurobiological and psychological research at the end of the 20th century radically changed this view of emotions (Dalgleish, 2004; Pessoa, 2008). Emotions may now be better conceptualized as an integrative component of human cognitive functioning (Pham, 2007; Salzman & Fusi, 2010). This definition entails serious consequences for the analysis of human behavior because cognitive states may never be detached from the current emotional experience (Dolan, 2002). Prior studies have shown how emotions affect human general cognitive processes like judgement, attention, and memory (Lench, Flores, & Bench, 2011; Yiend, 2010) but also more specialized processes such as decision-making or moral reasoning (Haidt, 2001; Lerner, Li, Valdesolo, & Kassam, 2015).

This connection of emotions and decision-making seems particularly interesting because prior theories have often suggested a sole rationalistic model of decision-making, often subsumed under the term *rational choice theory* (Kroneberg & Kalter, 2012). Many researchers have criticized this approach

and proposed other theories to better describe decision-making, for example by considering human biases (Tversky & Kahneman, 1981) or bounded rationality (Gigerenzer & Selten, 2002). But the inclusion of emotions into decision-making remains an open problem and not all effects of emotions can be sufficiently described by recent decision-making theories (Volz & Hertwig, 2016). To integrate emotions into decision-making, Lerner et al. (2015) propose the inclusion of emotions as precursors of the conscious or nonconscious evaluation and finally also for decision-making (Lerner et al., 2015, p. 815). Of course, this integration still includes cognitive processes as central preconditions of decisions, but emphasizes the role of emotions, in line with other studies (Baron, Gürçay, & Luce, 2018; Greene, Sommerville, Nystrom, Darley, & Cohen, 2001).

When integrated into such an approach, emotions also emerge as an important contributor to the motivation to act pro-environmentally. Generally, *pro-environmental behavior* is described as behavior which harms the environment as little as possible or even protects natural resources (Steg & Vlek, 2009). Because these behaviors basically require the decision to act environmental, emotions play an important role for pro-environmental behavior. Examples for prior studies about emotions for respective behaviors include recycling, public transportation (Carrus et al., 2008; Passafaro et al., 2014), money donation (Ku & Zaroff, 2014; Sollberger, Bernauer, & Ehlert, 2016), or volunteering (Bruyere & Rappe, 2007; Caissie & Halpenny, 2003).

1.3.2. Teaching emotions

Besides these general environmental behaviors, emotions also impact educational behavior (Schutz & DeCuir, 2002). While researchers from educational psychology, neuropsychology, or general educational research are quite familiar with investigating emotions in schools and universities (Pekrun & Linnenbrink-Garcia, 2014a), research in more subject-specific fields like ESD or science education is scarce (Sinatra, Broughton, & Lombardi, 2014). But especially in ESD, further research about emotions may be required to explain pro-environmental orientations of students and teachers (Ojala, 2013). Furthermore, teachers determine the emotional environment of classrooms (Harvey, Bimler, Evans, Kirkland, & Pechtel, 2012) and teaching is often described as emotional practice (Hargreaves, A., 1998b).

Generally, *teacher emotion* is a collective term for all kinds of emotional perceptions of teachers (Fried et al., 2015). Prior research has found a wide variety of differences in the emotional perception of teachers, with an emphasis on quantitative self-report studies but high diversity of research approaches (Keller, Frenzel, Goetz, Pekrun, & Hensley, 2014; Schutz, 2014; Sutton & Wheatley, 2003; Uitto, Jokikokko, & Estola, 2015). Generally, most of the research can be subsumed as concentrated either on emotions as a dependent or as an independent variable (Hascher & Krapp, 2014).

Research with teacher emotions as a *dependent variable* initially concentrated on more deeply investigating teacher emotions by (1) describing their characteristics, causes as well as development in

time. First of all, research on teacher emotions began by describing teacher emotions on a qualitative basis (Hargreaves, A., 1998b; Nias, 1996). These approaches were later methodologically enriched by teacher diaries (Frenzel & Götz, 2007) or experience sampling approaches (Keller, Chang, Becker, Goetz, & Frenzel, 2014). Most of these studies followed rather a discrete than an dimensional approach to emotions for the better interpretability for educational practice (Keller, Frenzel et al., 2014). Summarizing a wide variety of studies, Frenzel (2014) concludes a higher frequency of positive emotions like enjoyment than negative emotions (Frenzel, 2014).

Besides such a general description, researchers have investigated (2) causes of teacher emotions. On the most general level, teacher emotions are caused in relevantly assessed events due to an appraisal of these events with intended goals (Schutz, Hong, Cross, & Osbon, 2006; Sinclair & Nicoll, 1981). The majority of studies have investigated student behaviors such as discipline and motivation as a main contributor to teaching emotions (Becker, Keller, Goetz, Frenzel, & Taxer, 2015; Hagenauer, Hascher, & Volet, 2015). Other causes of emotions may be self-concepts or other personality traits (Lohbeck, Hagenauer, & Frenzel, 2018). A final strand of research about emotion causation concerns the regulation of emotions by teachers (Garner, 2010). While emotion regulation constitutes a central challenge for teachers (Lee et al., 2016), specific coping processes may be connected to burnout (Chang, 2013).

Box 1.5 Overview of studies on teaching emotions as dependent and independent variables.

Emotions as a dependent variable

(1) Description of teacher emotions Occurrence, frequency **(2) Emotion causation** Classroom conditions, personality, emotion regulation **(3) Long-term development** Change over time	→	**Teaching emotions**

Emotions as an independent variable

Teaching emotions	→	**(4) Personal variables** Teacher perception, behavior, identity **(5) Instruction** Emotional environment, teacher-student relationship **(6) Teachers environment** Reforms, Parents, school staff

Source: Adapted and extended from Hascher and Krapp (2014, pp. 685ff.).

Finally, researchers have investigated how (3) emotions develop over time, as teachers previous emotional experiences influence teachers' expectations for further situations (Hascher & Krapp, 2014). In this perspective, researchers are interested in investigating how positive emotions change over time and might translate to general positive dispositions, such as increased motivation (Krapp, 2002). Such

positive experiences may later translate into more positive self-concepts (Lohbeck et al., 2018). Another important developmental research contribution are longitudinal studies about teachers' emotional labor and feelings of exhaustion (Brouwers & Tomic, 2000; Philipp & Schüpbach, 2010).

Research concerning teacher emotions as an *independent variable* have investigated the consequences of teachers' experienced emotions on a variety of (4) personal teacher variables. As relevant variables, researchers have studied teachers' positive emotions as contributors to well-being, self-efficacy, or job satisfaction (DeMauro & Jennings, 2016; Frenzel et al., 2016) but also negative emotions and emotional labor (Keller, Chang et al., 2014; Zembylas, 2004). Emotions also severely affect and develop teacher identity (O'Connor, 2008; Zembylas, 2005), particularly in phases of educational change (Hargreaves, 2005; Schmidt & Datnow, 2005). Only a relatively small body of research has concentrated on specialized subject-specific effects of teacher emotions, such as teacher emotions and plausibility perceptions and teaching motivation in the context of climate change (Lombardi & Sinatra, 2013).

Besides these personal factors, teacher emotions have been studied based on their impact on perceived (5) instructional quality by students (Becker, Goetz, Morger, & Ranellucci, 2014), highlighting the central role of teachers' emotions for the classroom emotional environment (Harvey et al., 2012) and the relationships with students (Flavia, Teixeira, & Mortimer, 2003; Frenzel, Goetz, Lüdtke et al., 2009). A positive emotional climate and positive relationships fosters students' interest and learning (Keller, Goetz, Becker, Morger, & Hensley, 2014; Keller et al., 2017; Kunter, 2013).

Finally, emotions were studied in the wider (6) environment of teachers and their surrounding in schools, also in an organizational perspective (Liljestrom, Roulston, & Demarrais, 2007). These studies investigated either teacher emotions in terms of educational reforms (Kelchtermans, 2005; van Veen, Sleegers, & van de Ven, Piet-Hein, 2005), relations to policy decisions (Hargreaves, A., 1998a), or how teacher emotions shape personal contact with parents and other school staff (Hargreaves, 2001).

A final important contribution of recent teacher emotion research is the context-dependence of teacher emotions. First of all, emotions occur in a specific sociocultural setting (Schutz, 2014). Besides this sociocultural context, teaching emotions also show subject-dependent differences (Frenzel et al., 2015). Therefore, teaching emotions have always to be reflected in the concrete teaching situation and context. Because the contexts of this dissertation should be adequate for use in ESD, suitable environmental socioscientific issues are required as contexts for teaching.

1.4. Environmental socioscientific issues

1.4.1. A new learning paradigm

As described above, ESD needs environmental issues that allow for sufficient discussion. In science educational research, these contexts are referred to as *socioscientific issues* (SSIs). SSIs can be

described as a rather progressive instructional paradigm, aimed at emphasizing evidence-based reasoning and scientific inquiry about relevant controversial issues (Zeidler, 2014). Several studies have shown learning and interest gains by integrating such issues into education, and distinguished socioscientific discourse as a way to prepare students for active societal participation (Klosterman & Sadler, 2010; Sadler, 2009). The integration of such real-world contexts has a long tradition in science education, based on historical approaches termed *science-technology-society* (STS) education (Bennett et al., 2007). SSIs extend these prior approaches by further integrating ethical decision-making and virtue building (Zeidler, Sadler, Simmons, & Howes, 2005).

Levinson (2006) proposes three main criteria of an appropriate SSI. First of all, the issue has to be controversial, based on different deeply rooted premises. Such premises could include key beliefs, values, or similar understandings (Levinson, 2006). Furthermore, a substantial number of people should be involved in the conflict, to ensure a long openness and visibility of the issue at hand (Levinson, 2006). Finally, the issue may not be capable of being solved by evidence alone. This issue could inhibit deeper reflection because new evidence may convince people in discussions relatively quickly (Levinson, 2006). Besides this definition as SSI, Gilbert, Bulte, and Pilot (2011) propose specific focal events in a distinct behavioral environment, which involves a specific language and situational background knowledge as main criteria for issues to constitute sufficient educational contexts (Gilbert et al., 2011). Therefore, this should also be valid for SSIs.

1.4.2. Socioscientific issues of sustainable development

To describe suitable socioscientific issues in the face of ESD, issues have to comply with the proposed definitions of contexts (Gilbert et al., 2011), SSIs (Levinson, 2006) but also be issues of sustainable development (Rieckmann, 2018a). The adoption of such issues may catalyze learning about science topics and simultaneously link this fostered learning with the required step towards sustainable development (Tytler, 2012; Wals, Brody, Dillon, & Stevenson, 2014).

Hence, suitable contexts should have their own focal events within distinct behavioral environments using a specific language and requiring situational knowledge (Gilbert et al., 2011). To be suitable as an SSI, the issue should also be based on deeply rooted premises, involve a substantial number of people, and should not be solvable by scientific evidence alone (Levinson, 2006). To be finally suitable as an environmental SSI, the issue should be relevant for sustainable development, for example by being linked to the SDGs (Figure 1.2). One sort of suitable issue within the subject of biology concerns wildlife conservation conflicts (Brewer, 2006). Such issues might be the return of the wolf to Germany, a topic which has already been successfully utilized in biology education (Hermann & Menzel, 2013b).

The conflict is based on the return of the large predator to Germany, where it was eradicated in the year 1847 due to conflicts based on livestock killings (Buck, 2006). Following the fall of the iron curtain, the species reestablished in east Germany and is spreading further westwards (Ansorge,

Holzapfel, Kluth, Reinhardt, & Wagner, 2010; Chapron et al., 2014). Based on this spread, several regions have also experienced a comeback of human-wildlife-conflicts (Mech, 2017). The return is particularly problematic in regions with a high density of livestock and small preparation for the wild animal such as Lower Saxony (Ronnenberg, Habbe, Gräber, Strauß, & Siebert, 2017). Based on the livestock killings and protests, the conflict involves a variety of focal events in distinct environments, which require further situational knowledge such as that associated with the biology of wolves (Enserink & Vogel, 2006). Furthermore, the conflict is deeply rooted because it can be described as a value based conflict not solvable by scientific evidence alone (Levinson, 2006; Nie, 2002). Finally, it also is connected to the SDGs because SDG 15 (Life on land) explicitly targets securing earths' terrestrial biodiversity with a local and global perspective (United Nations, 2017). While the issue of returning wolves may be only suitable in specific regions where they are returning, other wildlife issues like the Andean bear (*Tremarctos ornatus*) could be utilized for educational purposes due to the similarities of both issues (Garcia-Rangel, 2012).

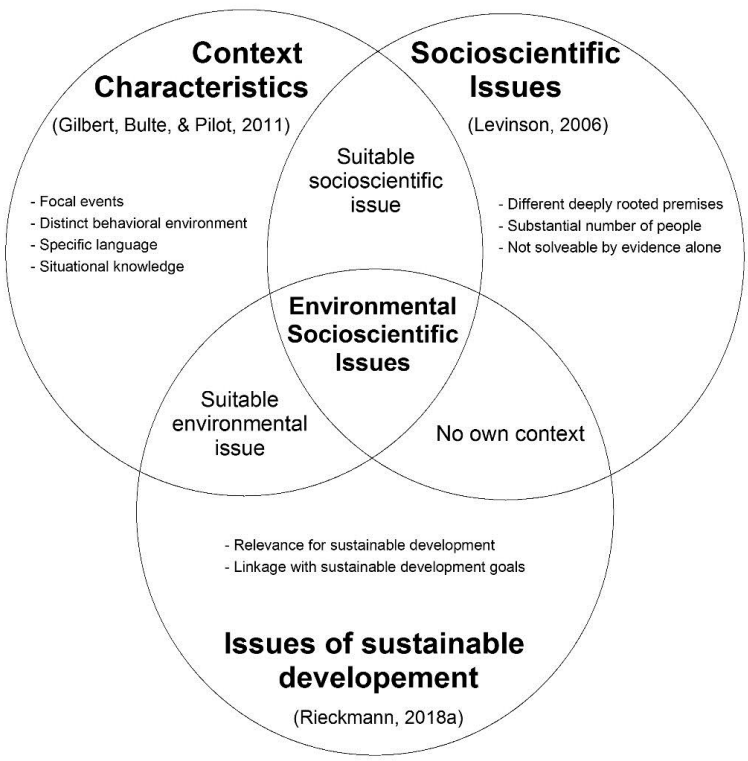

Figure 1.2 Characterization of environmental socioscientific issues as the overlap of suitable context characteristics (Gilbert et al., 2011), socioscientific issues (Levinson, 2006) and issues of sustainable development (Rieckmann, 2018a).

Another suitable context may be climate change (Peel, Sadler, Kinslow, Zangori, & Friedrichsen, 2017). While a high amount of specialized knowledge is required to understand the scientific background of the issue (Aksit et al., 2018), it includes several focal events such as the agreement of global declarations to fight climate change or environmentalists counteractions (Tollefson, 2018). Several results also show how some people are still not convinced that human causes are leading

to the warming of the planet's atmosphere, due to their underlying values and attitudes (The Core Writing Team, Pachauri, & Meyer, 2015). This is especially problematic because this unclarity even concerns science teachers, who subsequently may not be convinced to teach about the human causes of climate change (Plutzer et al., 2016).

1.4.3. Challenges when teaching environmental socioscientific issues

Besides the described pedagogical considerations and normative standards, issues of ESD are not fully integrated in education. For example in Germany, several federal documents predetermine the implementation of environmental SSIs in education (Menzel, 2010), but a recent monitoring study implied only a poor integration on all levels of education (Singer-Brodowski, Brock, Etzkorn, & Otte, 2018). One reason for this may be the problematic nature of these issues because teaching about such issues is particularly challenging for teachers (Pitipornta pin, Yutakom, & Sadler, 2016; Tidemand & Nielsen, 2017).

As described previously, teachers require subject-specific professional competence to teach these issues. But as studies have demonstrated, besides required knowledge teachers also need coherent affective traits (Plutzer et al., 2016). In recent studies, researchers also investigated teaching emotions as part of these traits (Fried et al., 2015). But while environmental psychologists acknowledged emotions as a fundamental part of human cognition (Kals & Müller, 2012), educational researchers have rather focused on cognitive aspects of teacher behavior such as knowledge (Großschedl et al., 2015; Harms & Riese, 2018).

However, because emotions play an important role in teacher behavior, particularly with respect to environmental SSIs (Lombardi & Sinatra, 2013), this dissertation first of all aims to investigate the connection between emotion and motivation:

> **RQ_1:** *Are emotions towards teaching connected to the motivations for specific behaviors?*

Based on these connections, the subsequent question concerns the antecedents of these emotions. Prior studies have shown a variety of contextual variables as connected to teacher behavior in topics of ESD (Atmaca, 2017). But as there is only scarce research for the context of teaching emotions, the dissertation aims to answer the second superordinate research question:

> **RQ_2:** *Which contextual variables may explain the emergence of specific teaching emotions?*

To investigate these two research questions, the dissertation utilizes the model of goal-directed behavior (Perugini & Bagozzi, 2001). This model integrates emotions as the independent variable and

desires as the dependent variable, which are suitable to capture the motivation for specific behaviors. Because it also integrates other relevant variables such as attitudes (Fang, 1996; Fives & Buehl, 2012; van Uden, Jolien M, Ritzen, & Pieters, 2014) and efficacy beliefs (Klassen, Tze, Betts, & Gordon, 2011; Morris, Usher, & Chen, 2017; Zee & Koomen, 2016), we chose this model to inspect the selected superordinate research questions. The following chapter will describe the model and its adaption for the presented studies in further detail.

Theoretical framework

2

2.1. Modelling teacher motivation with the model of goal-directed behavior

Based on the selected superordinate research questions, the theoretical framework of the study was chosen to model pre-service teachers' motivation to teach about different environmental SSIs and include emotions as predictors. While researchers applied different theories to study teaching motivation (Han & Yin, 2016), this dissertation builds on an extended version of the *model of goal-directed behavior* (Perugini & Bagozzi, 2001).

This model descended from the *theory of planned behavior* (Ajzen, 1991), a general socio-psychological model to predict behavioral intentions and behavior based upon attitudes, subjective norms as well as perceived behavioral control. Such theories have been widely adopted to study teaching intentions and behavior (Zint, 2002). But contrary to other general motivation theories like the self-determination theory (Deci & Ryan, 2000) or expectancy-value theory (Wigfield & Eccles, 2000), the MGB explicitly includes goal-directed emotions as predictors of the dependent variables (Perugini & Bagozzi, 2001). These emotions have been found to be connected to motivation (Bagozzi, Baumgartner, & Pieters, 1998). Furthermore, the MGB may be adapted to various behaviors, which could be either teaching a specific context, or protecting the environment (Perugini & Bagozzi, 2001). Finally, components of the MGB like attitudes or perceived behavioral control have already been applied in the context of teaching. Therefore, an integration of these components seems promising.

Concerning the description of the "classical" predictor variables, *attitudes* represent either a positive or negative psychological evaluation of an object or a context (Ajzen, 1991). These psychological evaluations affect teachers' behavior (Jones & Carter, 2007) and may function as filters, frames or guides for teachers (Fives & Buehl, 2012). As described above, the MGB also includes emotions, as second affective evaluation of the investigated behaviors.

Emotions are conceptually short-lived evaluative states to specific stimulus events and trigger multidimensional physiological and psychological responses (Scherer, 2005). Emotions are different to attitudes, as attitudes are usually more stable and do not include the same motivational function and somatic activation than emotions (Moors, 2009; Scherer, 2005). In educational settings, emotions may be concentrated on a variety of different objects. Following the classification of Pekrun and Linnenbrink-Garcia (2014b), emotions can either be triggered by the specific activity (*achievement emotion*), through the processing of information (*epistemic emotion*), by the content (*topic emotion*) or

the social context (*social emotion*). As prior studies showed especially achievement emotions as relevant for teacher behavior (Frenzel et al., 2016), all emotions in the dissertation describe achievement emotions. The emotions towards teaching therefore describe the momentary or anticipated emotional state when fulfilling the respective behavior (Pekrun, 2006). As mentioned in the introduction, discrete emotions allow for a better interpretation and measurement (Jacobs, Fehres, & Campbell, 2012; Keller, Frenzel et al., 2014). Therefore, the dissertation also utilizes a discrete approach to emotions instead of the initially dimensional approach in the original MGB. For the dissertation, we decided for the emotions of enjoyment, anger and fear.

These emotions are described as basic emotions, meaning they are of intercultural interest as they occur in every human culture (Izard, 2007). Furthermore, researchers found connections between these emotions and relevant teaching variables (Frenzel et al., 2016) as well as pro-environmental behaviors (Jacobs, Vaske, Dubois, & Fehres, 2014; Kals & Müller, 2012; Larson, Cooper, & Hauber, 2015). *Enjoyment* describes a positive emotion and is elicited in positively valued situations with medium control (Scherer, 2005). Similar to this, *anger* emerges in negatively valued situations with a medium control, but is also based on frustration (Scherer, 2005). Finally, people experience *fear* in negatively valued situations with a low amount of control (Scherer, 2005). While researchers in the topic of teacher emotions often chose the word "anxiety" to describe fearful emotional reactions (Frenzel et al., 2016), this dissertation explicitly selects the term fear because anxiety points to a more general trait of anxiety and fear always refers to a specific eliciting stimulus (Öhman, 2008). In the dissertation this stimulus will be teaching a particular topic.

Besides these affective variables, the theoretical model includes subjective norms as another classical predictor variable from the TPB. *Subjective norms* refer to a person's beliefs about the current social norms concerning the performance of the behavior (Ajzen, 1991). Also this variable was found as a significant predictor of teaching intentions, even when quantitative studies showed smaller effects than was implied by qualitative studies (Lumpe, Haney, & Czerniak, 1998b; Zint, 2002).

The final predictor of the TPB, *perceived behavioral control* defines the individual's belief about the possibility and difficulty of the specific behavior (Ajzen, 1991). This belief is conceptually related to general self-efficacy beliefs (Bandura, 1977), but more concentrated on the investigated behavior (Ajzen, 2002). Therefore, perceived behavioral control should be understood as "perceived control over performance of a behavior" (Ajzen, 2002, p. 668), and not as the general beliefs about the ability to control their level of functioning and events in their lives, which would be self-efficacy (Ajzen, 2002; Bandura, 1991).

Besides the integration of emotions as the most salient difference between the TPB and the MGB, the MGB further distinguishes between desires and intentions (Perugini & Bagozzi, 2004). *Desires* describe "a state of mind whereby an agent has a personal motivation to perform an action or to achieve a goal" (Perugini & Bagozzi, 2004, p. 71). This state is different to intentions, which were also conceptualized as a capture of motivational factors to perform a given behavior (Ajzen, 1991). But as

empirical results showed, intentions are characterized by a higher perceived performability, action-connectedness and a more emphasized temporal framing (Perugini & Bagozzi, 2004). Therefore, desires may more clearly capture motivation than intentions, which include concrete planning to fulfill the respective behavior at a specific time point.

A final difference between the MGB and the TPB is the integration of *past behavior*. While this integration was a long debate in the framework of the TPB (Ajzen, 2011), past fulfilments of behaviors have shown to predict a variety of behaviors (Carrus et al., 2008; Ouellette & Wood, 1998; Passafaro et al., 2014), which is why the integration also seems reasonable for the dissertation. The final adapted version of the MGB is displayed in Figure 2.1.

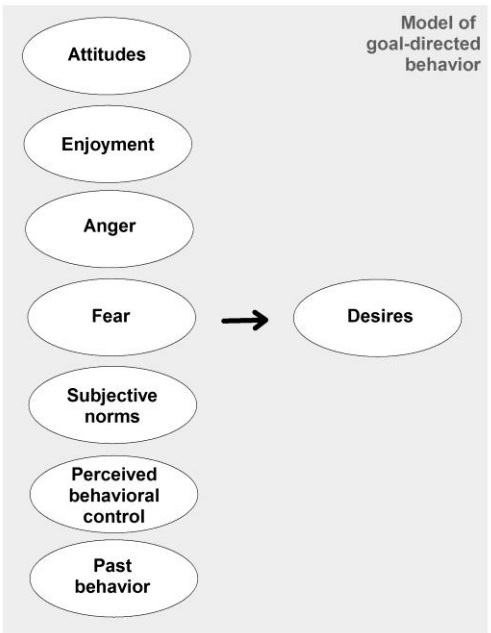

Figure 2.1 Adapted version of the model of goal-directed behavior (Perugini & Bagozzi, 2001) including discrete instead of dimensional emotions.

2.2. Integrating contextual variables

As all variables from the MGB are psychologically integrated into a greater worldview of the specific individual, the predictor variables might be shaped by further underlying psychological variables like values (Homer & Kahle, 1988). This order can be described according to the *theory of cognitive hierarchy*, which proposes deeper variables like values as the foundation of higher order attitudes and behaviors (Whittaker, Vaske, & Manfredo, 2006). These deeper variables are characterized by a generally smaller number, lesser possibility to change and higher generality than the higher order variables (Whittaker et al., 2006). While Whittaker et al. (2006) proposed their hierarchy in the domain of wildlife psychology, several other theories described similar structures in other domains. One example may be the value-belief-norm theory (Stern, 2000), which has also been applied to study

environmental behavior (Menzel & Bögeholz, 2010). Figure 2.2 shows the adaptation of the theory of cognitive hierarchy to the teaching context.

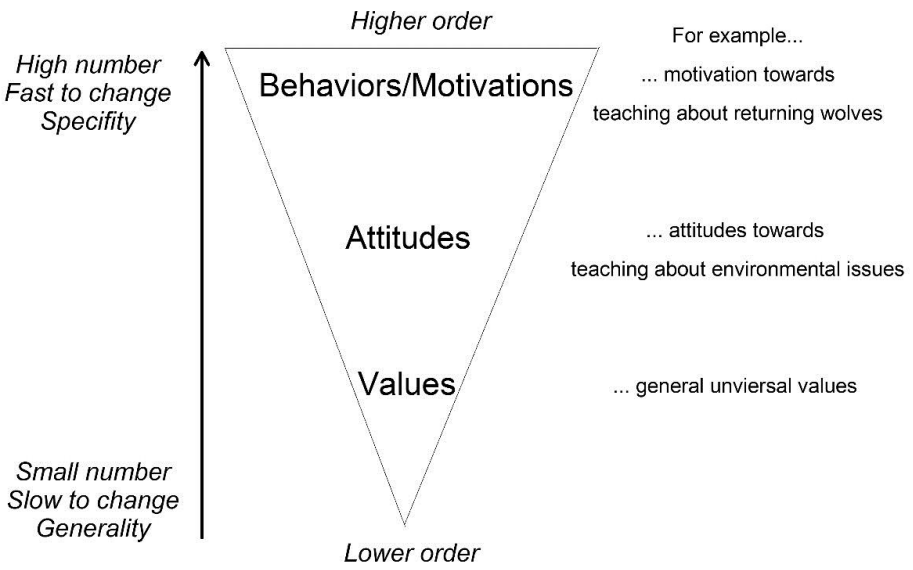

Figure 2.2 Theory of cognitive hierarchy as adapted from Whittaker et al. (2006, p. 517) with examples from the teaching context.

2.3.1. The return of the wolf

As first set of further contextual variabels the dissertations extends the MGB with contextually relevant values, called wildlife value orientations, higher order attitudes toward wolves and finally the protection motivation towards the species.

Wildlife values orientations describe general value orientations towards wildlife and determine higher order attitudes or motivations to protect wildlife species (Fulton et al., 1996). These value orientations can be differentiated in domination or mutualistic orientations. While values of *domination* are characterized by viewing wildlife animals as subordinate to humans, the value dimension of *mutualism* proposes wildlife animals equally valued and connected to humans (Manfredo, Teel, & Henry, 2009). As especially mutualism predicted protection motivation for the species in prior studies (Hermann & Menzel, 2013a), this dimension was included in the overall model of the dissertation. Besides these deep values, the model also includes more specific attitudes and protection motivation, to investigate possible connections with the teaching motivation.

The first more specified variable from the wolf context are attitudes towards the wolf. Similar to the attitudes towards teaching, these attitudes constitute a positive or negative evaluation of objects or contexts (Ajzen, 1991). As these attitudes refer towards the return of the wolf, *the attitudes towards the wolf* denote the positive or negative evaluation of returning wolves. While environmental attitudes play an important role for environmental behavior (Kaiser, Wölfing, & Fuhrer, 1999), prior research in

wildlife psychology found attitudes as one requirement for the acceptance of wildlife policy (Eriksson, Sandström, & Ericsson, 2015) and the general existence of species in a specific area (St John, Edwards-Jones, & Jones, 2011). These attitudes depend on several factors like closeness to wolf territories (Karlsson & Sjostrom, 2007), predation experiences (Ericsson & Heberlein, 2003) or descriptive factors like age and education (Dressel, Sandström, & Ericsson, 2015; Williams, Ericsson, & Heberlein, 2002). Besides these studies on positive attitudes towards wolves, other studies directly investigated protection motivations towards of the wolf, which is why we included this variable as second wolf specific variable.

Generally, *pro-environmental behaviors* are defined as behaviors which harm the environment as little as much or even protect natural resources (Steg & Vlek, 2009). Like described above, the protection motivation may be seen as a direct predecessor of these pro-environmental behaviors (Heckhausen & Gollwitzer, 1987; Perugini & Bagozzi, 2004; Steg, 2016). Pro-environmental motivations may be concentrated on several different behaviors (for example waste recycling, energy conservation or species protection). While the motivations for these behaviors show varying but moderate correlations with each other (Kaiser & Wilson, 2004), more specifically worded measures showed better measurement and prediction abilities (Carmi, Arnon, & Orion, 2014). Therefore, the model includes the *protection motivation towards the wolf* as a specific measure of the motivation towards protecting the species. Besides these wolf specific variables, the model finally includes further more general contextual variables.

2.3.2. Further contextual variables

The first additional contextual variable is psychological distance. *Psychological distance* generally describes the psychologically perceived distance towards objects or events (Liberman & Trope, 2008) and is constructed by four dimensions of temporal, social, geographical as well as hypothetical distance (Liberman & Trope, 2014). While researchers extensively applied this construct to study the perceived distance to climate change (McDonald, Chai, & Newell, 2015), this variable is rather new to the study of educational motivations. But as prior research from science education showed, a smaller perceived distance to specific issues might lead to a higher relevance for teachers and learners (Stuckey et al., 2013). Furthermore, this socio-psychological way of measuring distance to conservation conflicts might better capture the social nature of these conflicts compared to the observed distance as an indicator of closeness to the respective issues which was used in prior studies (Bath & Buchanan, 1989; Dressel et al., 2015; Karlsson & Sjostrom, 2007).

As a final further contextual variable the extended model integrates general values as indicators of world view, following Schwartz' (1994) theory of basic human values. In this theory, a universal and cross-culturally validated set of ten basic values divided in four value clusters lays the foundation of human personality and behavior (Schwartz, 1994). The theoretical model concentrates on values from the cluster of self-transcendence, as the values of universalism and benevolence have been found to be

motivationally relevant for environmental behavior (Menzel & Bögeholz, 2010; Schultz, 2005). While the cluster of *self-transcendence* emphasizes the "acceptance of others as equals and concern for their welfare" (Schwartz, 1994, p. 25), *universalism* describes an "understanding, appreciation, tolerance, and protection for the welfare of all people and for nature" (Schwartz, 1994, p. 22). Finally, *benevolence* furhter concentrates on the interpersonal dimension of self-transcendence and describes the value of "preservation and enhancement of the welfare of people with whom one is in frequent personal contact" (Schwartz, 1994, p. 22).

The full set of variables of the dissertation is displayed in Figure 2.3.

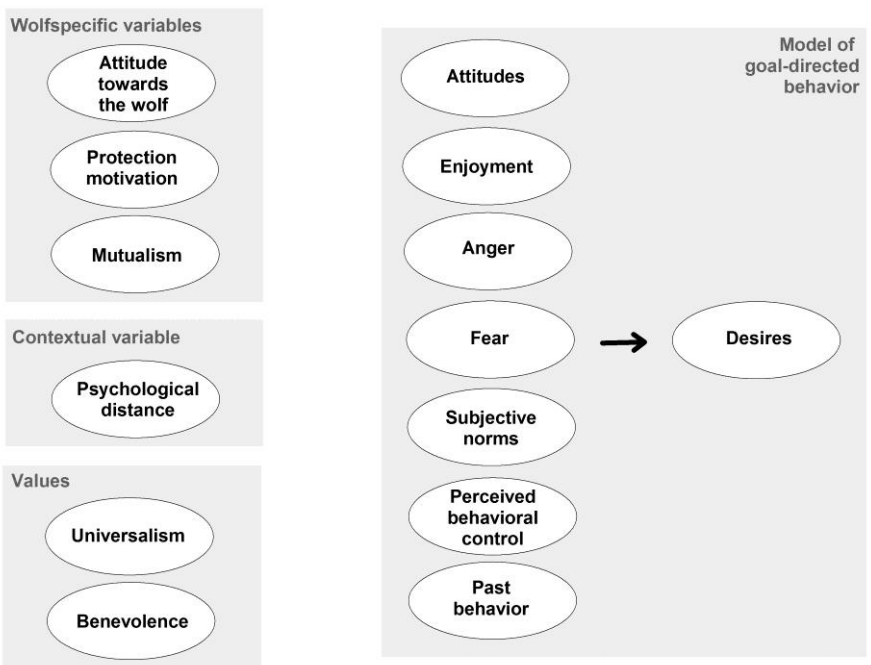

Figure 2.3 Full theoretical framework of the dissertation, divided into variables from the model of goal-directed behavior, wolfspecific variables, psychological distance as contextual variable and values.

Research foci and study design

3

Overall, this dissertation includes data from three studies to investigate the two major research questions of describing connections between emotions and motivation (research focus I) and the explanation of determining factors for emotions (research focus II). Besides the three presented studies further studies were conducted to get a deeper understanding of teaching emotions. Figure 3.1 gives an overview of all studies.

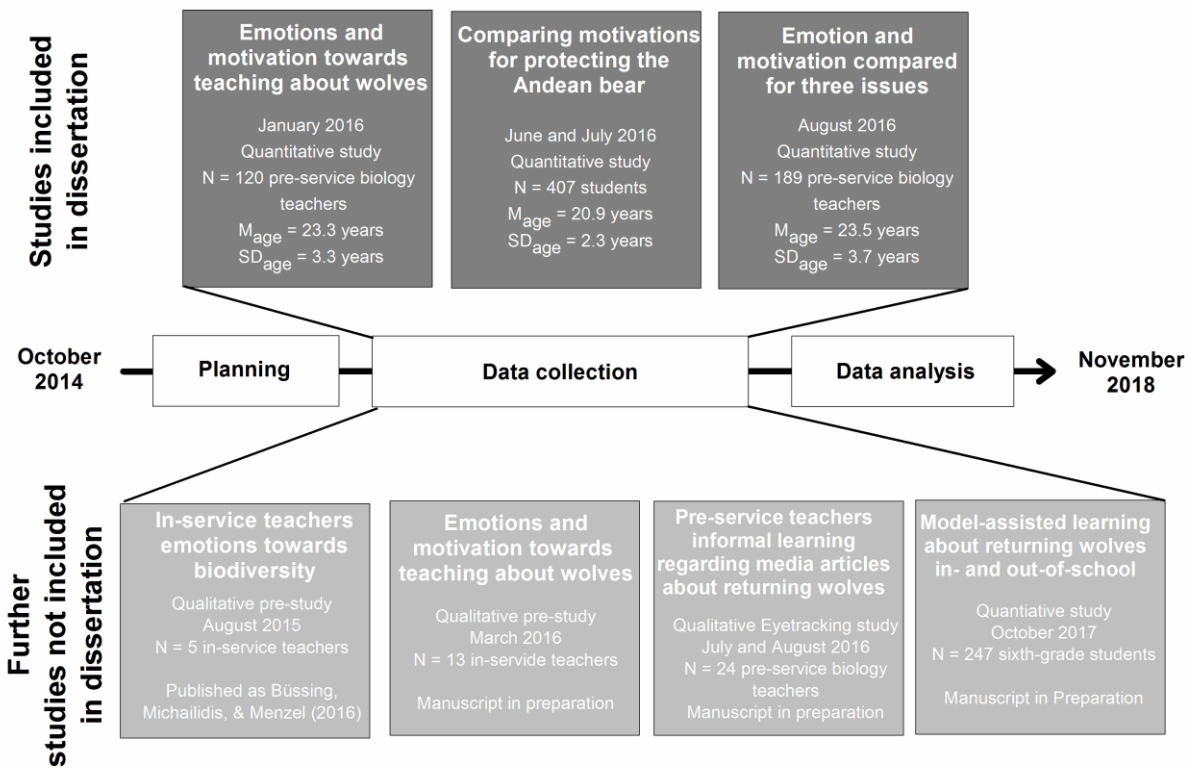

Figure 3.1 Overview of studies related to the dissertation with included studies in dark gray and further not studies in bright gray.

3.1. Connection between emotions and motivation

While emotions can be strong motivators of action (Dolan, 2002; Lench et al., 2011), only scarce studies investigated this motivational function of emotions in education (Fried et al., 2015; Sutton & Wheatley, 2003). But studies from environmental psychology showed clear connections between emotions and the motivation for behaviors like public transportation and recycling (Carrus et al., 2008; Passafaro et al., 2014) or to visit a nature-based festival (Song, Lee, Kang, & Boo, 2012). Because a further understanding of teaching motivation for SSIs is needed, the first research focus of the

dissertation concentrates on the connection of emotion and motivation, with emotions as independent variables for motivation (Figure 3.2).

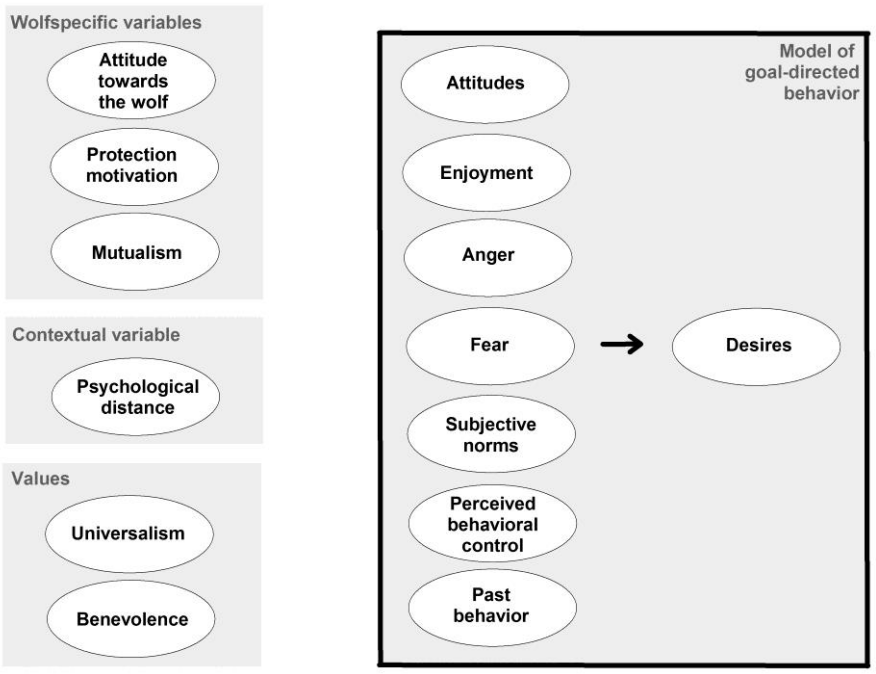

Figure 3.2 Research focus I: The connection of emotions and motivation in comparison to other behaviorally relevant variables.

3.1.1. Teaching motivation (Chapter 4.1)

To test the connection of teaching emotions and motivation to teach, the first study of the dissertation adapted the model of goal-directed behavior to teaching about the context of returning wolves. For this purpose, 120 pre-service biology teachers were surveyed at the end of January 2016 with a paper-pencil questionnaire (**Study 1**; N = 120, M_{age} = 23.3 years, SD_{age} = 3.3 years, 82.4% female; Questionnaire 1). Specifically, this study aimed at three research questions:

> **RQ_1:** Which discrete emotions do pre-service biology teachers anticipate the most when thinking about teaching the return of the wolf?
>
> **RQ_2:** Are the anticipated discrete emotions towards teaching the return of the wolf connected to motivational factors?
>
> **RQ_3:** What role do the anticipated discrete emotions play as predictors of teaching motivation when compared to other motivational factors?

The study found the positive emotion of enjoyment towards teaching as the most prevalent anticipated emotion. Furthermore, enjoyment substantially predicted the desires to teach in combination with attitudes and perceived behavioral control towards teaching. Finally, we found an interesting connection of enjoyment and perceived behavioral control towards teaching. Further information and the detailed results are described in chapter 4.1.

3.1.2. Pro-environmental motivation (Chapter 4.2)

To get a deeper insight in the connection of emotions and motivation, the second study of the research focus I investigated this connection in three specific wildlife protection behaviors. This further abstraction from the teaching context allows for the comparison of teaching and protection motivation. To enable such a comparison, we selected the biodiversity protection case of the Andean bear (*Tremarctos ornatus*) in Ecuador, based on the similarities of the context to the return of the wolf in Germany. The study was conducted in June and July 2016 at the University of Cuenca (Ecuador), by surveying 407 Ecuadorian students about their motivations to promote the protection of the species in social media, through money donation or through volunteering (**Study 2**; N = 407, M_{age} = 20.94, SD_{age} = 2.25 years, 61.2% female; Questionnaire 2). The study specifically examined the following hypotheses and research questions:

> **H_1:** There will be differences between the motivation to like for the protection of the Andean bear on a social network compared to the motivations to donate or volunteer for the protection of the species.
>
> **H_2:** There will be differences between the past behaviors of liking for the protection of the Andean bear on a social network compared to the past behaviors of donating money or volunteering for the protection of the species.
>
> **RQ_1:** Which factors are the motivationally relevant variables for predicting the motivation to like for the protection of the Andean bear on a social network?
>
> **H_3:** The motivation to like for the protection of the Andean bear in social media will be connected to the motivation to donate money and to volunteer for the protection of the species.

Overall, the participants reported the highest motivation for the protection of the species in social media, followed by volunteering and money donation. These differences in the motivation for the protection behaviors could be explained by controlling the independent variables while varying the dependent variables. In the selected regression models, only the variable of enjoyment predicted a substantial amount of variance in all three behaviors. Gender and perceived behavioral control emerged as main differences between the behaviors. Finally, liking showed to be an easy pathway to more pronounced forms of environmental action. The detailed results are described and discussed in chapter 4.2.

3.2. Contextual variables in the context of returning wolves

As a part of the bigger investigation of teaching emotions, the subsequent research focused on explaining the underlying appraisal dimensions of teaching emotions. In particularly, the studies concentrated on explaining the occurrence of enjoyment as the most prevalent positive emotion. This emotion was found as motivationally relevant emotion in research focus I and is important for student learning (Frenzel, Goetz, Lüdtke et al., 2009). In this view, enjoyment towards teaching is examined as

dependent variable, and contextual variables are tested for their ability to predict this emotion in several different contexts (Figure 3.3).

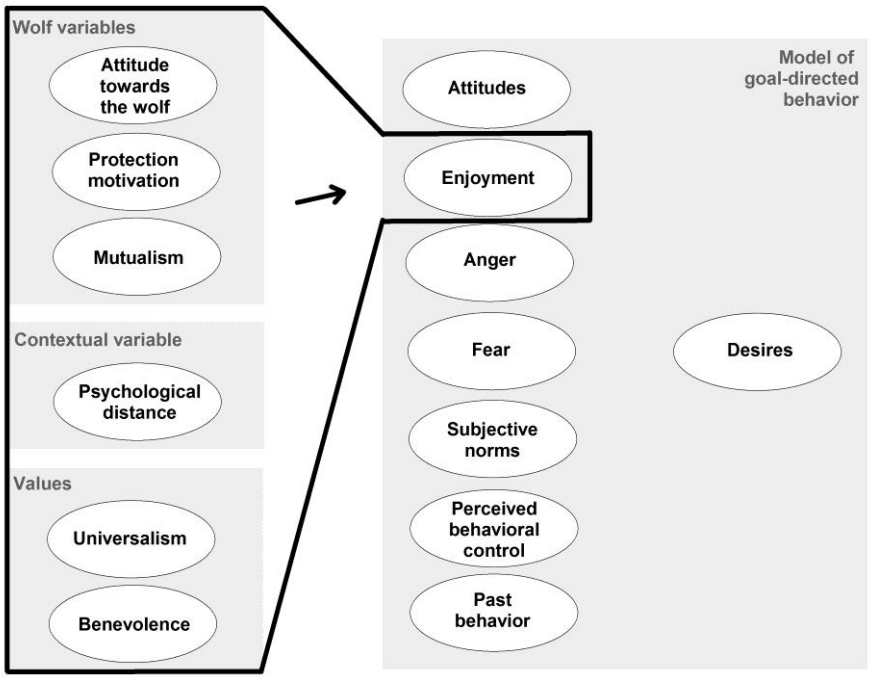

Figure 3.3 Research focus II: Explaining enjoyment towards teaching with further underlying contextual variables.

3.2.1. Enjoyment towards teaching about returning wolves (Chapter 4.3)

Using the data set from the first study (**Study 1**; N = 120, M_{age} = 23.3 years, SD_{age} = 3.3 years, 82.4% female; Questionnaire 1), we tested the motivational relevance of wolf specific constructs like mutualism, attitudes, or protection motivation towards the wolf. As dependent variables, we selected enjoyment, attitudes, and also perceived behavioral control towards teaching, due to their significant effects on teaching motivation (see Chapter 4.1). We finally integrated the variable of psychological distance, as prior research and additional interviews indicated differences between teachers who feel affected by the return of the wolf and those who do not. Overall, the study concentrated on one superordinate research question:

> **RQ:** What contextual and personality variables are motivationally relevant for pre-service teachers' motivation towards teaching about the return of the wolf?

Based on the extended model of the dissertation, the chapter hypothesizes the specific contextual variables as predictors of the dependent variables:

> **H_1:** Protection motivation is positively connected to the attitudes, enjoyment, as well as the perceived behavioral control towards teaching about returning wolves.

> **H_2:** Attitudes towards the wolf are positively connected to the attitudes, enjoyment, as well as the perceived behavioral control towards teaching about returning wolves.

H_3: The wildlife value dimension mutualism is positively connected to the attitudes, enjoyment, as well as the perceived behavioral control towards teaching about returning wolves.

H_4: Psychological distance is negatively connected towards the attitudes, enjoyment and perceived behavioral control towards teaching about returning wolves.

While according to our hypotheses mutualism laid the foundation of all other wolf specific variables, protection motivation and psychological distance were the most vital direct predictors for the dependent variables. The results concerning this investigation are described and discussed in chapter 4.3.

3.2.2. Comparison of different contexts (Chapter 4.4)

While the return of the wolf showed to be a very distinct context based on the effects of the contextual variables like protection motivation and psychological distance, the subsequent question was the comparison to other contexts. This context-dependence is salient for the overall context of the dissertation, as motivation may never be isolated from the specific context (Eccles & Wigfield, 2002). Therefore, the third and final study concentrated on comparing different contexts concerning values and psychological distance as predictors of enjoyment towards teaching (**Study 3**; N = 189, M_{age} = 23.45, SD_{age} = 3.71 years, 73.5% female; Questionnaire 3). This study included three different teaching contexts (return of the wolf, climate change and pre-implantational genetic diagnosis) and investigated how far the basic human values of universalism and benevolence as well as psychological distance and knowledge were connected to the enjoyment towards teaching about the issues. The study examined two central research questions:

RQ_1: Are universal values of universalism and benevolence predictors of the enjoyment towards teaching the contexts of returning wolves, climate change or pre-implantational genetic diagnosis?

RQ_2: Is psychological distance towards the issues a predictor of enjoyment towards teaching?

As for the prior chapter, we also proposed specific hypotheses based on the theoretical framework:

H_{1A}: Universalism positively predicts enjoyment towards teaching about the ecological topic of returning wolves.

H_{1B}: Psychological distance towards the return of the wolves negatively predicts the enjoyment towards teaching about the topic.

H_{2A}: Universalism positively predicts enjoyment towards teaching about the ecological topic of climate change.

H_{2B}: Psychological distance towards climate change negatively predicts the enjoyment towards teaching about the topic.

H_{3A}: Benevolence positively predicts enjoyment towards teaching about the health topic of pre-implantational genetic diagnosis.

H_{3B}: Psychological distance towards the return of the wolves negatively predicts the enjoyment towards teaching about the topic.

While psychological distance predicted the enjoyment towards teaching for every context, universalism only predicted the enjoyment towards teaching within the ecological topics of returning wolves and benevolence only within the health-based topic of pre-implantational genetic diagnosis. Furthermore, the means for psychological distance differed significantly between the selected contexts. The further results of this final study are described in chapter 4.4.

Empirical part

4

The empirical part of this cumulative dissertation includes manuscript versions (pre-print) of the following peer-reviewed journal articles, with me as a lead author:

For the final version please check the journal homepage, google scholar or use the DOIs provided in the beginning of the corresponding dissertation chapters.

4.1. Emotions and pre-service teachers' motivation to teach the context of returning wolves[7]

Abstract

Biodiversity issues can fruitfully be adopted as contexts of Education for Sustainable Development (ESD), as they involve ecological, economic and social dimensions. But as these contexts are demanding to teach, we need to know more about motivational factors to determine how teacher education should be conducted to lead to motivated teachers. To study this, we employed a quantitative paper-and-pencil questionnaire and surveyed 120 pre-service biology teachers (M_{age} = 23.2 years, SD = 3.3) based on the model of goal-directed behavior (MGB). Enjoyment towards teaching the topic was more frequently reported than fear and anger. The anticipated enjoyment correlated positively and anger negatively with the desires to teach. In a structural equation model, attitudes, enjoyment and perceived behavioral control (PBC) significantly predicted the desires to teach and should therefore be fostered in environmental teacher education. Furthermore, we found an interesting connection between PBC and enjoyment, which is further discussed in the paper.

Keywords

Emotion; motivation; education for sustainable development; affective domain; the return of the wolf

[7]Büssing, A.G., Schleper, M., Menzel, S. (2018). Emotions and pre-service teachers' motivation to teach the context of returning wolves. *Environmental Education Research*. doi:10.1080/13504622.2018.1487034

Introduction

The return of the wolf as a biodiversity protection case

The return of the wolf represents one example for a recent and controversially discussed biodiversity issue in Europe and recently in Germany (Chapron et al., 2014; Thomas, 2015). After being absent for more than 100 years, individuals of the grey wolf (*canis lupus*) naturally migrated into eastern regions of the country and are spreading further westwards (Landesjägerschaft Niedersachsen e.V., 2016). This generates conflicts, as these regions are densely populated (Ronnenberg et al., 2017).

While several examples show the possibility of successful coexistence between wildlife and humans in human-dominated landscapes (Chapron et al., 2014), the issue remains a controversial topic (Jürgens & Hackett, 2017). The return of large predators into the ecosystems positively affects the local biodiversity (Estes et al., 2011), but herds are not always properly protected, so wolves may harm livestock (Imbert et al., 2016). This seems especially problematic in the federal state of Lower Saxony in North-Western Germany. Besides the dense population (Ronnenberg et al., 2017), this part of Germany has the highest density of livestock units in the country (Kastens & Newig, 2007; Statistische Ämter des Bundes und der Länder, 2018). Owning livestock and the attachment to the animals is negatively connected to the attitudes towards the wolf (Vittersø, Kaltenborn, & Bjerke, 1998). Resolving this conflict is essential to ensure the future of the species in the region as well as in other similarly populated countries (Randi, 2011). This high dependence of the conservation on human activities labels the issue as especially suitable for biodiversity education (Grace, 2009). While the wolf population also spreads in other parts of Europe (Enserink & Vogel, 2006), similar wildlife protection cases, where the ecological conservation of a predatory species contradicts with human interests based on economic and social conflicts can be found in all parts of the world (Espinosa & Jacobson, 2012; Sakurai, Jacobson, Matsuda, & Maruyama, 2014; Skupien, Andrews, & Larson, 2016).

Education for Sustainable Development (ESD) using wildlife conservation issues

Wildlife conservation issues like the return of the wolf include various dimensions of conflict. For the persistent existence of such conflicting species, conservation attempts have to address the human needs (Nyhus, 2016). In connection with social sciences, successful species conservation always includes economical and social impacts, besides the ecological dimension (Redpath et al., 2013; Treves & Karanth, 2003). These dimension are also central in *Education for Sustainable Development* (ESD; Landorf, Doscher, & Rocco, 2008). Using this approach for teaching environmental topics, the return of the wolf can be adopted as an issue in subjects like biology (Hermann & Menzel, 2013b) or economics and politics (Trouwborst, 2010).

Besides an understanding of the declining biodiversity on a global scale, knowledge about local biodiversity represents one learning objective of the *Sustainable Development Goals* (SDG; United Nations, 2017). Biodiversity conservation issues like the return of the wolf have a local as well as a

global dimensions (Madden, 2004), and can therefore contribute to such knowledge. Furthermore, biological conservation issues can be used to develop students' decision-making about biodiversity (Grace, 2009). Hence, implementing these issues into education may also foster students' understanding of biodiversity (Menzel & Bögeholz, 2009).

Despite this, teaching such issues can be difficult for educators (Lowan-Trudeau, 2018). Possible reasons are the controversial nature of the issues (Kyburz-Graber, Hofer, & Wolfensberger, 2006), the inherent factual and ethical complexity (Sadler, Amirshokoohi, Kazempour, & Allspaw, 2006) or problems with the understanding of the concept of biodiversity (Fiebelkorn & Menzel, 2013). Furthermore, (future) teachers sometimes worry that they may influence pupils with their own particular views (Cross & Price, 1996). Even when teachers are generally motivated to teach biodiversity issues (Gayford, 2000), such subjectively perceived barriers may affect teaching behavior. For example in the subject of biology, teachers sometimes avoid ethical problems by concentrating on biological content rather than addressing social problems (Tidemand & Nielsen, 2017).

Motivation is a central topic in teaching ESD (Mulder et al., 2015). Therefore, this raises the question of which personality factors are connected towards teaching motivations for topics of biodiversity conservation. Such information may help to shape teacher education, as the results could be used to design higher education with the goal of encouraging teachers to include such issues in their teaching.

Teaching motivation and emotions

Researchers investigated teacher motivation using a variety of methods and theories (Han & Yin, 2016), and found several connections to educationally relevant constructs, like students interest (Keller et al., 2017). In terms of teaching motivations for societal and environmental issues, some studies indicate that external factors, like local school culture (McGinnis & Simmons, 1999) or initial teacher education (Cross & Price, 1996) contribute to a willingness to teach. Nonetheless, internal values and ideals are more important in the teacher's decision to adopt certain topics (Lee & Witz, 2009; McNeal, Petcovic, & Reeves, 2017). Emotions represent such internal factors.

Discrete emotions are connected to changes in cognition, judgement and behavior (Bagozzi et al., 1998; Lench et al., 2011). Therefore, emotions have also been suggested to be connected to teaching motivation (Keller, Frenzel et al., 2014; Linnenbrink, 2006). This seems logical, as positive emotions like interest and enjoyment fulfil relevant regulatory functions for developing self-determined and intrinsic motivation (Ryan & Deci, 2000). But also negative emotions like anger, fear and anxiety are motivationally relevant (Smith & Lazarus, 1993). Therefore, a recent model for teaching emotions outlines motivation as one key function of emotions (Fried et al., 2015). As affective connections are one requirement for protection motivations in environmental issues and successful ESD (Littledyke, 2008; Ojala, 2013; Sothmann & Menzel, 2017), issues of sustainable development are interesting for such an investigation.

While researchers investigated emotions of teachers as well as school students (Pekrun & Linnenbrink-Garcia, 2014a), empirical results for the group of pre-service teachers, especially in the domain of biology education, are scarcely available. As higher education plays a major role for the integration of sustainability into the society (Didham & Ofei-Manu, 2015) and environmental literacy (Arnon, Orion, & Carmi, 2015), knowledge about emotion and motivation of this group could be useful for teacher education.

Research aim

In the light of the aspects mentioned above, we were interested in the anticipated emotions of pre-service biology teachers towards teaching the return of the wolf, as well as their connections to motivational variables. Specifically, we addressed the following research questions:

> **RQ_1:** Which discrete emotions do pre-service biology teachers anticipate the most when thinking about teaching the return of the wolf?
>
> **RQ_2:** Are the anticipated discrete emotions towards teaching the return of the wolf connected to motivational factors?
>
> **RQ_3:** What role do the anticipated discrete emotions play as predictors of teaching motivation when compared to other motivational factors?

Theoretical background and hypotheses

Attitude-behavior theories like the theory of planned behavior (Ajzen, 1991) are commonly applied to study environmental and teaching behavior (Dillon & Gayford, 1997; Heimlich & Ardoin, 2008; Zint, 2002). The framework of our study is based on the model of goal-directed behavior (Perugini & Bagozzi, 2001), which is a further development of the TPB.

The MGB includes the same influencing factors as the TPB, namely attitudes, subjective norms and perceived behavioral control (PBC). *Attitudes* can be defined as psychological evaluations of objects or contexts, which can be either positive or negative (Perugini & Bagozzi, 2001). In previous research, attitudes were found to be an important antecedent of teaching intentions (Zint, 2002). *Subjective norms* refer to a person's beliefs about social norms concerning the performance of the behavior (Ajzen, 1991). In earlier quantitative studies, this factor seemed to play a role in explaining teaching intentions – although to a smaller extent, since it either served as a relatively weak predictor of teaching intentions or showed no effect at all (Lumpe et al., 1998b; Zint, 2002). *PBC* refers to the individual's beliefs about the possibility and difficulty of the particular behavior and is thus conceptually similar to the concept of self-efficacy (Ajzen, 1991; Bandura, 1977). PBC showed significant effects on teaching intentions in many studies, and was sometimes even the strongest factor (Lumpe et al., 1998b; Zint, 2002).

The MGB assumes positive and negative anticipated emotions as additional variables for predicting behavioral desires (Perugini & Bagozzi, 2001). While the original MGB proposes a

dimensional approach with measures for positive as well as negative emotions, prior research in teaching emotions favored discrete emotions over this dimensional approach (Keller, Frenzel et al., 2014). In the context of teaching, especially teachers' enjoyment, anger and anxiety showed connections to educationally relevant constructs. For example correlated anger and anxiety negatively with job satisfaction, while enjoyment is positively connected to this internal factor and also affects external variables like student ratings of positive teacher behavior (Frenzel et al., 2016). Therefore we selected these three discrete emotions for our investigation.

While emotions in educational contexts can either be prospective, retrospective or concentrated on the activity, *enjoyment* is elicited in positively valued events with a high level of control (Pekrun, 2006). Enjoyment is one of the most frequent reported teaching emotions, but negative emotions are also integral part of teaching (Frenzel, 2014). *Fear* could sometimes not clearly be distinguished from anxiety (Öhman, 2008). Yet we treated fear as distinct from anxiety, because fear has 'an identifiable eliciting stimulus' (Öhman, 2008, p. 710). Being confronted with the idea of teaching a relatively unfamiliar topic can be such a threatening stimulus. While fear has its core in a possible danger or threat situation, *anger* is based mostly on blaming others (Smith & Lazarus, 1993). Anger could be elicited due to a missing understanding why the return of the wolf should be addressed in education, and blaming for example curriculum developers for this.

Different than the TPB, the MGB defines *desires* as precursors of behavioral intentions. Desires 'represent the motivational state of mind wherein appraisals and reasons to act are transformed into a motivation to do so' (Perugini & Bagozzi, 2001, p. 84). They are the direct determinants of intentions and are characterized by a lower performability and action-connectedness than behavioral intentions (Perugini & Bagozzi, 2004). As our pre-service teachers were not in a real but anticipated teaching situation, the differentiation between desires and intentions seems problematic. Therefore we concentrated on the factor of desires as the dependent variable.

The proposed model and the hypothesized connections between the variables are shown in Figure 4.1.

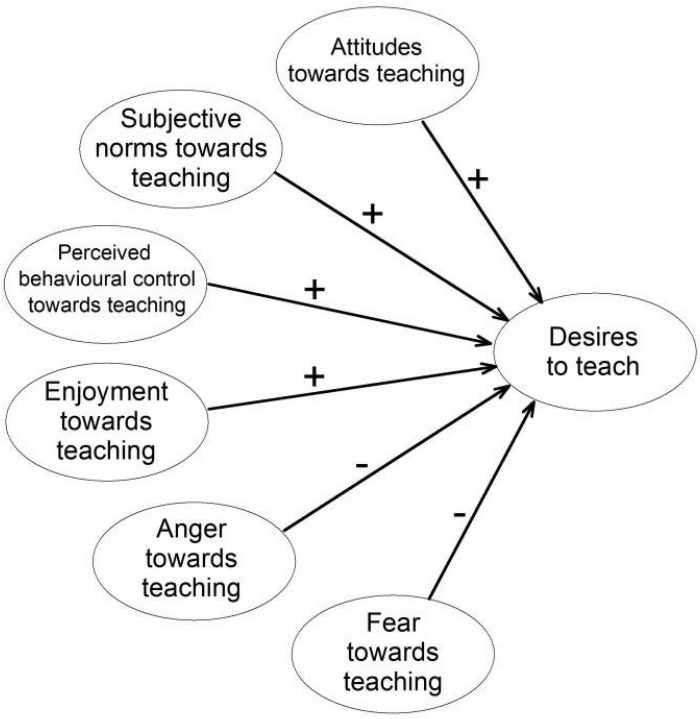

Figure 4.1 Hypothesized model of goal-directed behavior (MGB) for the desires to teach the return of the wolf.

Methods

Research design

As we were interested in measuring connections of variables between participants, we designed a cross-sectional quantitative study, with a self-completion paper-and-pencil questionnaire (Bryman, 2008). As we were only interested in how the selected variables we designed no specific intervention, and did not integrate the questionnaire in a specific teaching situation.

The questionnaire included scales derived from the MGB (attitudes, subjective norms, PBC, desires) and measures for the selected discrete emotions of enjoyment, anger and fear. Besides this, we also measured context-specific variables about the return of the wolf like attitudes toward the wolf, which are connected to protection motivations in wildlife contexts and could therefore also be connected to the teaching motivation (Dressel et al., 2015). The results concerning these scales are presented in a related paper (Büssing, Schleper, & Menzel, forthcoming). The original questionnaire was distributed in German; all the excerpts cited here were translated into English for the purpose of this paper.

Measurement of the variables

To measure the variables of the MGB, we adapted existing scales from a publication about the model to the teaching context (Song et al., 2012). We aimed to keep the adapted text close to the original version, by only replacing the respective objects of the sentences.

As mentioned above, attitudes are positive or negative evaluations of objects or contexts. In the questionnaire, we presented three positive evaluations of the situation of teaching the context of returning wolves. An example item is 'It would be good if the topic 'the return of wolves to Germany' was taught in biology class'. To measure subjective norms, we asked if the participants thought that the majority of people would support teaching the context of returning wolves, as subjective norms represent the perceived norms of other persons about the intended behavior. An example item was 'The majority of people think it would be right to teach about the return of the wolves to Germany in biology class'. PBC measures one`s efficacy belief of successfully executing a particular behavior, thus, we addressed the pre-service teachers' subjectively perceived possibilities of teaching the chosen context. 'I would have the possibility to teach about the return of wolves to Germany at my future school' is an example item. To measure desires, we chose 'would like', as this verb represents a lower performability (Perugini & Bagozzi, 2004). 'I would like to teach about the return of wolves to Germany in biology classes' is an example item for measuring desires. All the items were worded as statements and measured on a 6-point scale that ranged from 'I do not agree' (rating: 0) to 'I fully agree' (rating: 6) to constitute a Likert scale (Bryman, 2008).

For an enhancement of the validity of the scales, we used three items per construct (Bryman, 2008). The formulation of these items was based on different situations where the intended construct could be situated. This means that for the corresponding variables (attitudes, subjective norms, PBC and desires), we formulated one item for teaching in biology classes, one item in a general school context and one item for an extracurricular project week. This resulted in 12 items for the MGB scale.

To measure the prospective emotions towards teaching, we adapted the fourth version of the Differential Emotions Scale (DES-IV; Izard, Libero, Putnam, & Haynes, 1993). This instrument measures emotions according to the discrete emotions theory (Izard, 2009), which we selected as a theoretical foundation for the study. As a stimulus we presented an introductory sentence, which was 'If I imagine teaching the topic 'the return of wolves' in biology class, I feel ...'. Participants were then asked to rate their agreement to experiencing the respective emotion on a 6-point scale that ranged from 'I do not agree' (rating: 0) to 'I fully agree' (rating: 6). While 'happy' is one example for the enjoyment scale, 'annoyed' represents an example indicator for anger and 'worried' is an example for the fear scale. While these items are coherent with similar instruments like the teacher emotions scale (Frenzel et al., 2016), we nonetheless selected the DES-IV based on our theoretical foundation in discrete emotions theory (Izard, 2009). Here again, each emotion was measured using three indicators, which resulted in 12 items for the emotion scale.

Sample

The questionnaires were distributed at the end of January 2016 to pre-service teachers at one German university in Lower Saxony, a federal state in the North-West of the country. Prior to the study, several sightings of wolves had been reported in Northern Germany (Landesjägerschaft Niedersachsen e.V., 2016).

The overall sample consisted of 120 pre-service biology teachers, with 98 females (82.4%), 21 males (17.5%). One participant did not report the corresponding gender but remained in the sample as gender was not specifically investigated in the reported study. The participants' ages ranged from 19 to 38 years (M = 23.2, SD = 3.3). The majority of participants were enrolled at the bachelor level (78.9%), the others in their master studies (21.1%; a specialized master´s degree in teacher education is a requisite to become a teacher in Germany). The share of male and female participants reflects common gender distributions in the desired population of pre-service biology teachers (DeMauro & Jennings, 2016). We recruited the participants due to their presence in lectures and courses of their biology teacher education, but did not include a specific teaching situation. As we applied no further methods of randomization, the sample therefore represents a convenience sample (Bryman, 2008).

Based on a power analysis with a significance level of .05, the sample ensures a sufficient statistical power (.80) for medium to small effect sizes (Cohen, 1992).

Statistical Analysis

In a first step, we performed a confirmatory factor analysis (CFA) to ensure the convergent and discriminant validity of all scales (Brown, 2015). As an additional measure of consistency we used Cronbach's Alpha. Based on the CFA we calculated the mean scores for the further analysis. After this, we tested for differences in the elicitation of the anticipated emotions (RQ_1). After inspecting the correlational results between the variables (RQ_2), we calculated a structural equation model (SEM) in which we included the discrete emotions that correlated with the dependent variable (RQ_3).

We computed the CFA and SEM using the software Mplus 7.3 (Muthén & Muthén, 2017). As indicated by the skewness and kurtosis of several variables, the data violated the assumption of normality (see significant kurtosis and skewness in table 4.1). We therefore used a robust maximum-likelihood estimator for all calculations (Muthén & Muthén, 2017). As recommended by Kline (2016), we evaluated the model fit by combining the fit indices of the chi-square test, root mean square error of approximation (RMSEA), Bentler Comparative Fit Index (CFI) and the standardized root mean square residual (SRMR). A sufficient model fit is indicated by a RMSEA less than or equal to .08, a CFI more than or equal to .95 and an SRMR under or equal to .08.

Concerning the descriptive statistics of the factors and the difference tests, we used the program IBM SPSS Statistics 24.0. Due to the non-normal distribution of some variables we used nonparametric tests, namely the Friedman´s ANOVA for more than two groups and the Wilcoxon signed-ranks test for

post-hoc analyses of a significant Friedman´s ANOVA (Field, 2018). Additionally, we converted the resulting z-scores from the nonparametric tests into effect sizes *r* for better interpretation (Field, 2018, p. 550). All the presented values are standardized values.

Table 4.1 Overview of correlations and descriptive statistics of all variables.

Variable	1	2	3	4	5	6	7
1. Attitudes	-						
2. Subjective norms	.35***	-					
3. PBC	.41***	.35***	-				
4. Desires	.67***	.43***	.65***	-			
5. Enjoyment	.63***	.30***	.55***	.72***	-		
6. Anger	-.27**	.05	-.25**	-.36***	-.45***	-	
7. Fear	-.19*	-.02	-.12	-.16	-.26**	.63***	-
M	4.38	3.56	3.86	3.95	3.91	1.81	2.18
Median	4.33	3.66	4.00	4.00	4.00	1.66	2.33
SD	.90	.91	.98	1.10	.94	.88	.87
Skewness	-.52*	-.35	-.68**	-.54*	-.61**	1.06***	.09
Kurtosis	1.38**	.39	1.08*	.82	1.21**	1.21**	-1.04*
α	.86	.91	.84	.92	.92	.94	.76

Note. * = p < .05, ** = p < .01, *** = p < .001. PBC = Perceived behavioral control, α = Cronbachs' Alpha. Significant Skewness and kurtosis indicate a significant deviation from normality (Field, 2009).

Measurement results of the CFA and model modification

The first unmodified estimation of the data led to an unacceptable fit of the CFA model, with fit values not meeting the selected criteria (χ^2 = 455.50 (168, .00), RMSEA = .12, CFI = .86, SRMR = .10). A further inspection indicated loading problems with some of the items, which concerned all items that asked for the project weeks and the first item of the PBC scale. The inspected items showed several inter-correlations with other items.

We decided to modify the measurement model based on theoretical and empirical justifications (Brown, 2015; Kline, 2016). To cover the residual variance of the indicators we added correlations between the items for the extracurricular project activity. Finally, we added correlations from the first item of the PBC scale to the factors of attitudes, PBC and desires. These small modifications led to a good model fit, with χ^2 = 214.03 (159, .00), RMSEA = .06, CFI = .97, SRMR = .05, which indicates sufficient discriminant validity of the scales (Brown, 2015). The values of Cronbachs' Alpha supported this interpretation, as all proposed factors showed an acceptable internal consistency with values above .7 (Field, 2018). Therefore, we accepted the model under the given modifications and continued with the further analysis.

Results

Frequency of reported anticipated emotions

Enjoyment towards teaching the return of the wolf was the most frequently anticipated discrete emotion (*M* = 3.91, *SE* = .09, *Mdn* = 4.00) followed by fear (*M* = 2.18, *SE* = .08, *Mdn* = 2.33). Anger (*M* = 1.81, *SE* = .08, *Mdn* = 1.67) was the least anticipated discrete emotion (Table 4.1 and Figure 4.2).

While the difference between all three emotions was statistically significant (χ^2 (2) = 141.926, p < .001), the post hoc Wilcoxon-tests showed that enjoyment was significantly more often elicited than anger (Z = -8.537, p < .001, r = -.78) as well as fear (Z = -8.517, p < .001, r = -.78) with large effect sizes. Concerning fear and anger, fear was significantly more often elicited than anger, with a medium effect size (Z = -5.174, p < .001, r = -.47).

Figure 4.2 Boxplots illustrating the distribution and differences between the anticipated emotions. ***p < .001.

Connections of anticipated emotions and desires

Correlational analyses indicated significant relationships between the measured variables (table 4.1). While attitudes (*r* = .67, *p* < .001) and PBC (*r* = .65, *p* < .001) correlated strongly with desires, the other variables correlated to a medium amount. Subjective norms were stronger correlated to desires (*r* = .43, *p* < .001) than to PBC (*r* = .35, *p* < .001) and attitudes (*r* = .35, *p* < .001). Attitudes and PBC correlated also to a medium amount (*r* = .41, *p* < .001).

Concerning connections between the MGB variables and the discrete emotions, enjoyment correlated with more variables than the negative discrete emotions. Enjoyment correlated strongly with

desires (r = .72, p < .001), attitudes (r = .63, p < .001) and PBC (r = .55, p < .001) as well as to a medium amount to subjective norms (r = .30, p < .001). The negative emotion of anger correlated negatively with a medium effect size with desires (r = -.36, p < .001), attitudes (r = -.27, p < .01) and PBC (r = -.25, p < .01). Fear showed only one small negative correlation to attitudes (r = -.19, p < .05).

The discrete emotions also correlated among each other: While fear and anger correlated highly positive with each other (r = .63, p < .001), enjoyment showed a medium negative correlation to anger (r = -.45, p < .001) and a small correlation to fear (r = -.26, p < .01).

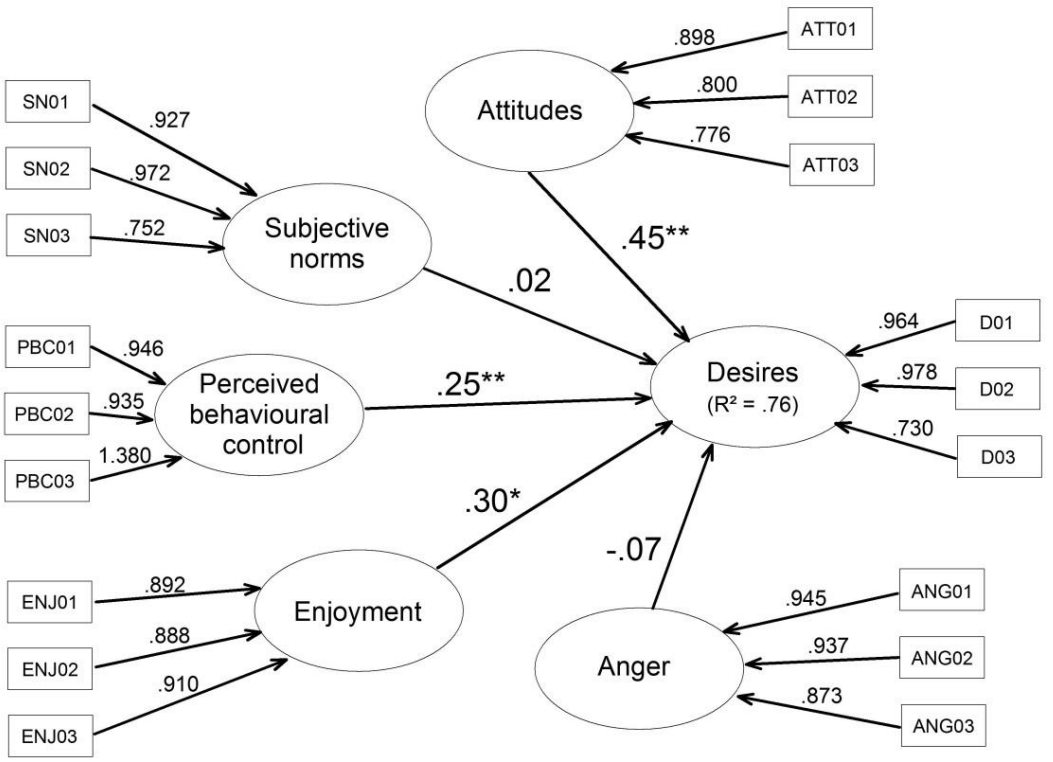

Figure 4.3 Structural equation model of the MGB with enjoyment and anger as discrete emotions. Model fit: $\chi 2$ = 137.47 (111, .04), RMSEA = .02, CFI = .96, SRMR = .04. Correlations between indicators were omitted, due to clarity of display.*p < .05, **p < .01. R^2 = Explained variance of the dependent variable.

Anticipated emotions as predictor of desires

We included all variables except fear in our SEM, as this construct showed no bivariate connection to desires. Due to the exclusion of fear in this model, the model fit increased slightly in comparison to the CFA (χ^2 = 137.47 (111, .04), RMSEA = .02, CFI = .96, SRMR = .04).

Concerning the regression results, attitudes (β = .45, p < .01), enjoyment (β = .30, p < .05), as well as PBC (β = .25, p < .01) were predictive for the desires to teach the return of the wolf. Anger (β = -.07, p > .05) and subjective norms (β = .02, p > .05) had no predictive quality (Figure 4.3). Overall, the model predicted the variance of the desires to teach to a high amount, as it explained 76% of variance in the dependent variable (R^2 > .76).

Discussion

Frequency of anticipated emotions (RQ_1)

The results reveal a positive emotional view of the pre-service teachers towards teaching the topic of returning wolves. This is in line with the general prevalence of positive emotions in the classroom (Frenzel, 2014; Lohbeck et al., 2018), but partly contradicts prior results concerning the teaching of controversial topics (Griffith & Brem, 2004).

We believe that the results should be considered in the light of the selected context. Positive expectations of the pre-service teachers towards preparing good and interesting lessons addressing the context of returning wolves is a possible explanation, as contexts with social references are perceived as more interesting than topics without such references (Krapp & Prenzel, 2011). Furthermore, the return of the wolf represents a new context, and novelty is one of the major triggers for positive emotions (Silvia, 2008). Also, the presence of wolves in the broader region of the sample could have fostered personal relevance, which is among the major triggers for interest (Palmer, Dixon, & Archer, 2016). Using the same data set, we found psychological distance towards the return of the wolf as a direct predictor of the attitudes, enjoyment as well as perceived behavioral control towards teaching the issue (Büssing et al., forthcoming). Furthermore, other contextual factors like attitudes towards the wolf and wildlife values also were indirect predictors of the respective motivational factors through protection motivation towards the wolf (Büssing et al., forthcoming). This expands knowledge from general environmental protection (Carmi & Kimhi, 2015) to the context of teaching environmental issues. But as these connections show, the results are highly context dependent and should be only cautiously generalized.

In prior studies from educational psychology, teacher enjoyment showed correlations to several learning relevant student constructs, like clarity and variety of instructions, or subjectively perceived teacher caring (Frenzel et al., 2016). While it is questionable how far such findings are transferable to the teaching of ESD-contexts, it is fair to assume a higher success of ESD when the teachers approach their teaching of environmental topics with positive than with negative emotions.

While the high elicitation of enjoyment a good sign, we are unable to assess the impact of possible self-report bias. More specifically, we are unable to rule out any kind of bias according to social desirability, which is a general problem for teacher emotion research (Frenzel, 2014). Future studies could try to reduce possible biases by adopting a more experimental research design and triangulating results of quantitative measures with other data types, like physiological measures of heart rate (Tobin, King, Henderson, Bellocchi, & Ritchie, 2016) or eye-tracking (Stürmer, Seidel, Müller, Häusler, & S. Cortina, 2017).

Connections between emotions and other variables (RQ_2)

We found several connections between the emotions and motivational relevant variables, why our results further illuminate connections between teacher emotions and their motivation to teach. Overall, the negative emotions were not as strongly connected to the desires as the positive emotions. While anger about teaching the return of the wolf correlated negatively with the desires to teach, fear showed only a very small and non-significant correlation to the desires. This is a positive result for teacher education, as possible perceived fear about teaching the topic may not hinder the motivation to teach.

Besides these connections between emotions and teaching motivation, we found an interesting connection between the predictor variables of PBC and enjoyment, as PBC correlated stronger with enjoyment than with all other predictor variables. Previous studies already found connections between self-efficacy beliefs and emotions (DeMauro & Jennings, 2016; Hascher & Hagenauer, 2016; Mahler, Großschedl, & Harms, 2017). While these studies concentrated on general or subject-specific efficacy beliefs, we were able to replicate this connection for teaching a specific environmental topic. This could imply that emotions and efficacy beliefs are indeed deeply connected. Further studies could address this relationship with a comparative approach with several topics or on an experimental basis to shed further light on the connection of emotions and pre-service teachers' efficacy beliefs towards teaching. Such knowledge about interventions about efficacy beliefs could be especially important in the context of teaching biodiversity topics, where efficacy beliefs are a key for successful teaching (Lindemann-Matthies et al., 2009).

Studies showed, that pre-service teachers elicited more anxiety and less anger towards teaching than in-service teachers (Lohbeck et al., 2018). Nonetheless, the belief system of teachers is very likely to change due to experiences in actual teaching situations (Rust, 1994), which is why our findings reflect the particular situation of future teachers. Future studies could sample in-service teachers concerning their emotional experiences in concrete environmental teaching situations. Nonetheless we believe that the examination of pre-service teachers' emotions allows for interesting insights into the emotional perception of teaching. Specifically, we can learn how pre-service teachers are emotionally primed, when they enter their teaching profession. This could be interesting, as this emotional priming might influence their attention on specific teaching topics (Yiend, 2010). Our results enable the investigation of such connections.

Relevance of emotions in the MGB (RQ_3)

In our model, only enjoyment, attitudes and PBC were significant predictors for the desires to teach the return of the wolf. Therefore, there seems to be a bivariate link between anticipated anger and the desires to teach, but the link is of subordinate importance when examined together with the other motivational variables. We may conclude that the negative emotions are of less motivational significance for pre-service teacher motivation compared to the positive emotions when teaching the return of the wolf. This is also plausible, as the motivational impact of emotions is dependent on the

specific behavior (Perugini & Bagozzi, 2001). The correlations of the emotions with the other variables in our study support this interpretation, as enjoyment correlated stronger with the attitudes and PBC than fear and anger. This connection of enjoyment and motivation fits to prior research. Enjoyment was connected to the self-concept of innovation (Lohbeck et al., 2018), which is why a higher enjoyment towards teaching an innovative topic may lead to a higher feeling of preparedness towards teaching the topic.

Overall, attitudes were a stronger and PBC a slightly weaker predictor of desires than enjoyment. This is quite interesting, as this partly contradicts former findings. In a study about the implementation of controversial issues into teaching, PBC was the strongest predictor of the behavioral intentions (Lumpe et al., 1998b). Two other studies that examined teacher intentions about implementing cooperative learning and particular thematic units came to similar results (Czerniak, Lumpe, & Haney, 1999; Lumpe, Haney, & Czerniak, 1998a). This fits to more recent research about connections of self-efficacy for teaching socio-scientific issues (Kılınç et al., 2013). However, in one study that assessed how far four specific reform strands should be implemented into science education, attitudes were the strongest predictor (Haney, Czerniak, & Lumpe, 1996). Especially in the context of ESD, PBC constitutes a prominent behavioral factor (Arbuthnott, 2009), why this connection seems logical. These partly contrary findings may be explainable by the nature of the specific dependent variable. In all studies that observed more abstract behaviors, like generally implementing controversial issues or cooperative learning methods (Lumpe et al., 1998b), PBC proved to be a strong predictor. In studies that explicitly addressed a teaching situation or context (Haney et al., 1996), attitudes were more important. For future studies, formulating a concrete context could improve the measurement, as our model had a high percentage of explained variance. This expands knowledge about measurement of ESD-related behaviors in a specific or general way to the context of teaching (Carmi et al., 2014).

Further implications and conclusion

For teacher education, our results underline the significance of attitudes, enjoyment and PBC for the motivation of pre-service teachers to teach environmental issues. Specifically, teacher educators should concentrate on positive attitudes of their students towards contexts of environmental education. This is also supported by other studies (Tomas, Girgenti, & Jackson, 2017). To maintain a positive emotional view of environmental topics, educators could utilize positive learning experiences from actual teaching, like a school practicum or teaching simulations. Mastering such teaching situations could also foster efficacy beliefs of teachers (Lumpe, Czerniak, Haney, & Beltyukova, 2012). But as prior results indicate, only successful and as positive evaluated teaching experience might be connected to efficacy beliefs (Großschedl et al., 2015). This underlines the importance of teacher education for the development of teaching efficacy beliefs (Malandrakis, 2018). But as empirical results illustrated, such approaches are bound to the positive evaluation and therefore to the emotional life of teachers. The inclusion of these emotional factors into teacher education may lead to a more holistic view of teaching.

Based on our data, this could be a way to foster teaching motivation for environmental topics and may be important for environmental education as a whole (Littledyke, 2008). Further, experimentally designed studies could underline the impact of emotions on teachers` motivation to teach, and make a stronger argument than our correlational results. Possibilities include the experimental variation of emotions, like inducing positive emotions in specific teaching situations. Results about the impact of emotions on motivations could lead to further opportunities for teacher professional development in contexts of ESD. Our study showed which factors would be important to address in such approaches for the specific context of the return of the wolf, why our results could be used to develop the learning opportunities of pre-service teachers more precisely.

Besides these implications for teacher education, we believe that the return of the wolf represents an interesting context for ESD, based on the enjoyment that the pre-service teachers elicited. As the return of the wolf to Germany is only an example wildlife context in our study, it is possible to select the context in other countries where the wolf returned, like in the United States or Asia (Ripple & Beschta, 2012). In other countries, similar wildlife issues may be adopted. Wildlife issues allow for the connection to real-world phenomena (Fensham, 2009), and as the further results of our study showed, these factors are also important for the motivational factors of pre-service teachers (Büssing et al., forthcoming). But all these results concentrate on affective factors and exclude cognitive factors like knowledge, which was a weaker but still significant predictor of teaching motivation (Großschedl, Konnemann, & Basel, 2014). Furthermore it is questionable if the real-world reference, the strengthened teaching motivation or the expressed teaching emotions lead to better learning in students. These subsequent questions, which could not be addressed in the recent study, are objectives for further research.

Finally, our study therefore stimulates new research about connections between emotion and motivation. While our study had a background in environmental education with an emotional context (Jacobs, 2009), the transferability of the results to other contexts is questionable. Emotions are highly domain-specific (Frenzel et al., 2015), which is why it is not clear if the emotional experience of one context is connected to the emotions toward teaching other environmental or non-environmental topics. In a recent study McNeal et al. (2017) found value-based interests of teachers as an important factor for teaching motivation in the context of climate change, which could indicate a similarity. But as their study not explicitly assessed emotions, we assume that further work needs to be done in the nexus between emotions and motivation in environmental issues. Especially due to their function of meaning-making in environmental contexts (Manni, Sporre, & Ottander, 2017), emotions might be interesting for further investigations to describe and analyze educational behavior.

4.2. Can a like save the planet? Liking biodiversity content on social media compared to classical pro-environmental behaviors[8]

Abstract

While researchers proposed social media as an innovative way to foster environmental action, there is only scarce research about the antecedents and consequences of digital environmental behavior. Therefore, we compared liking as a fundamental form of digital social media behavior to two traditional environmental behaviors (money donation and volunteering) in a cross-sectional research design. Within the biodiversity conservation context of the Andean bear (Tremarctos ornatus), we used the model of goal-directed behavior (MGB) to investigate motivationally relevant factors and investigated (1) the general motivation, (2) relevant motivational factors and (3) connections between the selected behaviors. The 407 Ecuadorian participants (Mage = 20.94 years, SD = 2.25, 61.2 % female) reported the highest motivation to protect the species through a like on social media. Gender (social media) and efficacy beliefs (volunteering and donation) emerged as the main motivational differences between the behaviors. Only enjoyment coherently predicted variance in all three conservation behaviors. Liking predicted the other motivations and partially mediated the effect of enjoyment on these more demanding environmental behaviors. The findings illustrate how social media might be a possible entry point for higher order environmental behaviors and connections of online behavior with offline activism.

Keywords

Emotion, Social media, Pro-environmental behavior, Andean bear, real-world activism, #Socialmediaforsustainability

[8] Büssing, A.G., Thielking, A., Menzel, S. (in review). Can a like save the planet? Liking biodiversity content on social media compared to classical pro-environmental behaviors. *Frontiers in Psychology*.

Introduction

While direct nature experiences are decreasing (Soga & Gaston, 2016), young people increasingly perceive social media sites as a source of information about environmental topics (Cheung, Fok, Tsang, Fang, & Tsang, 2015). Furthermore, the occurrence of specific contents about environmental topics like wildlife animals on social media shows similarities to the frequency of scientific literature about the corresponding species (Dylewski, Mikula, Tryjanowski, Morelli, & Yosef, 2017). This might illustrate how social media can be used to communicate conservational issues to a wider society. In combination with its decisive role in political participation processes (Boulianne, 2015), several researchers therefore proposed social media as a tool for education about and participation in environmental issues (Ballew, Omoto, & Winter, 2015; Pearson, Tindle, Ferguson, Ryan, & Litchfield, 2016).

This further participation of the general public is needed, as environmental degradation is relentlessly proceeding (O'Neill et al., 2018). Besides the overuse of the planet's resources, this particularly concerns the integrity of the biosphere, also called biodiversity (Mace et al., 2014; Steffen et al., 2015). This biodiversity is threatened by human activities especially in biodiversity hotspots like the tropical Andes (Myers, Mittermeier, Mittermeier, Da Fonseca, Gustavo AB, & Kent, 2000; Tilman et al., 2017). In this and other regions, large mammals like the Andean bear (*Tremarctos ornatus*) are at risk to go extinct due to steady deforestation for human economic development and illegal hunting in reaction to livestock killings (Garcia-Rangel, 2012; Goldstein et al., 2006; Peyton, Yerena, Rumiz, Jorgenson, & Orejuela, 1998; Tapia-Armijos, Homeier, Espinosa, Leuschner, & La Cruz, 2015). Due to these human-caused activities, the species is predicted to be the third most threatened carnivore species to go extinct and should be prioritized in conservation efforts (Can, D'Cruze, Garshelis, Beecham, & Macdonald, 2014; Cardillo et al., 2004).

To increase the awareness on the respective issue, environmental organizations like the Andean Bear Foundation (*Fundación Oso Andino*) try to promote conservational activities on Facebook (https://www.facebook.com/AndeanBearFoundation/) and Twitter (https://twitter.com/BearAndean). Prior studies analyzed how nongovernmental organizations like the Andean Bear Foundation utilized social media for their activities and found unidirectional information as a main usage, neglecting other dimensions like community-building or the initiation of action (Lovejoy & Saxton, 2012). This underestimates the ability of social media, which enables individuals and organizations to build up environmental identities (Kietzmann, Hermkens, McCarthy, & Silvestre, 2011) and initiate more pronounced forms of social action through multiplication (Pearson et al., 2016). The neglect of these dimensions may impair the capability to engage users and create an extensive societal change towards sustainable development.

But to increase peoples' involvement with environmental content on social media, environmental organizations and practitioners need further knowledge about determining factors of online social media behavior (Aksoy et al., 2013). Contrary to other environmental behaviors like

volunteering (Bruyere & Rappe, 2007) or money donation (Ku & Zaroff, 2014), there is only scarce theoretical and empirical knowledge about the motivational determinants of environmental social media behavior (Büscher, 2016). Prior studies applied methods like big data approaches and were able to answer questions regarding the agents, points in time and specific motivational factors for conservation behavior on different social media platforms (Di Minin, Tenkanen, & Toivonen, 2015). For example, users' posted pictures were used to analyze travels for natural recreation activities (Wood, Guerry, Silver, & Lacayo, 2013). Other studies investigated influencing factors like the emotionality of posts within digital social networks and found a higher rate of retweets for more emotional posts (Brady, Wills, Jost, Tucker, & Van Bavel, Jay J, 2017).

Due to the post-hoc nature of these procedures, such analyses have specific boundaries like the sufficient availability of accessible data (van der Sloot, Bart, Broeders, & Schrijvers, 2016). Furthermore, most of the studies remain isolated on a specific factors, neglecting the variety of motivationally relevant psychological factors for environmental behavior (Gifford & Nilsson, 2014). These approaches are also unable to directly compare online and offline behaviors, as they solely rely on digital data (Abbasi, Chai, Liu, & Sagoo, 2012). Such a comparison might shed light on how environmental social media usage may cause real-world activist behaviors, like it was suggested by research in other content areas like political participation in civic and political life (Boulianne, 2015).

Therefore, the present study selected the sketched biodiversity context of the Andean bear in Ecuador and applied established methods from environmental and social psychology to investigate motivationally relevant personality factors for environmental behavior on social media. We concentrate on general environmental motivation as dependent variables, as these motivations are a major cause for people to behave in environmental friendly ways, based on coherent underlying personality factors (Steg, 2016). Like we will describe in the theoretical background, we selected the motivation to like environmental content on social media as the most basic form of social media behavior and compared this in a subsequent step with the motivations for money donation and volunteering as more "classical" environmental behaviors. This comparison will enable the investigation of liking as a possible way to save the planet due to the possibility of causing more pronounced forms of acting environmentally.

Theoretical background

Liking as an environmental social media behavior

Generally, *social media* represents a collective term for a variety of web-based services, which allow their users to create public or non-public profiles to connect with other people or organizations (Boyd & Ellison, 2007). Whereas individuals might engage in social media through different activities such as liking, sharing or posting content (Alhabash, Almutairi, Lou, & Kim, 2018), likes can be described as the building blocks of social media, as every digital network relies on their users' ability to indicate affective responses to specific contents. While this constructs popularity as a fundamental logic within

social media services (van Dijck & Poell, 2013), liking emerges as the foundation of societal action as all further spread of information needs to trigger positive reactions in social media to cause the multiplication of content (Lipsman, Mudd, Rich, & Bruich, 2012).

This is particularly relevant for environmental topics, as environmental activists might use social media for spreading information to draw attention and increase vital knowledge (Pearson et al., 2016). Besides these possibilities, a study within the framework of the general socio-psychological theory of planned behavior (Ajzen, 1991) suggested social media to require fewer personal resources. In this study, perceived behavioral control as a measure of perceived possibility of performing a specific behavior showed only marginal effects on the intention to use social media (Ajzen, 2002; Baker & White, 2010). Especially as other environmental behaviors heavily rely on personal resources like money for donations (Leliveld & Risselada, 2017) or time for volunteering activities (Bruyere & Rappe, 2007), social media may be an easy way of doing something good (Pearson et al., 2016). As social media may also be perceived as an innovative and new form of environmental behavior (Specht & Ros-Tonen, 2017), there may be a higher motivation to like something than to donate money or volunteer for the protection of the Andean bear (Ballew et al., 2015).

To inspect if there are motivational differences to fulfill the selected behaviors of liking, donating money and volunteering, the study first of all investigates these differences based on the anticipated motivations as well as their past behaviors. Therefore, we state our first two research hypotheses:

> **H_1:** There will be differences between the motivation to like for the protection of the Andean bear on a social network compared to the motivations to donate or volunteer for the protection of the species.
>
> **H_2:** There will be differences between the past behaviors of liking for the protection of the Andean bear on a social network compared to the past behaviors of donating money or volunteering for the protection of the species.

Based on these differences between the respective behaviors, we subsequently investigated differences in the relevant motivational antecedents and state the following research question:

> **RQ_1:** Which factors are the motivationally relevant variables for predicting the motivation to like for the protection of the Andean bear on a social network?

Explaining environmental motivations using the model of goal-directed behavior (MGB)

While identifying a general theory of environmental behavior in contexts of social media is an open problem of existing research (Büscher, 2016), environmental psychologists have a long history in applying different theoretical models to explain behavior (Osbaldiston, 2013). One of the prominent frameworks is the already mentioned theory of planned behavior, which has already been applied to

investigate young people's social media behavior (Baker & White, 2010). But as studies showed, other variables like past behavior or emotions affect social media and environmental behaviors (Carrus et al., 2008; Passafaro et al., 2014; Pelling & White, 2009; Song et al., 2012; Stieglitz & Dang-Xuan, 2013). These variables are not covered by the theory of planned behavior, but the subsequent *model of goal-directed behavior* (Perugini & Bagozzi, 2001). This model builds on the theory of planned behavior and integrates emotions as well as past behavior into the framework and should therefore be more suitable for an adaption in the present study. Furthermore, the model proposes desires as a mediator of the independent variables on the behavioral intentions (Perugini & Bagozzi, 2004). Desires describe the 'motivational state of mind wherein appraisals and reasons to act are transformed into a motivation to do so' (Perugini & Bagozzi, 2001, p. 84). While intentions are more concretely connected to actions at specific time points (Perugini & Bagozzi, 2004), desires better cover the intended dependent variables, which aim for the general motivation to fulfill the selected behaviors.

Concerning the independent variables, the MGB still includes attitudes, subjective norms and perceived behavioral control as independent variables consistent to the theory of planned behavior. *Attitudes* represent either a positive or negative psychological evaluation of an object or a context (Ajzen, 1991) and describe in the present study the evaluation of the protection of the Andean bear. Prior studies found attitudes as a predictor of the intention to use social media, why we believe the same should apply for environmental liking (Baker & White, 2010; Pelling & White, 2009). The next variable of *subjective norms* describes the perceived social pressure to fulfill a specific behavior and refer to individual normative beliefs (Ajzen, 1991). For the intended behavior of the protection of the Andean bear this would describe the perceived social pressure of protecting the Andean bear. While these norms are socially constructed, subjective norms are stable across online and offline contexts (Postmes, Spears, & Lea, 2000) and were connected to social media behavior in prior studies (Baker & White, 2010; Pelling & White, 2009; Spottswood & Hancock, 2017). Furthermore, a randomized controlled trial of Facebook data found social influences as an major contributor to online and real-world political mobilization why this variable may also be important for explaining the motivation to like (Bond et al., 2012). Finally, *perceived behavioral control* as last predictor from the theory of planned behavior refers to the perceived ability to perform a specific behavior (Ajzen, 2002). In the present study this entails the personal internal and external resources to protect the Andean bear. As described above, this factor showed to be not a major predictor in contexts of social media (Baker & White, 2010; Pelling & White, 2009), but may be of severe importance for the other environmental behaviors of donation and volunteering (Gifford & Nilsson, 2014; Leliveld & Risselada, 2017).

As described above, the inclusion of emotions as antecedents of desires seems especially interesting in the context of social media, as the emotionality of contents in digital social networks emerged as one determining factor for information diffusion (Brady et al., 2017). Generally, emotions can be described as multidimensional and short lasting affective reactions to specific stimuli (Scherer, 2005). In the present study, this stimulus would be the protection of the Andean bear in a specific

context and the perceived emotion would describe the affective state when protecting the species in this context. While emotions can be viewed as a dimensional phenomenon based on the dimensions of value (positive/negative) and arousal (high/low), prior studies in wildlife psychology showed improved measurement results and a better interpretability when emotions are viewed from an discrete emotion perspective (Jacobs et al., 2012; Scherer, 2005). In this view, specific discrete emotions can be differentiated by their cognitive causes and affective experience (Izard, 2007).

In the present study we concentrated on such a discrete approach on emotions and selected enjoyment and anger as independent variables, as these emotions showed to be connected to wildlife protection behavior in prior studies (Jacobs et al., 2014; Larson et al., 2015; Vaske, Roemer, & Taylor, 2013). *Enjoyment* describes the positive emotional perception in positively valued situations with a medium amount of control (Scherer, 2005). For the selected context, people with a generally positive mindset about the protection of wildlife species will perceive enjoyment as most prevalent emotion when protecting the species in concrete contexts like building fences or collecting donations. While also involving a medium amount of control, *anger* is elicited in negatively valued events and also based on frustration (Kuppens, van Mechelen, & Rijmen, 2008; Scherer, 2005). As final variable from the MGB, *past behavior* reflects the past fulfillment of the specific behavior (Perugini & Bagozzi, 2001) and should therefore also be predictive of the selected environmental behaviors, as it already showed predictive effects on other environmental behaviors like recycling or mobility decisions (Carrus et al., 2008).

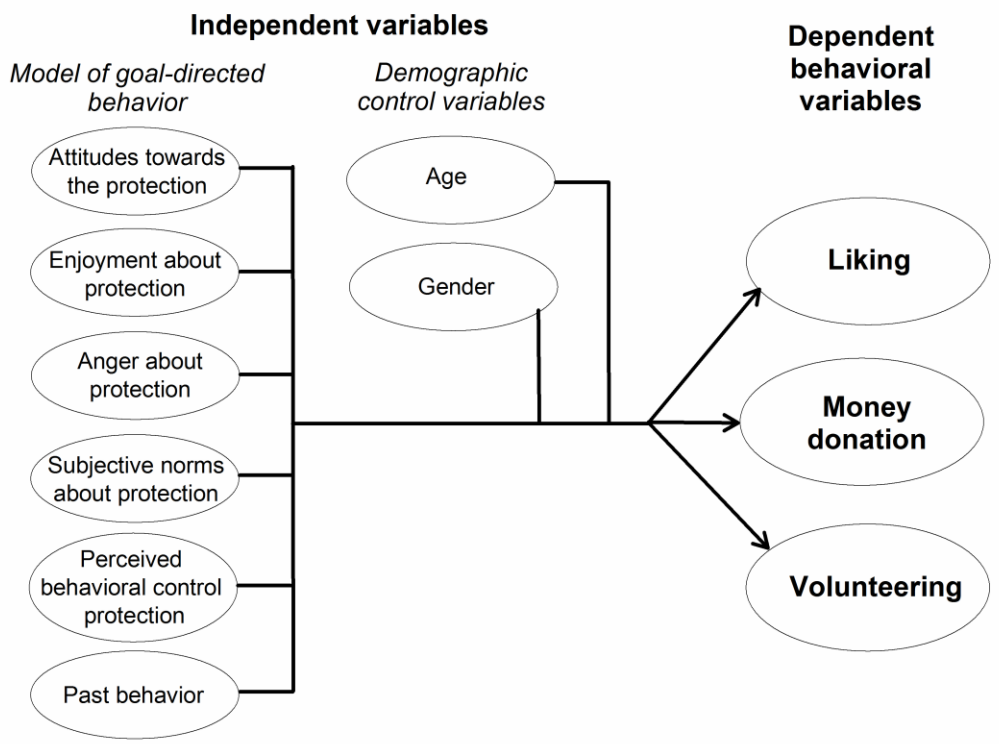

Figure 4.4 Overview of the theoretical framework originating in variables from the model of goal-directed behavior and demographic control variables predicting the motivation to like something on social media, donate money of volunteer to promote the protection of the Andean bear.

Besides these independent variables from the MGB we added age and gender as demographic control variables to our models, as prior studies indicated effects on pro-environmental (Olsson & Gericke, 2017) as well as social media behaviors (Schwartz et al., 2013). In these studies, women and older people showed higher environmental orientations (Gifford & Nilsson, 2014). An overview of all independent and dependent variables in the study can be seen in Figure 4.4.

Liking as a pathway to real-world environmental behavior

As described above, social media may be used as a way to engage individuals in subsequent activist behaviors, which might be of vital importance to foster society's sustainable development (Pearson et al., 2016; Warren, Sulaiman, & Jaafar, 2014). Activists and organizations might engage people in real-world behavior due to the informational, relational or experiential function of social media for environmental behavior (Ballew et al., 2015). This means, people could be motivated by specific information, social ties to other people or specific contextually relevant experiences (Ballew et al., 2015). Due to this possibility of turning individual behaviors into more concrete societal behaviors (Ganglbauer, Reitberger, & Fitzpatrick, 2013), we propose the following final hypothesis:

> **H_3:** The motivation to like for the protection of the Andean bear in social media will be connected to the motivation to donate money and to volunteer for the protection of the species.

Method

Research design

Like described above, the description of motivations for environmental linking on social media and the investigation of possible determinants might benefit from using approved methodologies from other social science fields like environmental psychology (Abbasi et al., 2012). Possible methodologies include survey data, which already were applied to describe general social media usage (Hughes, Rowe, Batey, & Lee, 2012). Such approaches could complement existing knowledge about digital conservation behavior and lay the ground for further experimental investigations. To compare the differences and connections between specific variables, we therefore selected a cross-sectional quantitative research design, based on a paper-and-pencil questionnaire. This study design allows a comparison of the different behaviors in an efficient way. Prior studies showed the usability of such a design to test the stated research hypotheses and questions (Yun & Trumbo, 2000).

Sample

As we selected the context of the Andean bear in Ecuador and aimed for a sample of young adults, we gathered data in June and July 2016 at two universities in Cuenca, Ecuador. We chose the study sites based on the occurrence of the Andean bear, as this region is located in proximity to the habitat of the

species (Goldstein, Velez-Liendo, Paisley, & Garshelis, 2008).

407 students participated in the survey (249 females (61.2%), 158 males; M_{age} = 20.96 years, *SD* = 2.24, age range = 18 – 34 years). We decided to collect data from young people, since older people use social media sites far less than young people and young people may reflect the most important user group of social media (Aksoy et al., 2013; Jordan, Trentacoste, Henderson, Manganello, & Fishbein, 2007; Perrin, 2015). The participating students came from diverse disciplines of study, including the life sciences, architecture, economics, psychology, or tourism. The sample nonetheless represents a convenience sample, as we did not apply any further randomization.

We followed the relevant national guidelines and laws of the study country, the selected universities, Declaration of Helsinki as well as APA´s Code of Conduct to ensure compliance to all ethical and legal standards. We ensured informed consent, guaranteed anonymity and provided information about the purpose of the study verbally and on the first page of the questionnaire. All participants had the chance to ask questions or to decline their participation at any time.

Questionnaire

Overall design

The questionnaire started with questions about demographic data, followed by the psychological scales from the MGB. As demographic data, we asked for the age, gender as well as the intended degree. While age and the intended degree were open questions, gender was asked in a closed format and coded with 1 (female) and 2 (male). We also assessed deeper personality factors related to wildlife protection, which were not analyzed in the present study. The available data set for the replication of our analyses also excludes these variables as well as the intended degree to protect the anonymity of the participants.

The questionnaire was distributed in Spanish and was constructed by translating approved English scales (Song et al., 2012). After the first translation, a different person translated the questionnaire back from Spanish to English, to check the accuracy of the translation. As a final step, the revised Spanish version was discussed with a native Ecuadorian speaker and tested with several students to ensure comprehension. In this paper, we report the English translations of this revised and finally applied version.

All variables except for past behavior were tested by multiple items to enhance the validity of the constructs (Bryman, 2008). If not described differently, all items were measured on a 6-point Likert scale, ranging from 1 (*do not agree at all*) to 6 (*agree completely*) and were worded as statements to allow the construction of a Likert scale (Bryman, 2008). The English wording of all items can be viewed in the supplemental material.

Model of goal-directed behavior (MGB)

As described in the theoretical framework, the MGB proposes attitudes, emotions, subjective norms, perceived behavioral control, as well as past behavior as predictors of desires (Perugini & Bagozzi, 2001). We constructed the items for these distinct scales by using existing MGB scales (Song et al., 2012) and adapting them to the protection of the Andean bear. We aimed to keep the adapted version close to the original version by only replacing the respective objects of the sentences with 'the protection of the Andean bear'.

Based on the definition of attitudes as a positive or negative psychological evaluation of an object or a context (Ajzen, 1991), we asked participants to rate their agreement with the belief that the protection of the Andean bear is a good behavior. We constructed three items based on the existing scale of Song et al. (Song et al., 2012). As described in the theoretical background, we measured discrete emotions instead of dimensional emotions (Perugini & Bagozzi, 2001). We decided to measure these discrete emotions with the established Differential Emotions Scale (Izard et al., 1993). The emotions of enjoyment and anger were measured with three items each, and participants were asked to rate their agreement with the items based on the introductory text 'If I promoted the protection of the Andean bear, I would feel…'. Concerning the variable of subjective norms, we measured participants' beliefs about the perceived social pressure for protecting the Andean bear (Ajzen, 1991). This was accomplished by asking participants in the questionnaire to rate their agreement with the question of whether the majority of people would view the protection of the Andean bear as favorable behavior. The next variable, perceived behavioral control, is concerned with the perceived difficulties of performing the respective behavior and is related to measures of efficacy (Ajzen, 1991; Perugini & Bagozzi, 2001). For the respective behaviors, this includes the personal belief about being able to support the species, as well as the personal resources for the protection.

The factor of past behavior was assessed using one item for every tested behavior. The items directly asked about the previous performance of the respective behavior. After the introductory text "How often did you…", participants were asked to rate their agreement to questions concerning all three behaviors. In difference to the other constructs, the scale for past behavior ranged on a 5-point Likert scale from 1 (never), 2 (rarely), 3 (occasionally), 4 (often), to 5 (very often).

Finally, desires as the dependent variables represent the motivation to perform the respective behavior (Perugini & Bagozzi, 2001). Based on their lower action connectedness, desires are conceptually different to intentions (Perugini & Bagozzi, 2004). We were mainly interested in measuring the antecedents of the selected protection motivations, why we decided not to further differentiate between desires and intentions. We also decided for the general term of 'social network' to ensure comprehension by every participant, as some of the participants might not be part of a specific network, which might have conflicted measurement. We therefore not differentiated between specific platforms, as this was not part of our intended research questions (Waterloo, Baumgartner, Peter, &

Valkenburg, 2018). All items for the desires were randomized to gain better measurement results and keep the attention of the participants on a high level.

Statistical analyses

General Procedure

As a first step we performed a confirmatory factor analysis (CFA) with all variables to ensure discriminant validity of the scales (Brown, 2015). Besides evaluating alternative models as another external validity criterion we also inspected Cronbach's Alpha as a measure of internal consistency of the constructs. Based on the satisfying measurement results we then compared the motivations between the different behaviors by investigating the descriptive statistics as well as testing possible mean differences with robust tests (H_1 and H_2). To test the motivational function of the MGB variables (RQ_1), we performed robust regression analyses for each dependent variable. In each of the models we controlled the independent variables for the protection of the Andean bear and varied the dependent variables, to test which of the independent variables may predict the respective dependent variables. Finally, we examined the connection of the motivation to like with the more classical behaviors using regressions as well as robust mediator tests.

We decided for a robust approach to our statistics, as most of the scales were skewed and not normally distributed (Table 4.2). These methods include the estimation of the CFA with a robust Maximum-likelihood estimator (Rosseel, 2012) and the selection of Spearman-rho as a correlation coefficient (Wilcox, 2012). Furthermore, we used robust versions of ANOVAs, t-tests and regressions based on Field and Wilcox (2017). Finally, the mediation analysis was also performed with a robust alternative (Alfons, Ates, & Groenen). All calculations were done in R-Studio Version 1.1.456 running R Version 3.5.1 (R Core Team, 2018). The script for the replication of the analysis is available in the supplementary material.

Measurement results

Kline (2016) recommends the evaluation of model fit by combining the fit indices of the root mean square error of approximation (RMSEA), Bentler comparative fit index (CFI), and the standardized root mean square residual (SRMR). Therefore, we assessed a good model fit in our study by a RMSEA under or equal to .05, a CFI over or equal to .95, and a SRMR under or equal to .05 (Hu & Bentler, 1999).

Table 4.2 Overview of the correlations (Spearman-rho) between the variables with bootstrapped upper and lower 95% confidence intervals above the diagonal and descriptive statistics.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Age	-	-.03,.18	-.11,.06	-.13,.08	-.05,.14	-.05,.13	-.16,.03	-.15,.04	-.03,.14	.04,.20	-.08,.11	-.20,-.01	-.21,.00
2. Gender	.08	-	-.23,-.01	-.21,-.01	-.01, .19	-.15, .06	-.16,.04	-.13,.06	-.09,.09	-.04,.15	-.28,-.09	-.11,.08	-.19,.01
3. Attitudes	-.03	-.12*	-	.29,.46	-.43,-.24	.39,.54	.26,.44	-.07,.14	-.07,.13	-.12,.10	.22,.41	.13,.31	.22,.40
4. Enjoyment	-.02	-.12*	.38**	-	-.40,-.24	.34,.52	.28,.45	-.12,.08	-.07,.13	-.10,.12	.25,.45	.24,.43	.33,.50
5. Anger	.05	.09	-.34**	-.32**	-	-.40,-.23	-.33,-.15	-.09,.10	-.12,.11	-.16,.03	-.41,-.22	-.26,-.09	-.29,-.09
6. Subj. Norm	.05	-.05	.47**	.44**	-.32**	-	.32,.50	-.07,.15	-.06,.13	-.05,.15	.24,.44	.17,.37	.24,.44
7. PBC	-.06	-.06	.35**	.37**	-.24**	.41**	-	.11,.29	.02,.22	.00,.20	.17,.35	.43,.59	.48,.63
8. Past Liking	-.04	-.04	.04	-.02	.00	.03	.20**	-	.21,.41	.03,.26	.02,.20	.04,.24	.14,.32
9. Past donat.	.06	.00	.03	.04	-.01	.04	.13*	.31**	-	.30,.68	-.08,.11	.07,.22	.04,.21
10. Past volunt.	.12*	.06	-.02	.01	-.06	.04	.10*	.14**	.50**	-	-.04,.15	.05,.23	.02,.17
11. Liking	.02	-.20**	.32**	.36**	-.31**	.34**	.26**	.11*	.01	.05	-	.18,.35	.25,.43
12. Donation	-.09	-.02	.22**	.34**	-.18**	.27**	.52**	.14*	.15**	.14**	.26**	-	.48,.63
13. Volunteer.	-.10	-.09	.32**	.42**	-.19**	.35**	.57**	.22**	.13*	.09	.35**	.56**	-
Items	1	1	3	3	3	3	3	1	1	1	3	3	3
Mean	20.96	-	5.64	4.99	1.41	5.12	4.21	1.80	1.11	1.11	5.10	3.97	4.40
SD	2.24	-	.65	.89	.67	.87	.94	1.18	.50	.50	1.13	1.17	1.13
Median	21.00	-	6.00	5.00	1.00	5.00	4.33	1.00	1.00	1.00	5.33	4.00	4.33
α	-	-	.91	.69	.92	.90	.72	-	-	-	.95	.93	.91

Note. Gender was coded as female (1) and male (2). * = p < .05, ** = p < .01. PBC = Perceived behavioral control, SD = Standard deviation, α = Cronbach's Alpha.

Based on these criteria, the estimated CFA of the theoretical model led to the best and overall good model fit (RMSEA = .04, CFI = .98, SRMR = .04). Besides this, we estimated similar models to inspect if another factor solution might be a better fit to the data. But as displayed in Table 4.3, no model showed better fit than the initial and theoretically justified model. As all variables also showed good measurement reliabilities based on Cronbach's Alpha (Table 4.2), we continued with the further analyses.

Table 4.3 Overview of measurement results from the confirmatory factor analysis (CFA) of the fit between the theoretical and two alternative models based on the root mean square error of approximation (RMSEA), Bentler comparative fit index (CFI) as well as standardized root mean square residual (SRMR).

	RMSEA	CFI	SRMR
Theoretical model	.04	.98	.04
Alternative model 1: Classical desires together (^{DON} + ^{VOL})	.07	.93	.05
Alternative model 2: Classical desires (^{DON} + ^{VOL}) + Perceived behavioral control together	.09	.85	.07
Alternative model 3: All desires together (^{LIKE} + ^{DON} + ^{VOL})	.13	.73	.10

Note. ^{LIKE} = Desire to like for the protection of the Andean bear, ^{DON} = Desire to donate money for the protection of the Andean bear, ^{VOL} = Desire to volunteer for the protection of the Andean bear.

Results

Differences between the different motivations and past behaviors (H_1 and H_2)

As a first step of the analysis, we investigated the differences between the reported motivations using robust versions of between groups ANOVAs and post-hoc robust t-tests. As shown in Table 4.2, we found the highest motivation for the liking on social media (M = 5.10, SD = 1.13, Mdn = 5.33), followed by the motivation to volunteer (M = 4.40, SD = 1.13, Mdn = 4.33) and the motivation to donate money (M = 3.97, SD = 1.17, Mdn = 4.00). These differences were also statistically significant, as the between groups ANOVA as well as the post-hoc comparisons showed (Table 4.3). While the motivation to donate money and to volunteer only differed with a small effect size ($d_{DON\text{-}VOL}$ = .28, p < .001), we found large effect sizes for the differences between the motivation to like and to donate ($d_{LIKE\text{-}DON}$ = 1.04, p < .001) as well as to volunteer ($d_{LIKE\text{-}VOL}$ = .83, p < .001).

Table 4.4 Results from between robust group and post-hoc difference tests between the motivations to protect the Andean bear.

	Liking	Donation	Volunteering
Between groups	ANOVA: F(2, 406) = 202.62***		
Post-hoc			
Liking	-	M_{DIFF} = 1.29 [1.14, 1.43]	M_{DIFF} = .93 [.81, 1.06]
Donation	t(235) = 17.30***, d = 1.04	-	M_{DIFF} = -.34 [-.45, -.23]
Volunteering	t(237) = 14.70***, d = .83	t(237) = -6.07***, d = .28	-

Note. *** = p < .001. M_{DIFF} = Difference between trimmed means, d = Cohen's d.

The results for the past behaviors resembled this pattern, as the participants reported the highest past behavior for liking (M = 1.80, SD = 1.1.8, Mdn = 1.00). Past donation (M = 1.11, SD = 1.1.8, Mdn = 1.00) and volunteering behavior (M = 1.11, SD = 1.1.8, Mdn = 1.00) were only marginally reported. These differences were underlined by the statistical tests displayed in Table 4.4, which only found differences between the past liking behavior and the classical environmental behaviors with small effect sizes ($d_{PASTLIKE\text{-}PASTDON}$ = .31, p < .001; $d_{PASTLIKE\text{-}PASTVOL}$ = .36, p < .001), but not between the two classical environmental behaviors ($d_{PASTDON\text{-}PASTVOL}$ = .00, p > .05).

Motivational determinants (RQ_1)

To investigate the antecedents of environmental liking, we first of all examined the bivariate correlations with the independent variables from the MGB with the dependent variable of the motivation to like for the protection of the Andean bear. As displayed in Table 4.2, all of the independent variables correlated with the motivation to like for the protection of the Andean bear. While enjoyment (r = .36, 95% CI [.22, .41], p < .01), subjective norms (r = .34, 95% CI [.25, .45], p < .01) as well as attitudes (r = .32, 95% CI [.24, .44], p < .01) towards the protection showed all positive correlations, anger was negatively correlated (r = -.31, 95% CI [-.41, -.22], p < .01). While all of these correlations had a medium effect size, perceived behavioral control (r = .26, 95% CI [.17, .35], p < .01) and past behavior (r = .11, 95% CI [.02, .20], p < .01) showed correlations with small effect sizes.

Table 4.5 Results from between robust group and post-hoc difference tests between the past behaviors to protect the Andean bear.

	Past liking	Past donation	Past volunteering
Between groups		ANOVA: F(2, 406) = 30.54***	
Post-hoc			
Past liking	-	M_{DIFF} = .40 [.26, .54]	M_{DIFF} = .40 [.26, .54]
Past donation	t(240) = 5.53***, d = .31	-	M_{DIFF} = 0 [0, 0]
Past volunteering	t(240) = 5.53***, d = .36	t(240) = .00, d = .00	-

Note. *** = p < .001. M_{DIFF} = Difference between trimmed means, d = Cohen's d.

Concerning the control variables, age showed no correlation with the motivation to like on social media for the protection of the Andean bear (r = .02, 95% CI [-.08, .11], p > .05). But as only dependent variable, the motivation to like was correlated with gender (r = -.20, 95% CI [-.28, -.09], p < .01). As gender was coded with female (1) and male (2), female participants showed a higher motivation to like the protection of the Andean bear on social media. The same gender effect occurred for the variables of attitudes (r = -.12, 95% CI [-.23, -.01], p < .05) and enjoyment (r = -.12, 95% CI [-.21, -.01], p < .05), which correlated with a small effect size with gender.

The two more classical behaviors showed similar correlations with the variables of attitudes, enjoyment, subjective norms and past behavior. But different to the motivation to like, donation (r = .52, 95% CI [.43, .59], p < .01) and volunteering (r = .57, 95% CI [.48, .63], p < .01) correlated much

stronger and with large effect sizes with perceived behavioral control. Furthermore, anger was weaker correlated for these behaviors, as it correlated only weakly with the motivation to donate (r = -.18, 95% CI [-.26, -.09], p < .01) and to volunteer (r = -.19, 95% CI [-.29, -.09], p < .01). These differences in the bivariate correlations point to an inherent disparity between the motivation to like and the motivations for the more classical behaviors of donation and volunteering.

The robust regressions further illustrated these connections between the independent variables and the motivation for liking on social media, eliminating those without predictive effects. Of the seven correlating independent variables, only the four variables of attitudes (β = .34, p < .01), gender (β = -.32, p < .001), enjoyment (β = .21, p < .01) and perceived behavioral control (β = .34, p < .01) showed a predictive quality in the regression analysis (Table 4.6). Especially the strong prediction of gender was interesting, as this variable was only weakly correlated to the motivation to like, but emerged as the best predictor in the regression. Despite their bivariate correlation, anger (β = -.11, p > .05), subjective norms (β = .08, p > .05) and past behavior (β = .05, p > .05) were not predictive for the motivation to like on social media. Overall, the model predicted with 35% a medium amount of variance in the motivation to like (R^2_{LIKE} = .35).

Table 4.6 Standardized regression results (β) from the robust regressions for the prediction of the motivations to protect the Andean bear with liking on social media, money donation and volunteering based on the independent variables of the model of goal-directed behavior (MGB), the motivation to like on social media (LIKE) and the full model with all predictors (FULL).

	Liking	Donation			Volunteering		
	MGB	MGB	LIKE	FULL	MGB	LIKE	FULL
Age	.02	-.03		-.03	-.03		-.04
Gender	-.32***	.05		.08	-.16		-.10
Attitudes	.34**	-.02		-.06	.00		-.04
Enjoyment	.21**	.23***		.18**	.31***		.25***
Anger	-.11	.03		.03	.05		.04
Subject. norms	.08	.03		.03	.05		.03
PBC	.14*	.58***		.58***	.59***		.58***
Past behavior	.05	.20***		OUT	.14*		OUT
Liking			.34***	.14**		.44***	.17**
Adjusted R^2	.35	.40	.11	.41	.46	.18	.48

Note. Gender was coded with female (1) and male (2). * = p < .05, ** = p < .01, *** = p < .001. OUT = Variable excluded due to outliers. R^2 = Explained variance.

Similar to the correlations, we also found differences in the regressions concerning the predictive ability of the independent variables for the motivation to donate and to volunteer. This mainly concerned the strong predictive effect of perceived behavioral control for the motivation to donate (β = .58, p < .001) and to volunteer (β = .59, p < .001). While this factor was only a weak predictor for the motivation to like, it was the strongest predictor for the classical behaviors. Another difference was the variable of past behavior, which showed no predictive ability for the motivation to like but predicted the motivations to donate (β = .20, p < .001) and to volunteer (β = .14, p < .05).

Enjoyment was the only variable with similar prediction abilities for all behaviors, as this variable also was predictive for the motivations to donate (β = .23, p < .001) and to volunteer (β = .31, p < .001) with about the same strength as for the motivation to like. Concerning the explained variance, the models for the classical behaviors explained with 40% for donating money (R^2_{DON} = .35) and 46% for volunteering (R^2_{VOL} = .35) a higher amount of variance in the dependent variables than the model for the motivation to like for the protection of the Andean bear.

Connection between liking and the other behaviors (H_3)

Also for this hypothesis we first looked at the bivariate correlations between the behaviors (Table 4.2). The motivation for liking on social media was correlated with the motivation to donate (r = .26, 95% CI [.18, .35], p < .01) as well as the motivation to volunteer (r = .35, 95% CI [.25, .43], p < .01). While these connections showed small to medium effect sizes, the motivation to donate and to volunteer were correlated with a large effect size (r = .56, 95% CI [.48, .63], p < .01). This pattern was repeated by the past behaviors, as past donating and past volunteering behavior were strongly correlated (r = .50, 95% CI [.30, .68], p < .01), while there were only weak to medium correlations of past liking to past donations (r = .31, 95% CI [.21, .41], p < .01) as well as past volunteering (r = .14, 95% CI [.03, .26], p < .01). This might again point to the similarity of the behaviors of donation and volunteering in contrast to the motivation for liking. But despite these differences in the strength of the correlations, the motivation to like was nonetheless connected to the motivation for the classical behaviors.

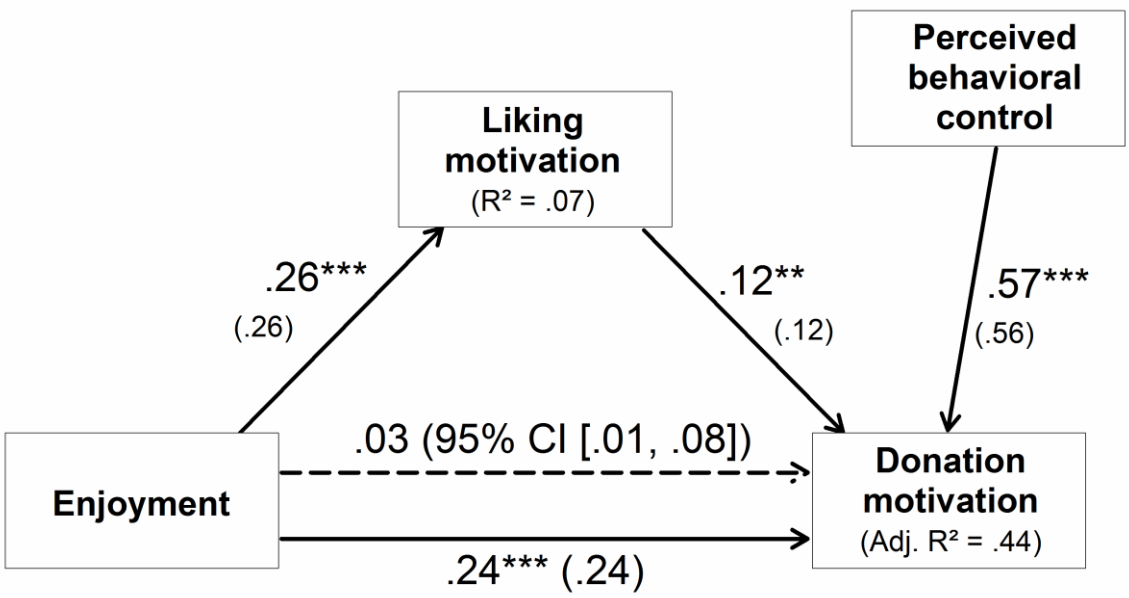

Figure 4.5 Mediation of the donation motivation by liking motivation including perceived behavioral control as a covariate (N = 379). All values are standardized coefficients based on robust mediation analysis with 5000 bootstrap samples. Solid lines represent regressions and the dotted line the indirect effect of enjoyment on the donation motivation through linking motivation as a mediator.

To further illustrate this connection and check the predictive ability of the motivation to like for the classical behaviors, we added this variable into the regressions. As described in Table 4.6, the

motivation to like significantly predicted variance in both full models. Even when it was the weakest predictor for the motivation to donate (β = .14, p < .01) and to volunteer (β = .17, p < .01), an increased motivation to like might still lead to an increased motivation for money donations and volunteering. Moreover, the addition of liking as an independent variable led to a decrease of the predictive ability of enjoyment. As this pointed to a mediating effect of liking, we investigated this further using the robust mediator analysis.

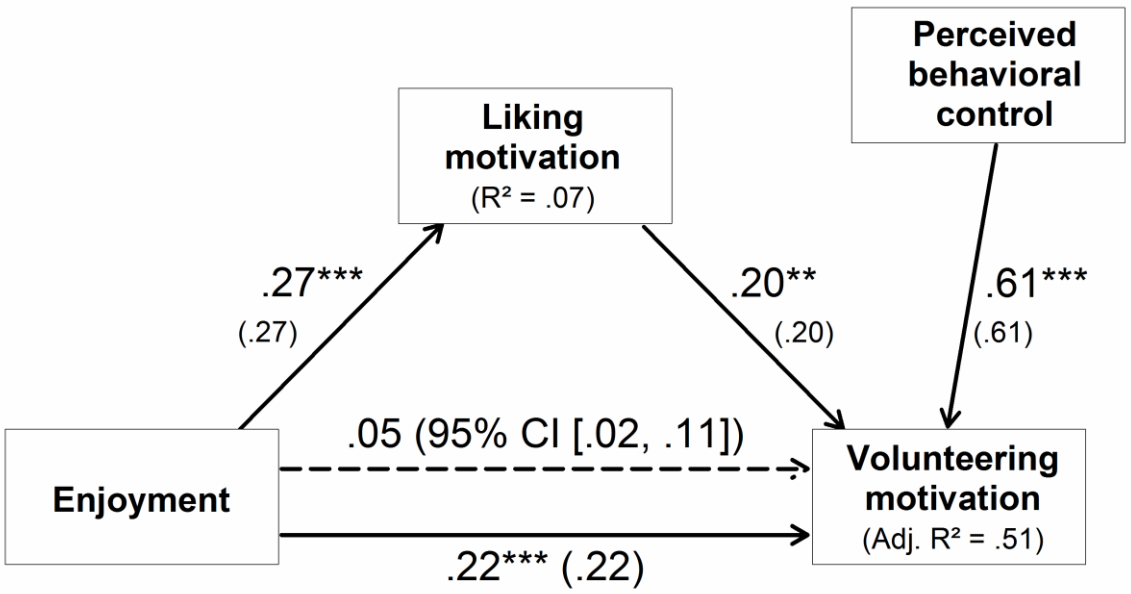

Figure 4.6 Mediation of the volunteering motivation by liking motivation including perceived behavioral control as a covariate (N = 381). All values are standardized coefficients based on robust mediation analysis with 5000 bootstrap samples. Solid lines represent regressions and the dotted line the indirect effect of enjoyment on the donation motivation through linking motivation as a mediator.

As displayed in Figure 4.5, liking motivation was a weak but significant partial mediator of the effect of enjoyment on the motivation to donate money. While controlling for perceived behavioral as a covariate, liking showed a predictive ability for the motivation to donate (β = .12, p < .01). These three predictors explained with 44% already a good amount of variance for the motivation to donate ($R^2_{MED.DON}$ = .44). This was also shown for volunteering (Figure 4.6), were we found a slightly stronger predictive effect of liking (β = .20, p < .01). This also resulted in an increase of the explained variance of this behavior to 51% ($R^2_{MED.VOL}$ = .35). Overall, these mediating effects underline the impact of liking motivation on the more demanding environmental behaviors of money donation and volunteering.

Discussion

The innovative nature of environmental liking

While the overall aim of the study was to investigate differences and similarities between the motivation to like for the protection of the Andean bear and the motivation to donate money or

volunteer for the protection of the species, we found large differences between the overall motivations for the behaviors as well as their past fulfillments (H_1 and H_2).

As described in the results, the participants showed overall a high motivation for liking, a medium motivation for volunteering and the weakest motivation to donate money for the protection of the Andean bear. Based on these results, people will be highly motivated to like for the protection of the species, while showing overall less motivation for the other two behaviors. This result is consistent with our hypotheses H_1 as well as prior studies, which found environmental social media behavior as an innovative way of protecting the environment (Baker & White, 2010; Pearson et al., 2016). We believe the results can also be explained by the general close relationship of young people with social media. As a qualitative study about social media usage showed, participants might be heavy users of social media, even when they want to avoid it or have to bear consequences for their offline life (Powell, Gray, & Reese, 2013). Interestingly, we found a similar pattern concerning the higher usage of social media also for the past behaviors.

These reported past behaviors showed overall much smaller means and medians compared to the motivations, as the participants reported the highest past behavior for liking and only marginally prior donations or past volunteering for the protection of the Andean bear. This is consistent with our hypothesis H_2, but indicates a manifest difference between liking and the more pronounced selected activist behaviors, as there were basically no differences between past money donations and past volunteering. This contrasts our prior difference tests for the motivations, which showed consistent differences between all behaviors. We therefore believe people might clearly differentiate between past likings and other environmental behaviors.

Of course the results have also to be reflected concerning the selected sample, as students may live under severe financial boundaries and may earn less money. As the available amount of money is one major contributor to donations (Leliveld & Risselada, 2017), this population may therefore show inherently smaller possibility to donate money. While future studies should include the available amount of money as a possible control variable, we believe the results nonetheless show our aimed research interest, based on the differences between the behaviors. These differences were also underlined by the motivational analyses, which illustrated the relevant underlying personality factors.

Explaining motivational differences

Concerning our first research question, we were able to find the most relevant factors for the motivation to like for the protection of the Andean bear and found major differences to the other two behaviors (RQ_1). Overall, this mainly concerned the variables of gender, attitudes and perceived behavioral control. While gender and attitudes were only predictive for the motivation to like for the protection of the Andean bear on social media, perceived behavioral control showed a much stronger predictive ability for the motivation to donate money and to volunteer.

Starting with the effects of attitudes and gender, we found these variables as predictors of liking motivation, but for no other environmental behavior. Especially the effect of gender seems interesting, as prior studies found women as generally more environmentally motivated than men (Gifford & Nilsson, 2014; Olsson & Gericke, 2017), which was also replicated in an evaluation study in the context of the Andean bear (Espinosa & Jacobson, 2012). While this is consistent with our results concerning the positive correlation of attitudes and enjoyment with gender, only the motivation to like for the protection of the Andean bear could translate this gender effect into a higher environmental motivation. This might point to an inherent significance of gender within environmental social media behavior, as it was already shown for general social media behavior by prior studies. In these studies, researchers found gender differences based on women's overall larger internet usage as well as concerning their way of communication (Jones, Johnson-Yale, Millermaier, & Pérez, 2009; Schwartz et al., 2013). As we only tested the behavior of liking in the case of protecting the Andean bear, this effect of gender on environmental social media behavior should only cautiously be generalized. But based on the prior studies, gender seems nonetheless to be one major factor for environmental behavior on social media.

The missing connection between the attitudes and the motivation to donate money and volunteer contrasts prior studies, which found attitudes as predictor for donating money and time (Pentecost & Andrews, 2010). As we also found bivariate correlations between attitudes and the motivations for these two behaviors, we believe the effect might be explainable by the strength of perceived behavioral control as a predictor of the motivation to donate money and volunteer, which could have exceeded attitudes based on the motivational relevance. This strong effect of perceived behavioral control was the third very distinctive motivational difference between the three environmental behaviors.

Although the variable of perceived behavioral control was a strong significant predictor of the motivation to donate money and to volunteer for the protection of the Andean bear, it had only a small predictive quality for the motivation to like for the protection of the Andean bear on social media. This contrasts to prior studies, which found no predictive effect of perceived behavioral control on money donation intentions (Kashif, Sarifuddin, & Hassan, 2015). But as this study used another, non-student sample, we believe the missing personal resources might explain why perceived behavioral control showed so strong effect for the motivation to donate money and to volunteer. This also illustrates the easy nature and habituation with social media in contrast to the other two behaviors, which is in line with prior research (Pearson et al., 2016). Odds are that every participant generally had the opportunity to perform this respective behavior, considering the young age of the participants (Perrin, 2015). Therefore, especially for the younger generation, social media might be an interesting entry point for fostering environmental action. We will further discuss this topic concerning the connection of the motivation to like with the other two behaviors (H_3).

A final difference between the behaviors was the connection of past behavior, which only affected the motivations to donate money and to volunteer for the protection, but not the motivation to like. This result partly contrasts with prior research about social media behavior (Pelling & White, 2009), but is in line with prior research about money donation which found past behavior as the strongest predictor of future donation (Kashif et al., 2015). This was also shown by our data, as the correlations between past behavior and the motivation were stronger for the behavior of donating money than for the other behaviors. The general connection of past behavior seems logical, as people who have already acted environmentally in a certain way might find it easier to do so in the future. But the missing connection for the liking on social media shows an inconsistency with prior research (Pelling & White, 2009). We believe the missing effect might be explainable by the prevalent connection of the other MGB variables, especially of enjoyment and gender, which were no predictors in the study of Pelling and White (2009) but explained a large amount of variance in the present study. While this underlines the motivational relevance of these factors, future studies could further investigate the connection and causality between past and social media behavior based on an experimentally comparison between people who have or have not supported an environmental organization on social media concerning their protection motivation.

Besides these differences between the behaviors, enjoyment towards the protection of the Andean bear emerged as only motivational determinant of all environmental behaviors. This fits to prior research about the connection of emotions with environmental motivations (Kals & Müller, 2012) and the motivations for joining volunteering programs (Caissie & Halpenny, 2003). This further underlines the importance of emotions for social media (Brady et al., 2017; Powell et al., 2013), which therefore should be further elaborated in future studies. One example might be the explicit confrontation of people with emotion stimuli from social media based on pictures or comments referring to environmental topics (Lee, 2012). These studies might then further illustrate how social media might lead to attitudinal change and could be a way for fostering action.

A final similarity was the absence of a predictive effect of age, anger and subjective norms for all environmental behaviors. The missing effect of anger is interesting, as this implicates a higher motivational relevance of positive than negative emotions for the tested behaviors. Nonetheless, we only can judge the abundance of this and the other connections of variables like the subjective norms based on the presented regression models. Except for age, all variables showed bivariate correlations with the dependent variables. But as described in the results, these variables possess no predictive quality when included in the calculated regression models using the selected theoretical framework. Therefore, this does not implicate a general independence between the variables, but only shows the importance of other variables based on their predictive ability.

Liking as a pathway to money donation and volunteering

As described in the results, we found correlational as well as predictive connections between the

motivation to like for the protection of the Andean bear and the motivation to donate money and to volunteer. This is in line with our hypothesis (H_3) and was also suggested by prior research (Pearson et al., 2016). The results imply a connection of all motivations and are interesting for the investigation of liking as a low-level entry point for more pronounced environmental behaviors like money donation and volunteering, which we investigated using the mediator analyses. In these mediator analyses, we found liking motivation as a significant mediator of the connection between enjoyment and the motivations to donate money and to volunteer while controlling for perceived behavioral control as a covariate. These three variables showed already a good explanation of the variance within the more demanding environmental behaviors.

For environmental organizations this implicates liking and social media as a way to translate enjoyment towards the protection of the Andean bear into higher order environmental actions like donating and volunteering (Haro-de-Rosario, Sáez-Martín, & del Carmen Caba-Pérez, María, 2018). This might be especially suitable in the selected context of the Andean bear, which is already part of popular culture (Platt, 2015). Furthermore, the communication and distribution of scientific results to concerned rural communities is major barrier to the general acceptability of wildlife as well as management actions (Mech, 2017). This could for example include information about the suitability of specific wildlife management strategies (Eklund, López-Bao, Tourani, Chapron, & Frank, 2017), which sometimes are counterintuitive to common sense like killing problem wolves (Swan, Redpath, Bearhop, & McDonald, 2017). Other possible usages include allowing dialogue or planning future actions (Warren et al., 2014).

While all these ways of engaging individuals in the protection of biodiversity seem promising, it is clear that online activism (clicktivism) is only of limited reach for transformative societal actions (Halupka, 2014). This means, every form of social media behavior should later translate into further, real world actions. As our data indicated liking as a possible proxy of such a transformation into real-world behavior, attention of people in online campaigns can be the foundation for further conservation work and should have a place in the greater rationale of species conservation. Overall, successful conservation largely depends on successful communication, just as classical activism. But especially for the issue at hand, social media could be an important way of information, as prior studies revealed a lack of information about the Andean bear as a serious problem for the conservation of the species (Can et al., 2014). As the distribution of information is one major aim of social media usage (Lovejoy & Saxton, 2012), social media might be appropriate in this issue to overcome this lack of information. For future environmental work it might be interesting to further investigate if social media behavior may be an easy entry point for pro-environmental behavior, which could entail more difficult behaviors in terms of spillover effects (Nilsson, Bergquist, & Schultz, 2017). Particularly, this could mean studies about the impact of social media behavior as a way to overcome the often discussed intention-behavior-gap (Sheeran, 2002).

Conclusion

As described above, our study enabled the behavioral comparison of social media behavior to two other more classical conservation behaviors and found specific motivationally relevant factors based on the selected theoretical framework for the motivation to like content for protecting the Andean bear. While the participants were highly motivated for the protection of the Andean bear in social networks, smaller motivations were reported for volunteering and money donation. We were able to explain these differences based on the absence of a predictive effect of perceived behavioral control, which we interpreted as the evaluation of this behavior to be easy. Besides this, we found gender as second major difference, as this variable only affected social media protection behavior. Enjoyment was the only variable which coherently predicted variance for all behaviors. While all these variables should be reflected in the further development of a theory of environmental social media behavior, especially the final connection of the liking motivation with the other more demanding motivations seems promising for guiding further sustainable development.

Of course our study had a rather explorative approach to the selected issues, based on the scarce theoretical background (Büscher, 2016). Furthermore, cultural backgrounds have always to be reflected for environmental as well as social media behavior (Burke & Şen, 2018). But based on the present results, our study allowed for the better description of environmental liking and complements prior empirical approaches. Nonetheless, in times of 'post truth' (Sismondo, 2017), there is a need for more knowledge about how people environmentally behave in digital spaces to foster sustainable development (Gifford, 2014). As such, our results help to understand, plan, and implement conservation activities. Therefore, future work in this regard seems interesting, to further uncover how social media might facilitate pro-environmental behavior and finally lead to more sustainable societies (O'Neill et al., 2018).

4.3. Do pre-service teachers dance with wolves? Subject-specific teacher professional development in a recent environmental issue[9]

Abstract

Affective variables like values and attitudes constitute a crucial requirement for sustainable behavior. But while general environmental psychology started to investigate such non-cognitive factors, there is only scarce knowledge about contextual factors in the domain of motivation to teach about contexts of Education for Sustainable Development (ESD). But as topics of ESD often are demanding to teach, we need more knowledge about motivationally relevant factors to shape teacher professional development. Therefore, we selected the wildlife conservation issue of the grey wolf (canis lupus) in Germany and possible relevant variables from prior studies, to investigate their motivational relevance towards teaching about the issue. In a sample of 120 pre-service biology teachers (Mage = 23.2 years, SD = 3.3), we found protection motivation of the wolf as a positive and psychological distance towards the issue as a negative direct predictor of the attitudes, enjoyment and perceived behavioral control towards teaching the issue. While wildlife values and attitudes showed indirect effects on the motivational variables, we conclude a higher teaching motivation of pre-service teachers who want to protect the respective species and feel psychologically near to the issue. We reflect the results as opportunities for subject-specific teacher professional development in ESD.

Keywords

teaching motivation; values; attitudes; psychological distance; return of the wolf

[9] Büssing, A.G., Schleper, M., Menzel, S. (2019). Do pre-service teachers dance with wolves? Subject-specific teacher professional development in the context of returning wolves. *Sustainability*. doi:10.3390/su11010047.

Introduction

The return of the wolf as a context of Education for Sustainable Development (ESD)

Declining biodiversity is a major problem for sustaining life on planet earth (Steffen et al., 2015). But as the example of reintroduced wolves into Yellowstone National Park showed (Ripple & Beschta, 2012), there are ways to respond to declining biodiversity and recover ecosystems (Johnson et al., 2017). While the project in the Yellowstone National Park serves as an example of intentionally reintroducing a predator species into an ecosystem, wolf packs are also returning in natural ways to some of their ancestral habitats. Examples from Europe show the recovery of wolves in regions where they were eradicated through human activities in the last centuries (Chapron et al., 2014). However, this natural return often leads to conflicts between stakeholders, especially in densely populated regions (Enserink & Vogel, 2006).

The main conflict arises due to the economic damage experienced by livestock owners, which is a major cause for the rejection of wild wolves in affected areas (van Heel, Boerboom, Fliervoet, Lenders, & den Born, 2017). In Lower Saxony, a federal state in the northwest of Germany, the issue of returning wolves is particularly controversial (Ronnenberg et al., 2017; Thomas, 2015). This region has the highest density of livestock in the country (Statistische Ämter des Bundes und der Länder, 2018), and farmers are afraid of losing animals to predators when more wolves enter the region (Mech, 2017). Besides the possible economic costs, the return of wolves also provokes opposition based on social factors like distrust, conflicting values or beliefs (Dickman, 2010). Furthermore, deeply rooted implicit beliefs and feelings led to the stereotype of the "Big Bad Wolf", which is promoted by society's subjectively perceived fears about the return of the wild animal (Jürgens & Hackett, 2017).

While analyses from affected areas showed only a small proportion of livestock as a source of nutrition for wolves (Ronnenberg et al., 2017; Wagner, Holzapfel, Kluth, Reinhardt, & Ansorge, 2012), the viable status of the species in new regions highly dependents on mutual solutions between the stakeholders (Hindrikson et al., 2017; Randi, 2011). Such solutions require an in-depth understanding of the conflicts and their management, which optimally leads to joint solutions considering the needs of all stakeholders (Redpath et al., 2013).

The described interconnectedness of ecological (biodiversity), economic (the costs of livestock) and social dimensions (conflict between farmers and conservationists) underline the suitability of the issue as a context of Education for Sustainable Development (ESD). In contrast to prior approaches of environmental education focused on sole ecological knowledge, ESD explicitly integrates these dimensions in education (Leicht, Heiss et al., 2018; United Nations, 2017). Prior studies showed conservation issues as a suitable way to address these interconnected dimensions with students (Menzel & Bögeholz, 2009) and foster their decision-making competencies (Grace, 2009). Furthermore, such decision-making competencies constituents of a wider general literacy (Hofstein et al., 2011) and therefore also found their way into national curricula. For example school subjects like biology,

German regulations bind teachers to explicitly foster students decision-making about biodiversity issues and foster these competencies (KMK, 2005; Steffen & Hößle, 2014). The issue of returning wolves has already been successfully utilized as a possible topic, linking biological learning opportunities, affective appeal, and personal relevance (Hermann & Menzel, 2013b).

Environmental issues in schools

Despite these normative preconditions to teach topics like the return of the wolf, teaching about such topics within the context of ESD remains difficult for teachers (Borg et al., 2012). This might hinder teachers in the utilization of specific contexts, why we need to know more about the teaching motivation for teaching specific issues to properly design teacher professional development One problem is the uncertainty due to the controversial nature of the issues (Borg et al., 2012). Based on this controversial nature, a high amount of specialized knowledge is needed to make informed decisions about environmental issues (Robelia & Murphy, 2012). Furthermore, teachers might have an unclear understanding of the intrinsically complex and abstract construct of biodiversity (Fiebelkorn & Menzel, 2013).

Besides these cognitive factors, worldviews are another severe problem, as factors like values or experiences and contextual beliefs are inevitably linked to meaning- and decision-making in environmental issues (Lundholm, 2005; Manni et al., 2017). This affects teaching, since a wide variety of personal or contextual variables influence teaching habits and motivation in ESD contexts (Atmaca, 2017). Other examples from climate change show how political views and teacher identity might influence science teachers in the United States to doubt human activities as a cause for the globally changing climate (Plutzer et al., 2016). Especially in science subjects, this might lead to a concentration on factual knowledge instead of ethical decision-making (Sadler et al., 2006; Tidemand & Nielsen, 2017). Such teaching approaches neglect the high potential of conservation issues in order to foster ethical decision making in school students (Grace & Ratcliffe, 2002). But there is only little knowledge about specific behaviorally relevant personality variables.

Further knowledge about such behaviorally relevant contextual values, beliefs, and motivations may help to better understand pre-service teachers' learning in controversial issues and explain why discussions might become emotional (Quigley, 2016). Finally, a further understanding of teaching identity and motivation is important for successful professional development, as the effectiveness of development is aimed at engaging teachers with content instead of only offering it to them (Kennedy, 2016; Korthagen, 2017). This knowledge is also needed to properly design teacher professional development (McNeal et al., 2017).

Teacher professional development in ESD

Teacher professional development generally describes teachers' learning processes and seeks to understand how these learning processes can facilitate student learning (Postholm, 2012). Since early

times, teacher development has concentrated on knowledge development (Shulman, 1986; Shulman, 1987). Based on the differentiation of knowledge into the categories of content knowledge (CK), pedagogical knowledge (PK), and the subsequent pedagogical content knowledge (PCK), PCK in particular has been found to be a main contributor towards student achievement and learning outcomes (Keller et al., 2017). Due to this importance, teacher knowledge emerged as one main facet of professional teachers (Neumann, Kind, & Harms, 2018). But normative models like the model of professional action competence from Baumert and Kunter also propose motivation, consistent values/beliefs as well as self-regulative functions as other components of teacher's professional competence (Baumert & Kunter, 2013).

These more affective variables of teacher behavior raise problems for teacher professional development, as they are at the core of understanding teacher behavior, but have been often neglected in prior research (Korthagen, 2017). Due to the central role of emotions in ESD (Ojala, 2013) as well as motivations and values as key competencies of sustainably literate citizens (Barth, Godemann, Rieckmann, & Stoltenberg, 2007; Rieckmann, 2018b), there may be a urgent need in ESD to better understand teachers' beliefs and values and their influences on teaching (Bertschy et al., 2013; Dickman, 2010; Sund, 2015).

Knowledge about such factors is also needed to adapt transformative learning to teacher professional development. Transformative learning aims at changing the learner's prior frames of reference to make them more inclusive, open and reflective (Mezirow, 2009). For these learning processes, educators need knowledge about the prior way of thinking to transform this into more sustainable ways (Sipos, Battisti, & Grimm, 2008). This especially concerns emotions and deeper personality factors as emotions and values (Illeris, 2014; Taylor, 2001).

One concrete example of possible values for the context of returning wolves may be wildlife value orientations, which have predicted protection motivations in the context of returning wolves (Hermann & Menzel, 2013a) and build the basis for higher order attitudes as well as motivations in wildlife contexts (Whittaker et al., 2006). When wildlife issues should be included in schools, such values have to be reflected in initial teacher education, as teachers otherwise will rely on their everyday life values. In society, these values are often not coherent with the aims of ESD (Manfredo et al., 2017).

Besides these values, also teachers' general attitudes towards wolves may influence teaching decisions and approaches when teaching about the species (Dressel et al., 2015). Besides these personality factors, the personal relevance and closeness to the issue was found to be connected to the motivation to protect the species (Carmi & Kimhi, 2015; McDonald et al., 2015) and may increase the motivation of learners based on a higher relevance (Stuckey et al., 2013). But this increased closeness may also have reverse effects on the motivation to teach about the issue, as teachers may be inhibited by the regional political climate and could therefore try to avoid such topics (Kuhl, 2017).

Aim of the present study

To sum up, while values, beliefs and other non-cognitive variables like the closeness to issues of ESD may play and important role in teacher motivation and ultimately competent teachers, prior teacher education studies so far mostly neglected these components. This is problematic, as a further investigation of emotional and motivational variables is needed to advance professional development programs (Korthagen, 2017).

In prior studies, researchers used a wide variety of theories to explain teaching motivation (Han & Yin, 2016). One way of doing so is to draw upon general socio-psychological theories, like the *theory of planned behavior* (Ajzen, 1991), which have been widely adapted to explain general environmental behavior and also to predict intention to teach specific topics (Carmi et al., 2014; Zint, 2002). As several studies showed additional variables as predictor of intentions, researchers broadened the TPB resulting in the *model of goal-directed behavior* (Perugini & Bagozzi, 2001). The MGB includes emotions as additional predictors for behavioral intentions and further distinguishes this dependent variable into desires and intentions (Perugini & Bagozzi, 2001).

The MGB has already been successfully adapted as a model to investigate pre-service teachers' desires to teach about the return of the wolf (Büssing, Schleper, & Menzel, 2018). In this and other studies (Lumpe et al., 1998b), attitudes, enjoyment, and perceived behavioral control towards teaching emerged as predictive factors for the motivation to teach about the return of the wolf. We do not know, however, what variables are in turn conductive for these attitudes, enjoyment and perceived behavioral control towards teaching the issue of returning wolves. In the original TPB these were called background factors, and possible variables have often been debated (Ajzen, 2011). In order to shed light on this question, we decided to use these variables as dependent motivational variables in the current study and investigate if any of the presented variables of values, motivations or closeness to the issue may constitute predictors for these factors (Ajzen, 2011).

As the study aims to draw conclusions on initial teacher professional development, we focused on pre-service teachers and addressed the following general research question:

> **RQ:** What contextual and personality variables are motivationally relevant for pre-service teachers' motivation towards teaching about the return of the wolf?

To answer this superordinate research question, we developed a theoretical framework including specific relationships between the personality and motivational variables based on findings from environmental and wildlife psychology (Manfredo, 2008).

Theoretical framework

Teaching motivation

Attitudes towards teaching about the return of the wolf as a first motivational variable in our study describe positive or negative evaluations regarding teaching the respective topic in schools (Ajzen, 1991). These evaluations have an affective as well as cognitive character; they concentrate on specific objects and have been found as predictors of behavior in earlier studies (Ajzen, 2001). In prior ESD studies, such attitudes have been also found to be linked to pre-service teachers' learning processes in sustainability issues (Tomas et al., 2017).

Another, purely affective motivational variable is the emotion of *enjoyment towards teaching about the return of the wolf*. Emotions can be differentiated to attitudes in terms of their duration, complexity, and the object of affective reaction (Shuman & Scherer, 2014). Individuals experience enjoyment in positively valued situations with high controllability (Pekrun, 2006) and the emotion was also found as the prevalent positive teaching emotion (Frenzel, 2014). Besides the connection to teaching motivation (Büssing et al., 2018), enjoyment also correlated with other internal as well as external educationally relevant variables, like job satisfaction or student ratings of positive teacher behavior in earlier studies (Frenzel et al., 2016).

Finally, *perceived behavioral control towards teaching about the return of the wolf* describes the individuals' beliefs about the perceived control of their own ability to perform a specific behavior and is therefore conceptually similar to self-efficacy (Ajzen, 1991). While both variables refer to the individuals' ability to perform behaviors, perceived behavioral control better captures the specific nature of teaching about topics, as self-efficacy is a more general trait than concentrated on one behavior (Ajzen, 2002; Zee & Koomen, 2016). Prior studies found knowledge (Menon & Sadler, 2018) and initial teacher education (Mahler et al., 2017) as important antecedents of efficacy beliefs.

Contextual variables

Personality traits

As a first group of contextual variables we included personality variables like the wildlife value orientation of mutualism, attitudes towards the wolf and the protection motivation towards the species in our theoretical model. These variables have shown to motivate the protection of wildlife species (Manfredo, 2008) and may explain some of the relevant personality factors, which constitute additional background factors for the respective behavior (Ajzen, 2011).

Protection motivations are defined as behaviors which harm the environment as little as possible or even protect its resources (Steg & Vlek, 2009). These behaviors may occur in different settings, such as public or non-public behaviors (Stern, 2000) and can be either concentrated on general or specific manifestations of environmental behavior (Carmi et al., 2014). Therefore, the *protection*

motivation towards the wolf represents a specific motivation for harming wild wolves as little as much or protecting the species in public and non-public occasions. The increase in the motivation to protect the species is one requirement for a higher acceptance of wolf recovery in many parts of the world (Mech, 2017; Randi, 2011).

As described above, attitudes are positive or negative evaluations of contexts and are predictive of intentions and subsequent behaviors (Ajzen, 1991). In addition to attitudes towards teaching the specific issue, there are also the *attitudes towards the wolf*, which concentrate purely on the species and evaluate its existence (Kaczensky, Blazic, & Gossow, 2004). In combination with other social and contextual factors, such attitudes contribute to fostering acceptance about the protection of the species (Bruskotter, Vaske, & Schmidt, 2009) and protection motivations (Mech, 2017). But while attitudes might lead to subsequent motivations, attitudes also originate in deeper factors like values (Whittaker et al., 2006). As described above, one prevalent value type for the return of the wolf may be wildlife value orientations.

Generally, wildlife value orientations describe the fundamental values, which people assign to wildlife (Fulton et al., 1996). These wildlife values can be differentiated into a mutualistic and a dominant value dimension. While *mutualism* constitutes a positive and protectionist view of wildlife, individuals with a higher domination oriented value set place humans over wild animals and assign society the right to decide over wildlife and use their resources (Manfredo et al., 2009). Within these two dimensions, different subcategories may be differentiated (Fulton et al., 1996). One example may be the subdimension of *caring beliefs*, which capture how strong individuals personally care for animals and their welfare (Manfredo et al., 2009). As prior studies found mutualism as the basic foundation for protection motivation in the context of returning wolves in Germany (Hermann & Menzel, 2013a), we integrated this variable in our theoretical model.

Generally, young people with better education hold more positive attitudes and a higher general protection motivation towards the wolf (Dressel et al., 2015). As our sample of pre-service teachers is characterized by a young age and good educational background, we propose the following research hypotheses for the investigation about the connections between the presented personality traits and the motivational variables:

H_1: Protection motivation is positively connected to the attitudes, enjoyment, as well as the perceived behavioral control towards teaching about returning wolves.

H_2: Attitudes towards the wolf are positively connected to the attitudes, enjoyment, as well as the perceived behavioral control towards teaching about returning wolves.

H_3: The wildlife value dimension mutualism is positively connected to the attitudes, enjoyment, as well as the perceived behavioral control towards teaching about returning wolves.

Closeness to the issue

As described above, the perceived or real closeness to the return of the wolf might be connected to the motivation to teach, as prior studies found effects on behaviorally relevant variables like attitudes towards wolves (Dressel et al., 2015; Eriksson et al., 2015). Different to other studies, which directly measured the distance to wolf territories (Karlsson & Sjostrom, 2007), we decided to utilize a socio-psychological approach to perceived distance. It is possible that people might not feel concerned by the return based on their profession, even if they live nearer to wolves. Therefore, we selected the construct of *psychological distance* (Liberman & Trope, 2008).

This variable has already been extensively applied to study the closeness to climate change (McDonald et al., 2015) and comprises of four subdimensions of geographical, temporal, social, and hypothetical distance (Liberman & Trope, 2014). In the context of returning wolves, a psychologically distant individual will perceive wolves to return not in close proximity to her or him (geographical), not in the near future (temporal), not to her or him personally (social) and be generally relatively unlikely (hypothetical). In prior studies a decrease of psychological distance lead to higher environmental motivations (Jones, Hine, & Marks, 2017), we propose the following hypotheses concerning this variable:

> **H_4:** Psychological distance is negatively connected towards the attitudes, enjoyment and perceived behavioral control towards teaching about returning wolves.

Order of variables based on cognitive hierarchy

As described above, the original framework of the TPB allows for the integration of further background factors, which in turn predict the behaviorally relevant variables (Ajzen, 2011). Therefore, all of the presented variables can be positioned as antecedents of the subsequent MGB variables.

To further classify the order of the tested variables to each other, we utilize the *theory of cognitive hierarchy*, which describes deeper factors like values as the basis for higher-order attitudes and more nuanced behaviors (Whittaker et al., 2006). While the theory originated in wildlife research (Fulton et al., 1996), other researchers found similar structures within similar domains like environmental psychology. One example may be the value-belief-norm theory (Stern, 2000), which also has been applied to study the pro-environmental behavior of students (Menzel & Bögeholz, 2010). While the terminology may be different, the structure of deeper and more general variables, which then in turn predict more specific variables, is similar.

While the deeper factors are more general and also slow to change, the higher order variables are more specific and also faster to change. Based on this assumption, the variable of mutualism should be predictive of the attitudes towards the wolf, which will in turn be predictive of the protection motivation towards the species. While protection motivation should then be directly connected to the

motivational variables, psychological distance might be directly connected to the motivational variables. Therefore, we state our final hypothesis:

H_5: The variables are ordered in accordance to the theory of cognitive hierarchy.

A graphical overview of the theoretical framework of our study is shown in Figure 4.7.

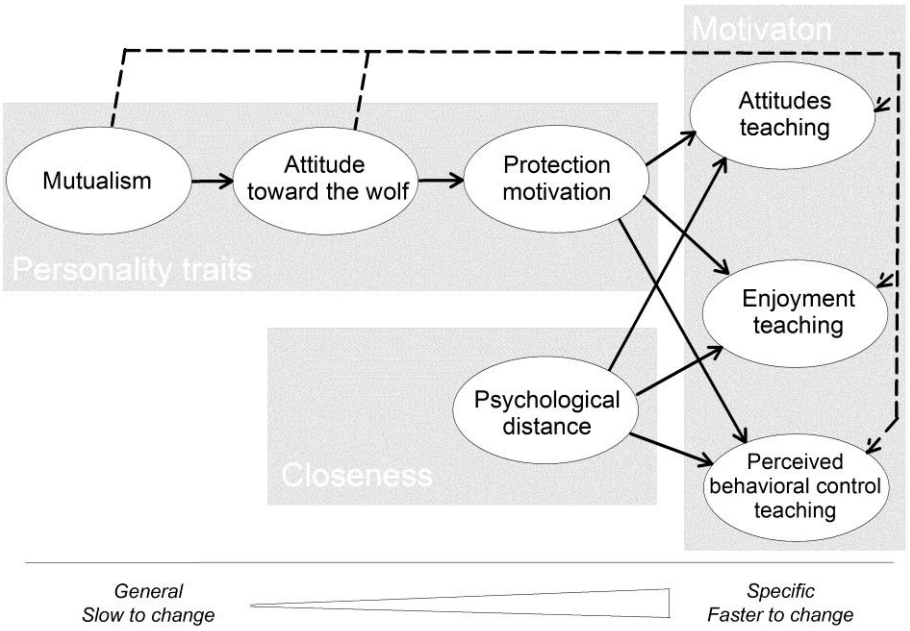

Figure 4.7 The theoretical model of the study testing for connections between contextual variables of personality traits and closeness to the issue of returning wolves with the motivational factors to teach about returning wolves according to the theory of cognitive hierarchy. Bold lines indicate direct and dashed lines indirect effects.

Materials and Methods

Research design and sample

To investigate the superordinate research question and address the stated hypotheses, we followed a cross-sectional research design and created a self-completion questionnaire (Bryman, 2008). The questionnaire was distributed in a German paper-and-pencil version in several lectures at a university in Lower Saxony, a federal state in the northwest of Germany. Because no special randomization was implemented, the sample represents a convenience sample (Bryman, 2008). Prior to the study, several sightings of wolves were reported in the surroundings of the city and in Lower Saxony in general (Landesjägerschaft Niedersachsen e.V., 2016; Ronnenberg et al., 2017).

The analyzed sample consisted of 120 pre-service biology teachers, 98 of them female (82.4%) and 21 male (17.6%). One participant did not report the corresponding gender but was not excluded from the analysis as gender was not investigated further in the current study. Even though the number of female participants is greater than the number of male participants, the sample appears to reflect the gender distribution in the desired population of pre-service biology teachers, as other studies had similar

sample structures (Lombardi & Sinatra, 2013). Participants ranged in age from 19 to 38 years (M = 23.2 years, *SD* = 3.3 years).

The study was conducted in accordance with the Declaration of Helsinki, the German Research Foundation (DFG) as well as the American Psychological Association (APA) and we obtained informed consent for inclusion in the sample from every participant before the study. Furthermore, we ensured anonymity of all participants, who also had at any moment the possibility to skip single questions or the whole questionnaire. The protocol was therefore not approved be a local ethics committee, as the research had no medical background, assessed no sensitive personal information and all participants were introduced to the aim of the study.

Questionnaire

The scales relevant for the current study were integrated in a greater questionnaire about the teaching motivation of pre-service teachers. All variables except of gender were measured using a 6-point Likert scale. The original questionnaire was distributed in German, and the corresponding items were translated into English for the purpose of this paper. The translation of the original scales into German was achieved using a double-translation approach by back translating them from German to English and checking for coherence. The wording of all items can be obtained from the appendix.

Contextual variables

To measure the mutualistic dimension of wildlife value orientations, we used the established original wildlife value scales (Manfredo et al., 2009). We decided to measure the mutualistic subdimension of caring beliefs, as these showed to be the most relevant based on prior studies (Vining, 2003). The scale overall compromised four items.

To measure attitudes towards the wolf, we selected the general attitude towards wildlife measure of Kaczensky, Blazic & Gossow (2004) and adapted it to the chosen animal context. This was done by replacing the word “bear” in the original items with the word “wolf”. Furthermore, we changed the original destination in one item (Slovenia) to Germany, as this was the selected country where the study was done. While the overall scale comprised five items, the final item was reverse coded similar to the original scale.

The scale for the protection motivation towards the wolf was constructed using the items of Stern et al. (1999). We closely adapted these items to the context of the protection of the wolf, similarly to the attitudes towards the wolf. This resulted in a three item scale, which included private-sphere behaviors as well as public behaviors to measure protection motivation coherently to our theoretical framework (Stern, 2000).

The scale for the measurement of psychological distance was constructed based on the four subdimensions of the variable (Liberman & Trope, 2014), which were each measured with one item.

This is similar to the adaption of the scale in prior studies (Carmi & Kimhi, 2015). This means that each participant rated his or her concern about the return of the wolf in terms of the social, temporal, geographical, and hypothetical manifestation of the phenomenon. After the data collection, all items of this scale were reverse coded, since the overall scale is negatively defined.

Motivational variables

The scales of the motivational variables were constructed using established scales of the MGB (Song et al., 2012). Similar to the other scales we aimed for a direct adaptation by only replacing the respective objects of the items. Different to the original MGB we measured emotions using discrete emotions, instead of the dimensional emotions from the original MGB (Izard, 2007). The emotion of enjoyment towards teaching was measured using the Differential Emotions Scale (Izard et al., 1993). The stimulus was presented by an introductory sentence, which was "If I imagine teaching the topic 'the return of wolves' in biology class, I feel ...". Participants were then asked to rate their agreement to experiencing the three respective adjectives. Finally, we addressed PBC by asking the pre-service teachers for their subjectively perceived possibilities of teaching the chosen context.

Statistical analysis

General approach

As a first step, we performed a confirmatory factor analysis (CFA) to ensure the discriminant validity of all scales (Brown, 2015). After inspecting Cronbach´s alpha as a further measure of internal consistency (Field, 2018), we investigated relations between the variables based on their correlations (Table 4.7). Following our theoretical assumptions, we then calculated a structural equation model (SEM) and tested the predictive ability of the variables ($H_{1\text{-}4}$) with the hypothesized structure, building on the theory of cognitive hierarchy (H_5).

As an additional test of this structure, we calculated an additional structural equation model with direct effects of the deeper variables on the motivational factors and compared it to our theoretical model. In this additional model, only the most specific contextual factors of psychological distance and protection motivation were predictive of the attitudes, enjoyment and perceived behavioral control towards teaching. This additionally indicated the direct effects of these variables and indirect effects of mutualism and attitudes towards the wolf according to the selected theoretical model.

To further illustrate the differences for pre-service teachers' motivational factors based on their psychological distance and protection motivation, we finally split the sample into two groups according to a high or low scoring on these scales ("median split") and compared these groups according to the attitudes, enjoyment and perceived behavioral control towards teaching about the return of the wolf (Iacobucci, Posavac, Kardes, Schneider, & Popovich, 2015).

Applied procedures

Due to the skewness and kurtosis of several variables (see Table 4.7), we selected robust statistical procedures. For the calculations of all models we therefore used a robust maximum-likelihood estimator (MLR), which showed to be robust against the violation of several assumptions like non-normality (Muthén & Muthén, 2017). We also used robust methods for the correlations (correlation coefficient spearman-rho) and difference tests (Mann-Whitney-U for group comparisons).

As recommended by Kline (2016), we evaluated the model fit by combining the fit indices of the root mean square error of approximation (RMSEA), Bentler comparative fit index (CFI) and the standardized root mean square residual (SRMR). Sufficient model fit is indicated by a RMSEA less than or equal to .08, a CFI greater than or equal to .95, and a SRMR less than or equal to .08 (Schreiber, Nora, Stage, Barlow, & King, 2006). Possible model modifications were based on the combination of model modification indices in accordance with theoretical considerations (Brown, 2015; Kline, 2016). To test for indirect effects of the variables, we performed a Sobel test (Muthén & Muthén, 2017).

While the CFA and SEM were performed using Mplus 7.3 (Muthén & Muthén, 2017), we used IBM SPSS 24 for the descriptive statistics, the calculation of Cronbach's alpha, as well as the correlations and difference tests between the variables. Results from the Mann-Whitney-U test were converted to a standardized effect sizes for better comprehension. All presented values represent standardized values.

Measurement results

The first estimation of the data led to an unacceptable fit of the CFA model, with some values fitting but others not passing the selected criteria (χ^2 = 460.906 (231, .00), RMSEA = .09, CFI = .88, SRMR = .09). Further inspection indicated a measurement problem with one item from the psychological distance scale and intercorrelations between several items from similar scales (e.g., perceived behavioral control and wildlife values). We therefore decided to modify the measurement model based on empirical as well as theoretical justifications (Brown, 2015; Kline, 2016).

As a first step, we excluded the last item (hypothetical distance; PD04) from the psychological distance scale. We think the unacceptable loading is due to the non-plausibility of the item in the selected sample. The wolf already started to establish near the study site (Ronnenberg et al., 2017), so the participants may have seen no sense on indicating how likely the return will occur. The psychological distance scale still encodes the spatial, temporal, and social distance to the process, so this exclusion does not impede the overall measurement of closeness to returning wolves. Besides this, we finally added five intercorrelations to the model (see the supplemental material for further information). We decided to add these correlations as a better way to address the problem than deleting single items, which is most often theoretically unjustified (Brown, 2015).

The estimation of this modified model led to an acceptable fit for the CFA [χ^2 = 314.559 (225, .00), RMSEA = .06, CFI = .95, SRMR = .06] and overall good factor loadings. The very good values for Cronbach's alpha (Table 4.7) also indicated a good internal consistency. Therefore, we accepted the model under the given modifications and continued with the further analysis.

Results

Descriptive results and correlations

As described in Table 4.7, most of the variables showed a slightly negatively skewed distribution. This concerned almost all variables except for mutualism and attitudes towards the wolf. The skewness was mainly due to relatively high values for the motivational variables of attitudes (*M* = 4.38; *SD* = .90; *Mdn* = 4.33), enjoyment (*M* = 3.91; *SD* = .94; *Mdn* = 4.00), and perceived behavioral control (*M* = 3.86; *SD* = .98; *Mdn* = 4.00) towards teaching. The skew also concerned protection motivation (*M* = 3.66; *SD* = 1.04; *Mdn* = 3.66). The highest value was reported for psychological distance (*M* = 4.79; *SD* = 1.14; *Mdn* = 5.00).

Table 4.7 Bivariate Spearman-rho correlations and descriptive statistics of the variables.

Variable	1	2	3	4	5	6	7
1. Mutualism	-						
2. Attitudes wolf	.34***	-					
3. Protection motivation	.43***	.59***	-				
4. Psychological distance	-.22*	-.04	-.01	-			
5. Attitudes teaching	.24**	.33***	.52***	-.27**	-		
6. Enjoyment teaching	.49***	.46***	.65***	-.15	.63***	-	
7. PBC teaching	.31**	.19	.46***	-.23*	.48***	.61***	-
Items	4	5	3	3	3	3	3
Mean	3.50	4.39	3.66	4.79	4.38	3.91	3.86
Median	3.50	4.40	3.66	5.00	4.33	4.00	4.00
Standard deviation	1.05	.82	1.04	1.14	.90	.94	.98
Skewness	-.05	-.41	-.71**	-.88**	-.52*	-.61**	-.68**
Kurtosis	.00	.49	.60	.15	1.38**	1.21**	1.08*
Cronbach's α	.87	.89	.85	.86	.86	.92	.84

Note. * = $p < .05$, ** = $p < .01$, *** = $p < .001$. PBC = perceived behavioral control. Significant skewness and kurtosis indicate a significant deviation from normality (Field, 2018).

Concerning the connections between the variables, almost all of the contextual personality traits correlated with the attitudes, enjoyment and perceived behavioral control towards teaching (Table 4.7). While almost all connections had a medium effect size, especially protection motivation was positively correlated to the attitudes ($r = .52$, $p < .001$) and enjoyment ($r = .65$, $p < .001$) with a large, as well as to perceived behavioral control towards teaching with a medium effect size ($r = .46$, $p < .001$). The

strongest relations were found between the dependent variables, which all showed positive correlations with large effect sizes (r = .48 - .63, p < .001).

Structural equation model

The results of the structural equation model are depicted in Figure 4.8. Mutualism positively predicted the attitudes towards the return of the wolf (β = .40, p < .001), which in turn positively predicted the protection motivation of the wolf (β = .63, p < .001). This protection motivation was a very strong direct predictor of the attitudes (β = .71, p < .001), enjoyment (β = .68, p < .001), as well as PBC towards teaching (β = .52, p < .001). Psychological distance was another but overall weaker negative direct predictor of the attitudes (β = -.39, p < .001), enjoyment (β = -.22, p < .01), and PBC towards teaching (β = -.31, p < .01).

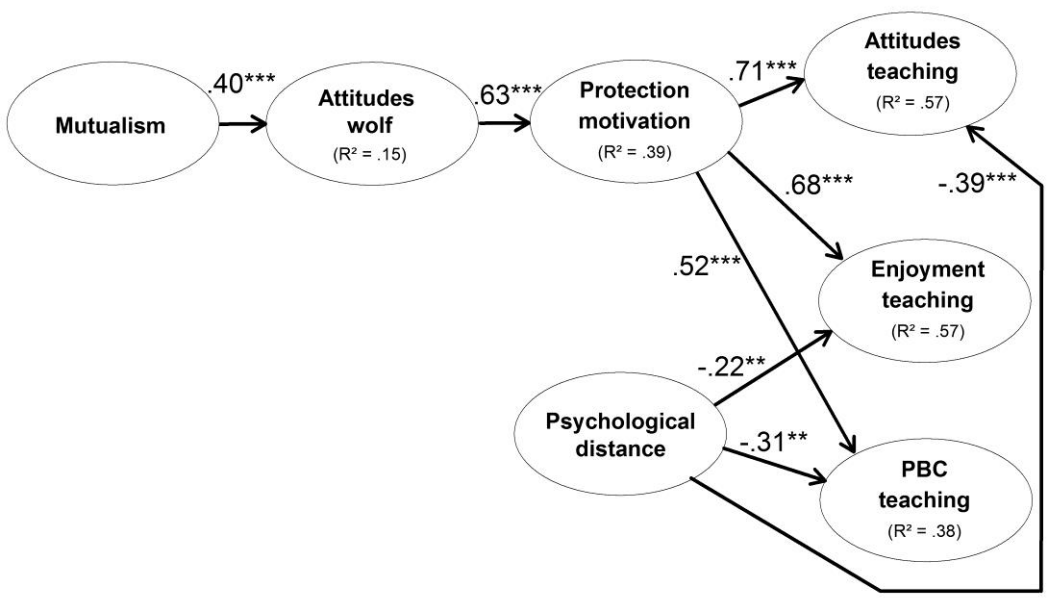

Figure 4.8 Structural equation model for the attitudes, enjoyment, and perceived behavioral control (PBC) towards teaching. Indirect effects and loadings are omitted for clarity. Indirect effects are displayed in Table 4.8, and the loadings can be obtained in the supplemental material. Model fit: RMSEA = .06, CFI = .95, SRMR = .08. ** = p < .01 *** = p < .001, R^2 = explained variance of the latent variable.

Overall, attitudes towards the wolf showed with 15% the lowest share of explained variance (R^2 = .15). For the variables of protection motivation (R^2 = .39) and perceived behavioral control (R^2 = .38) the predictors explained overall more variance, with 38% and 39% of the explained variance. Finally, the predictors of attitudes (R^2 = .57) as well as enjoyment towards teaching (R^2 = .57) explained the variance in these variables to a great extent, as the predictors explained more than half of the variance in both variables.

The indirect effects of mutualism and attitudes towards the wolf are further displayed in Table 4.8. Both variables showed no direct, but indirect effects through protection motivation. Overall, attitudes towards the wolf predicted a substantial amount of the attitudes (β = .45, $p < .001$), enjoyment (β = .43, $p < .001$), and PBC towards teaching (β = .33, $p < .01$). Mutualism also showed indirect effects, which were overall weaker.

With regard to the total effects, protection motivation was clearly the strongest predictor for all of the three dependent variables. Attitudes towards the wolf still showed remarkable effects, which were slightly greater than the relations between psychological distance and the dependent variables. Mutualism only predicted variance for the enjoyment towards teaching (β = .29, $p < .01$).

Table 4.8 Direct, indirect, and total standardized regression effects (β) of the predictors for the dependent variables of attitudes, enjoyment, and perceived behavioral control towards teaching.

	Attitudes teaching	Enjoyment teaching	PBC teaching
Direct effects			
Mutualism	-.16	.14	.00
Attitudes towards wolf	-.09	-.05	.00
Protection motivation	.71***	.68***	.52**
Psychological distance	-.39***	-.22**	-.31**
Indirect effects			
Mutualism$^{ATTWOLF+PROT}$	.14*	.15**	.13*
Attitudes towards wolf^{PROT}	.45***	.43***	.33**
Protection motivation	-	-	-
Psychological distance	-	-	-
Total effects (direct + indirect)			
Mutualism	.02	.29**	.13
Attitudes towards wolf	.36**	.38***	.33**
Protection motivation	.71***	.68***	.52**
Psychological distance	-.39***	-.22**	-.31**
Overall explained variance (R^2)	.57	.57	.38

Note. * = $p < .05$, ** = $p < .01$, *** = $p < .001$. PBC = perceived behavioral control, $^{ATTWOLF+PROT}$ = through attitudes towards the wolf and protection motivation, ^{PROT} = through protection motivation.

Group comparisons for psychological distance and protection motivation

As psychological distance and protection motivation emerged as only direct predictors, we used a median split and compared high and low scoring individuals on these scales concerning their attitudes, enjoyment and perceived behavioral control towards teaching. As the results illustrate, we found significant differences between the high and low scoring individuals for almost all dependent variables (Figures 4.9 and 4.10).

First of all, we found significant differences between higher for the protection of the wolf motivated (score of 4 and above) and less for the protection motivated pre-service teachers (score under

4) for the attitudes (Z = -5.160, d = 1.074, p < .001) enjoyment (Z = -6.205, d = 1.383, p < .001) and also for the perceived behavioral control towards teaching (Z = -4.22, d = .889, p < .001).

For the split of the psychological distance, we found significant differences between psychologically distant (score above 5) and psychologically more close individuals (score 5 or smaller) for the attitudes (Z = -3.068, d = .586, p < .01) and perceived behavioral control (Z = -2.114, d = .414, p < .05), but not for enjoyment towards teaching (Z = -1.175, d = .217, p > .05).

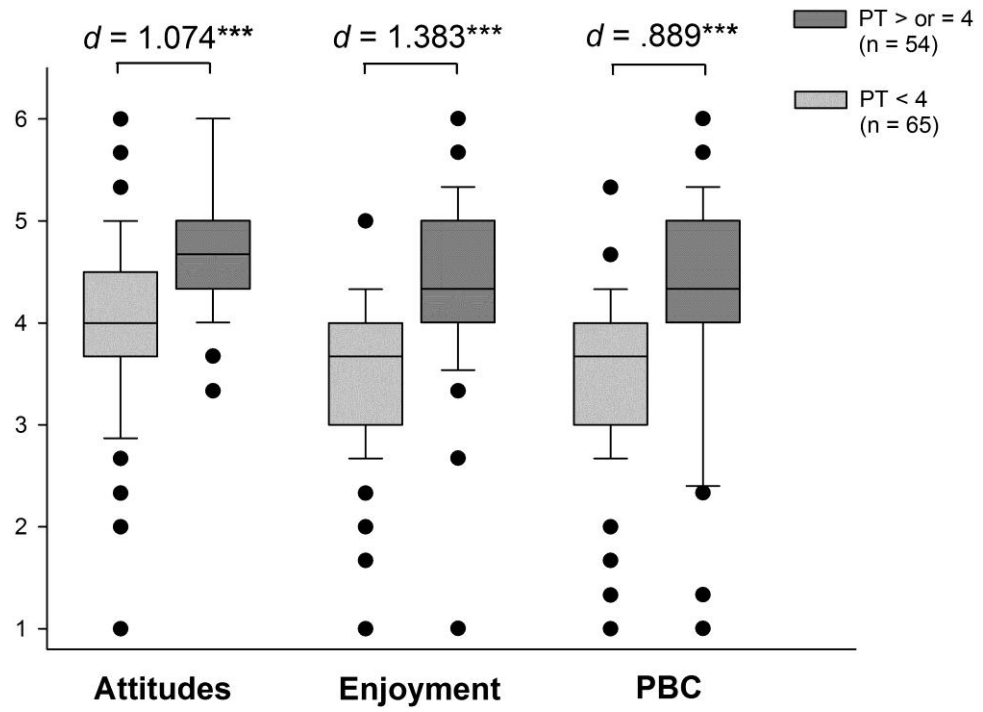

Figure 4.9 Group comparisons for the highly (value of 4 and above, dark gray) and small protection motivated individuals (value smaller than 4, light gray) for the variables of attitudes, enjoyment and perceived behavioral control (PBC) towards teaching about the return of the wolf.

Discussion

Relations among contextual and motivational variables

Protection motivation towards the wolf (H_1)

The strong relation between protection motivation and the three motivational variables of attitudes, enjoyment and perceived behavioral control towards teaching about returning wolves shows how a protection motivation about a species translates into higher motivation for teaching about the respective species. This result supports our hypothesis, as the positive direct prediction as well as the group comparisons indicated the hypothesized positive connection between the variables.

This is also the first result with a positive link between a contextual motivation to protect a species and a specific teaching relevant variable. Such personal contextual factors have been suggested as influences of teacher behavior in ESD (Atmaca, 2017), but have only scarcely been investigated in

prior studies. Moreover, our findings close a gap in prior research, as other studies either concentrated on teacher's protection motivation towards species or on teaching about the species, but only few studies investigated the relation between these two perspectives. Our results also underline normative statements, which emphasize the motivation of pre-service teachers' sustainable behaviors as an aim of teacher education (Qablan, 2018).

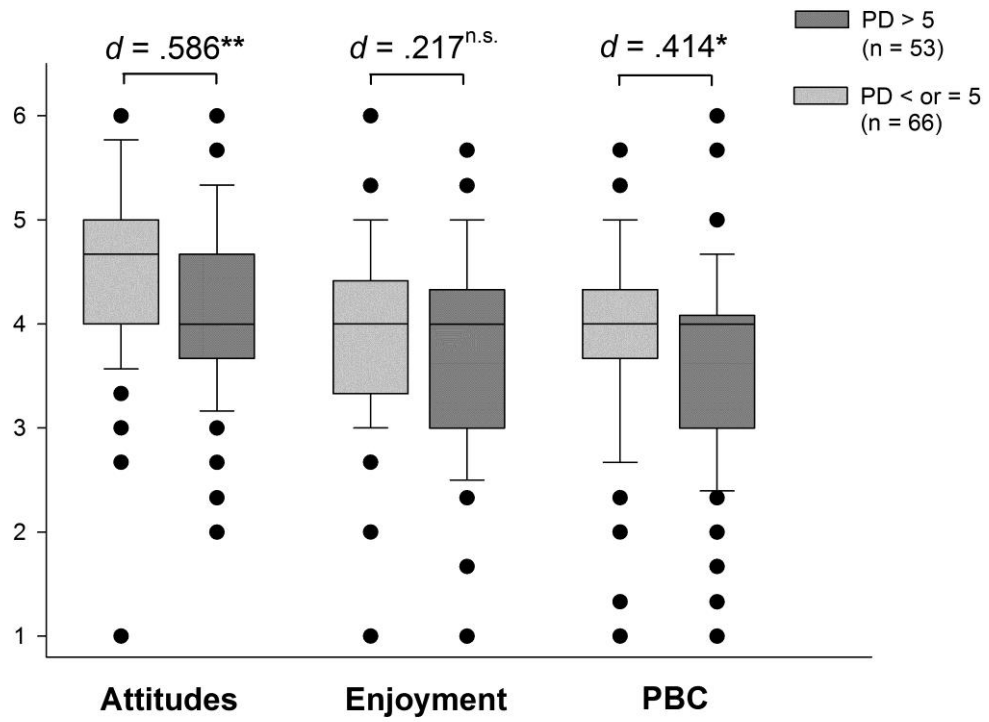

Figure 4.10 Group comparisons for the psychologically distant (value above 5, dark gray) and psychologically more close individuals (value 5 or smaller, light gray) for the variables of attitudes, enjoyment and perceived behavioral control (PBC) towards teaching about the return of the wolf.

Transferred to other contexts, this connection implies a positive relationship also for other topics of ESD, for example climate change, energy saving or waste reduction. For these topics, the motivation to protect the climate, save energy or reduce waste should also translate to a higher motivation to teach about these topics. Nonetheless, it may be discussable, how specific these protection motivations should be assessed. This is also an open discussion in environmental psychology. Prior studies showed robust connections between different specific protection motivations like energy conservation, recycling or sustainable transportation (Kaiser & Wilson, 2004). These connections would implicate one general protection behavior as sufficient, due to the same underlying motivations. In this case, a general approach to teacher professional development may be sufficient. But in empirical investigations specific predictors outperformed general predictors for their predictive ability for environmental behaviors (Carmi et al., 2014). Transferred to connections between nature protection and teaching, specific protection motivations should also outperform general variables for their predictive ability.

This is at the moment only a hypothesis, but it might be important to further investigate this to assess the possibility of using protection motivation as a possible target of interventions and explicit instruction. As our results show, this might be a good way of increasing teaching motivation. But nonetheless, such an intended increase of specific protection motivations in teacher education might be challenging, since a wide variety of deeper personality variables determines protection motivation (Gifford & Nilsson, 2014). As our study showed, deeper personality traits of attitudes towards the wolf and wildlife values build the foundation of pre-service teacher's protection motivation.

Attitudes towards the wolf (H_2)

Concerning the attitudes towards the wolf, we found this deeper personality factor as an indirect predictor of the attitudes, enjoyment, and perceived behavioral control towards teaching about the return of the wolf. Overall, attitudes towards the wolf showed a smaller connection to the dependent motivational factors than the protection motivation. But according to our hypothesis, attitudes towards the wolf were highly predictive of the protection motivation, which is why they should nonetheless be reflected in teacher professional development in ESD.

These results are in line with prior studies, which showed a positive connection between environmental attitudes and environmental behavior (Pe'er, Goldman, & Yavetz, 2007). Beliefs and attitudes are one integral part of teacher identity and might promote or hinder pre-service teachers in integrating ESD contexts into teaching, especially if personal beliefs and attitudes are not in harmony with ESD-related values (Corney, 2006). Consistent to this, attitudes towards the wolf served as the foundation of the protection motivation towards the wolf in our study. The connection with the motivational variables is also in line with studies from other domains, which successfully correlated context-specific attitudes with the preference to teach about the respective context. Examples stem from the domains of teaching about the evolution of species (Großschedl et al., 2014) and climate change (Liu et al., 2015; Plutzer et al., 2016).

These results are important for teacher professional development, as differences in attitudes may lead to differences in the success of professional development activities (Korthagen, 2017). Therefore, pre-service teachers with more positive attitudes towards the wolf may acquire knowledge in teacher education easier as other pre-service teachers, which was also implicated by a study about attitudes and knowledge about climate change (Liu et al., 2015). While this should be investigated in further studies, attitudes towards the respective animals should obviously be addressed in teacher education.

This concerns, for example, the aim of higher education to foster future teachers' positive attitudes towards teaching about sustainability-related issues (Summers, 2013). Due to their position in the cognitive hierarchy, attitudes might be easier to change than values. Values are of a more general nature and therefore more difficult to change once they have been developed (Schwartz, 1994; Whittaker et al., 2006). Changing attitudes might nonetheless be difficult for the case of returning

wolves, as direct experiences are not possible or could lead to declining attitudes (Eriksson et al., 2015). Therefore, possible interventions should focus on either positive examples of human-wolf-coexistence (Nyhus, 2016) or use a system approach and give new information about how the ecological, economic and social dimensions of the conflict interact with each other. Besides these opportunities to increase attitudes, our results imply wildlife values as the deepest foundation of the protection motivation and attitudes towards the wolf (Whittaker et al., 2006). Therefore, attitude change might be not possible without changing the factors causing the attitudes.

Wildlife value orientations (H_3)

As described in the results section, the wildlife values of caring beliefs were an indirect predictor of the enjoyment to teach about the return of the wolves, but neither a predictor of the attitudes nor the perceived behavioral control towards teaching. While this result fits to the direction of our hypothesis, the connections were not as strong as suggested by our theoretical model, as the wildlife values only predicted one of the motivational variables.

We believe this result is explainable by the nature of emotion causation. While there is still discussion about this causal nature in general (Moors, 2013), all theories define that emotions describe reaction to a specific stimulus, which then causes the individual to react, based on prior experiences (Moors, 2010; Shuman & Scherer, 2014). Qualitative results about teachers' emotions showed that individual identity and biography are important factors for teachers' emotional reaction on a particular stimulus (Cross & Hong, 2012). The wildlife values of our study may finally be a measure of this identity and biography, as values are deeply connected to one's own life and experiences (Hitlin, 2003).

While this is in line with general emotion theory (Nelissen, Dijker, & Vries, 2007), prior research on teacher emotions has regarded reactions to student actions as a main cause of teacher emotions in general (Frenzel, 2014). Our results indicate for the first time a different and more topic-specific cause of teacher emotions. While it is clear that teachers might react in specific situations involving student misbehavior with negative emotions (Becker et al., 2015), there might still be differences in the teachers' appraisals when they teach a positively valued topic compared to a negatively valued topic. For example, individuals with a higher mutualistic view of the world may show more resilience against disruptive student behavior in lessons about returning wolves. This should be further investigated in a comparative study with in-service teachers.

Whereas these results clarify the causation of teaching emotions, the investigation of values as part of teachers identity points to problems based on an ethical dilemma of teacher professional development. When we know the coherent values for specific aims of education, should teachers be purposefully selected to fit to these values? Or should we try to change these values in higher education? This is especially problematic as societal values might change. First of all, our study explicitly not aimed at investigating pre-service teacher personality in means of excluding inappropriate candidates, but rather analyzing successful candidates to foster learning in higher education.

Furthermore, teacher professional development about issues like returning wolves should not force learners to adopt any desired way of thinking, but build students capacity to manage their own life in a changing environment (Vare & Scott, 2007). Vare and Scott (Vare & Scott, 2007) described this capacity building as ESD 2, which also includes contradictions and therefore is different to ESD 1 (giving clear information and motivating in the short term).

Therefore, in professional development activities, students should reflect about their own values about topics like returning wolves. In this view, the role of teacher educators might shift to enable students' reflection processes by providing the right environment and suitable learning materials and topics. This directly points to the next hypothesis, as topic selection is at the core of teacher educators' work and psychological distance was the final predictor of the motivational variables.

Psychological distance (H_4)

Besides the personality traits towards the species, psychological distance was the second direct predictor of pre-service teachers' attitudes, enjoyment, and PBC towards teaching about the return of the wolf. In our model, psychological distance was negatively connected to the motivational variables. Therefore, pre-service teachers with less psychological distance to the return of the wolves showed more positive attitudes, enjoyment and perceived behavioral control towards teaching about the issue. This was also illustrated by the group comparisons in which those who scored higher in psychological distance were compared to those with a lower score. According to the results from the regression we found significant differences between the two groups for the attitudes and perceived behavioral control (lower in the high-score group for psychological distance). Only for the enjoyment towards teaching there was no difference between the groups.

This mostly supports our initial hypothesis and seems logical in terms of prior research about relevance processes in educational research, as an increased relevance based on a more close feeling to the process of returning wolves should contribute to a higher motivation to learn about the topic (Stuckey et al., 2013). But as this effect was not yet tested in a pre-service teacher sample, we now have a more specific indicator and a further possible antecedent of teaching motivation.

For the concrete design of teacher preparation courses, this implicates the selection of topics with a small psychological distance within these courses, as the increased closeness to the issue might facilitate the learning of content or pedagogical content knowledge based on a higher interest (Sadler, 2009). As the scale of psychological distance is rather new to educational research, a further test of the applicability to teacher training is needed. Furthermore, the results of the present study should be only cautiously transferred, as the surveyed pre-service teachers generally reported a high psychological distance towards the return of the wolves (mean of 4.79 and a median of 5). While this might be explainable by the teaching profession being far away from the problems with returning wolves, future studies should comparatively look in how this psychological distance might differ between specific teaching contexts.

Another interesting finding was the missing connection between psychological distance and the protection motivation or the attitudes towards returning wolves. Within the topic of returning wolves, there were already studies who found more negative attitudes and less protection motivation for individuals living closer to or being affected by wolves (Hermann & Menzel, 2013a; Karlsson & Sjostrom, 2007). While prior experimental studies showed how a decreasing psychological distance might lead to a higher engagement with climate change (Jones et al., 2017), our results show a more nuanced view, as there may be differences in how individuals experience psychological distance based on the context and their belonging to different groups (McDonald et al., 2015). Future studies could further investigate in how teachers might differ to stakeholders of returning wolves or the general public concerning their evaluation of psychological distance to specific processes.

Structure of variables (H_5)

As shown by the direct and indirect effects, we found a hierarchical structure of the variables, which was implied by prior literature and also corresponds with our hypothesis. Due to this hierarchical structure, wildlife values can be regarded as the foundation of positive attitudes towards the wolf, which in turn foster the protection motivation towards the species. Finally, this protection motivation was a significant contributor to the motivation to teach about the wolf.

In terms of teaching and learning about of the return of the wolf, this might be a difficult message, since values are deep factors of personality, which are difficult to change (Schwartz, 1994; Whittaker et al., 2006). This view generally complicates societal value change for nature protection (Manfredo et al., 2017). While such a change may be too ambitious in the context of teacher education, changes in individual values might possibly lead to greater changes in systems. Similar research described such changes as "leverage points" (Abson et al., 2017). The selection of a deep leverage, like changing goals or values deep in a system might therefore lead to greater positive changes in the whole system (Abson et al., 2017). This underlines the normative character of education in addressing learners not only on cognitive levels but also on social-emotional and behavioral levels (United Nations, 2017).

Nonetheless, this change might be impossible due to the difficult nature of values, the high influential potential of the closer personal social surrounding such as parents and family, and the diverse interests in societies (Manfredo et al., 2017). Furthermore, local beliefs and cultures might play a difficult role, as studies have shown differences in wildlife values based on (local) culture (Dietsch, Teel, & Manfredo, 2016). Yet, teacher education should not give up on this issue. Making teachers aware of the role of values in a person's general view on ESD-related issues may shape their view on educational interventions that address children's value perspectives. While future teachers are still in their higher education system, they may also want to learn about relevant teaching strategies. Therefore, universities should take the responsibility to offer such holistic learning opportunities. Examples are classes in which students reflect on their own value basis while at the same time learning about the theoretical assumptions surrounding the role of values for facing the challenges of a sustainable future.

This could also include the economic dimensions, illustrating the ecosystem services provided by wolves.

Affective and ultimately transformative teacher professional development in ESD

As described by our results and discussed before, we found values, attitudes and psychological distance as important contributors to pre-service teachers motivation to teach about returning wolves. This is an important new insight for teacher professional development, as motivation is described as one part of competent teachers in professionalization models like the action competence model (Baumert & Kunter, 2013). When we normatively expect teachers to be motivated when teaching about topics of ESD, then the presented personality values may be of severe importance and need to be reflected in professional development activities.

First of all, these activities should be affectively oriented (Korthagen, 2017). This means, teachers need deeper learning experiences instead of only acquiring new knowledge. Concrete examples include integrating external stakeholders and real-world experiences in relevant issues in teacher professional development, which might be a way to address the pre-service teachers' affective values and foster the sustainability behavior of pre-service teachers (Andersson, Jagers, Lindskog, & Martinsson, 2013; Biasutti, 2015; Bürgener & Barth, 2018). These real-world experiences might connect the cognitive input with interdisciplinary characteristics of the issues and needed affective appeals (Molderez & Fonseca, 2018). For the issue at hand, this would ideally mean to invite stakeholders into the lessons. But as this might not always possible in formal education, educators should try for the most authentic learning experience. These could for example also be assisted by media contents. In addition, students and especially in-service teachers could be brought together in learning communities with a specific scope (Natkin & Kolbe, 2016). Such communities provide new knowledge, teaching materials, or social connections, which are further requirements for sufficient motivation to teach ESD issues (Mulder et al., 2015). Similar learning communities in institutions of higher education might also foster the integration of such topics into higher education (Holdsworth & Thomas, 2015), which might be a main catalyst for curricular transformation (Barth & Rieckmann, 2012).

While learners should always reflect on their experiences and value structure none of these affective experiences are by any means a silver bullet to foster deeper personality change in pre-service and in-service teachers. Like the effect of psychological distance in our study showed, motivation and also learning are contextually bound processes (Atmaca, 2017). Therefore, teacher professional development should reflect this and look for specificity instead of general recipes in teacher education. This directly points to the start of the discussion, where we discussed the specifity of protection motivations. Of course it is not possible to tackle every ecological problem solely in ESD. Teacher educators should instead look for specific experiences, which probably also lead to transformational learning processes (Mezirow, 2009). As described above, through such a learning process deeper

personality factors like core beliefs and values might be better changeable and lead to a transformation of several overlaying behaviors, which also would be a "psychological" leverage point (Abson et al., 2017). Therefore, future studies should investigate how these affective experiences can be integrated into approaches of transformative learning and also assess their long-term impacts on the individual and probably also groups. But based on our data, such transformations in higher ESD seem to be successful through changing deeper personal variables than classical intervention studies.

Conclusions

Our study showed how specific contextual factors about an exemplary ESD context are connected to the attitudes, enjoyment and perceived behavioral control of pre-service teachers to teach about the issue of returning wolves. Besides identifying specific variables which may be aim of interventions to foster the teaching motivation for the selected context, our study identified further, non-cognitive dimensions that should be considered in teacher professional development. This includes protection motivation, psychological distance but also deeper variables like values.

Finally, our study stimulates new research in the domain of non-cognitive factors in teacher professional development in the context of ESD. As the belief system of teachers is likely to change when they enter school practice (Rust, 1994), our results are at the moment only applicable to pre-service teachers. But since teachers' individual experiences during teacher education are an important contributor to professional development (Mahler et al., 2017), this phase of teacher education is important for shaping the professional identity of teachers. This has also been shown in biodiversity contexts (Lindemann-Matthies et al., 2011). Sound teacher education concepts may arm teachers for the challenges of school practice. For example, if they learnt how to reflect on their own value structure, they may become more capable in asking themselves of their teaching practice is still congruent with what they value. Sometimes, such reflective practices fall short under the pressure of challenging school routines. In higher education, we may be able to train future teachers in value reflection and try to transform them to more sustainable ways of living and teaching (Lotz-Sisitka, Wals, Kronlid, & McGarry, 2015).

This transformation may not stop in general higher education, but it should be explicitly integrated in teacher education (Martin, Summers, & Sjerps-Jones, 2007). Prior studies have shown differences between specific cultures and countries concerning the preparation of teachers in the domain of sustainability (Kalsoom, Khanam, & Quraishi, 2017). This also concerns specific subjects, which may differ in their integration of ESD, based on the different subject-related cultures (Borg, Gericke, Höglund, & Bergman, 2014). Therefore, teacher educators should not rely on general solutions for all countries and subjects but should deliver subject-specific formats of teacher professional development. This is also underlined by the effect of psychological distance as a specific contributor to the motivation to teach about issues in ESD.

Overall, our study therefore allowed a first glimpse into how considering context-specific protection motivations, values, positive attitudes, and the selection of contexts with a low psychological distance might translate into an increase in the teaching motivation of pre-service teachers in ESD. This increased motivation of pre-service teachers might be one stepping stone to strengthen ESD in schools and lead to a more sustainable future for everyone. This hopefully also leads to sufficiently prepared future citizens to overcome human-wildlife conflicts and viable populations of wildlife animals like wolves.

4.4. Psychological distance and contextual basic human values predict enjoyment towards teaching about socio-scientific issues[10]

Abstract

Due to the relevance of teaching enjoyment for student learning, researchers and educators need to better understand the underlying appraisal processes. Contrary to prior studies we found additional personality factors of 189 pre-service biology teachers as contextual determinants for teaching enjoyment about three selected socio-scientific issues (SSI). While psychological distance substantially differed between the topics, it predicted enjoyment towards teaching about all three topics. Universalism and benevolence served only as context-dependent predictors. All effects remained stable when controlling for demographic variables. The results are discussed based on their relevance for subject- and context-specific professional development.

Keywords

Teaching emotion; appraisal; enjoyment; values; psychological distance; identity

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Introduction

While emotions traditionally played a rather small role in schools (Pekrun, 2005), recent research uncovered substantial influences of emotional phenomena for educational learning and teaching (Pekrun & Linnenbrink-Garcia, 2014a). In this regard, especially teaching emotions gained increased attention in research, due to their effects on a wide variety of classroom related variables on an inter- and intrapersonal level (Frenzel, 2014; Fried et al., 2015; Sutton & Wheatley, 2003).

Speaking of interpersonal connections, positive teacher emotions like enjoyment towards teaching have been found to be linked to student enjoyment through perceived teaching enthusiasm (Becker et al., 2014; Frenzel, Goetz, Lüdtke et al., 2009; Keller, Goetz et al., 2014). This increased student enjoyment in turn positively affects learning and achievement (Frenzel, 2014; Kunter, Klusmann et al., 2013; Trigwell, Ellis, & Han, 2012). But besides these interpersonal connections, enjoyment towards teaching also plays a prominent role for intrapersonal variables like teacher's general affect, feeling of emotional exhaustion, and teaching motivation (Büssing et al., 2018; Frenzel et al., 2016; Meyer & Turner, 2002).

Due to these wide ranging effects of teaching emotions, several studies aimed at better understanding what determines teacher's emotional experiences. Building on appraisal-theory, researchers attributed teachers' enjoyment towards teaching often to teacher's evaluation of student behavior such as student motivation and discipline (Becker et al., 2015). This led to a reciprocal model of teaching emotions in class, with student behavior influencing teaching emotions and instructional behaviors, which are causing student behavior vice versa (Frenzel, 2014).

While this approach seems reasonable for in-class state emotions, the present study hypothesizes an underestimation of the contextual nature of emotions in this model of teacher emotion causation, at least for specific teaching contexts. Therefore, we selected the positive emotion of enjoyment towards teaching, adapted it to the teaching of three specific science-related topics and investigated how contextual factors like universal values and psychological distance might be linked to the elicitation of this emotion for the respective topics. To further underpin the hypotheses, we first review prior approaches of investigating the causation of enjoyment towards teaching and proceed by outlining possible missing contextual dimensions based on the contextual nature of teaching emotions. Finally, we compile testable hypotheses grounding on teaching and general emotion theory.

Enjoyment towards teaching – definition and antecedents

As described above, enjoyment towards teaching affects student learning as well as motivation, mediated by enthusiastic teaching (Frenzel, Goetz, Lüdtke et al., 2009; Keller, Goetz et al., 2014; Kunter, Klusmann et al., 2013). Frenzel (2014) emphasizes the theoretical distinction between enjoyment and enthusiasm towards teaching. While enthusiasm describes the observable enthusiastic teaching behavior, enjoyment towards teaching denotes the involved internal processes within teachers

(Frenzel, 2014). This differentiation is also supported by a recent review, which defines observable indicators like facial expressions, vocal delivery or body movements as integral part of enthusiasm, distinct from enjoyment towards teaching (Keller et al., 2016). Therefore, *enjoyment towards teaching* defines the internal state of subjective happiness and approach motivational tendencies towards teaching. As this enjoyment constitutes the internal foundation for enthusiastic teaching (Frenzel, Goetz, Lüdtke et al., 2009), there is a need for further knowledge about what contributes to teacher's experience of enjoyment towards teaching.

As mentioned before, prior studies primarily investigated student behavior as the cause of enjoyment towards teaching (Frenzel, 2014). For example, a quantitative study found student ratings of class motivation as predictors of teacher enjoyment, mediated by teacher appraisals (Becker et al., 2015). This fits to older results, where teacher's perceived student behaviors like performance, motivation and discipline predicted teachers trait and state enjoyment towards teaching (Frenzel, Goetz, Stephens, & Jacob, 2009). In prior literature, these effects were explained by the compliance of student behavior to predefined teacher goals, like students being motivated and disciplined (Frenzel, 2014; Frenzel, Goetz, Stephens et al., 2009). In combination with the perception of student's actual behavior, this will lead to the teacher's emotional reaction. But besides these external variables, also internal variables like efficacy beliefs were connected enjoyment towards teaching (Hagenauer et al., 2015). Several studies replicated or found similar connections between efficacy beliefs and emotions, also in more pronounced domains. In one study with pre-service teachers in a teaching practicum perceived self-efficacy was a predictor of enjoyment towards teaching (Hascher & Hagenauer, 2016). A connection between these variables was also found in more specialized topics of science education (Brígido, Borrachero, Bermejo, & Mellado, 2013).

While all these studies investigated either how classroom conditions or specific efficacy beliefs might affect enjoyment towards teaching, there is only scarce research about the contextual dimensions of these teaching events, particularly concerning their psychological basis. Because emotions are always concentrated on specific events, called *stimulus events* (Scherer, 2005), there may be severe differences in the emotional experience towards the same stimulus between different events. More concretely, it may be plausible to hypothesize differences in teachers' emotional behavior towards the same student misbehavior (stimulus) in a lesson with positively valued content (context A) in comparison to a negatively valued context (context B). Prior studies mainly investigated this contextual dimension in means of differences between teaching subjects (Frenzel et al., 2015). A further contextualization was discussed but not further empirically investigated (Frenzel et al., 2016). Based on the central importance of stimulus events for the appraisal of emotions (Moors, 2009), this understanding of context only as the respective subject underestimates the contextual specifity of teaching.

The contextual nature of teaching emotions

Generally, *context* in a wider sense enables the specification of meaning and coherence in a given situation and might be understood in a variety of different ways (Dohn, Hansen, & Klausen, 2018; van Oers, 1998). Emotions always need this coherence, as their meaning may vary based on different contexts, meaning different situations. This was illustrated by a variety of experiments using manipulated emotional pictures (cf. Hassin, Aviezer, & Bentin, 2013). In these experiments, participants rated the same emotional faces differently, based on the experimental manipulation of situations while controlling for the faces. For example, a face with narrow eyes (stimulus) might indicate pain when positioned on the body of a patient in a hospital (context A), but the same face could also indicate victory when presented on the body of a victorious athlete (context B; Aviezer, Trope, & Todorov, 2012).

This contextual dimension of emotions is also integrated into recent appraisal theories of emotions, which attribute how similar situations might lead to diverging emotions (Moors, Ellsworth, Scherer, & Frijda, 2013). Appraisal theories define the conscious or unconscious cognitive appraisal of a stimulus as central for emotion causation (Moors, 2009; Scherer, 2009). This appraisal entails subsequent motivational, somatic and motor responses, which finally result in the attribution of the emotional experience or feeling component (Scherer, 2005). The aggregate of all these processes denotes the entire emotion (Moors, 2009). This multidimensional approach to emotions and the importance of appraisal processes are also specified as central to the occurrence and explanation of teacher emotions (Frenzel et al., 2016; Fried et al., 2015; Sutton & Wheatley, 2003), which are therefore also bound to contextual interpretations.

For teaching emotions, these contextual interpretations can be either based on the (1) exterior organization of teaching and learning (social context) or on (2) interior characteristics of the topics (concrete context; Dohn et al., 2018; Rose, 2012). In the regard of the *social context* of learning, Schutz (2014) proposed a nested system of possible contextual levels for the investigation of teaching emotions. On the deepest level, single (1) emotional episodes occur within (2) teachers, who hold specific goals, standards and beliefs (Schutz, 2014, p. 4). These teachers may then again act within specified (3) classroom contexts, which occur in a corresponding (4) social historical contexts (Schutz, 2014, p. 4). Like described above, there is plenty of quantitative research about classroom processes as the cause of teaching emotions, which emerged as central paradigm of teacher emotion research. While other, more qualitative studies also addressed specific emotional episodes and the social cultural context of teaching emotions (Schutz et al., 2006), the third dimension of teacher beliefs and goals remains only scarcely researched. But this dimension may be crucial for teacher emotions, as the content within different learning contexts may possess very diverse characteristics, which are shaped by the teacher beliefs and goals (Fives & Buehl, 2012).

Context in this dimension can be described as the *concrete context* (Rose, 2012). While generally all teaching and learning needs some content (Anderson, Reder, & Simon, 1996), many

researchers proposed the integration of real-life contexts as a way to foster learning and motivation (Perin, 2011). These effects were particularly persuasive in otherwise more abstract subjects like physics or biology (Bennett et al., 2007; Fensham, 2009; Sadler, 2009). While the integration of these topics into education might foster motivation and learning of students, such approaches add another dimension to the behavior of teachers, which showed to affect teachers orientations and knowledge (Campbell, Melville, & Goodwin, 2017). Therefore, also the emotional perception of teachers might differ based on the different concrete contexts (Sinatra et al., 2014).

Only one study explicitly addressed such a topic specific approach to emotions, revealing connections between emotions towards the general topic as well as towards teaching about climate change (Lombardi & Sinatra, 2013). These emotions were finally also predictors of plausibility perceptions (Lombardi & Sinatra, 2013). Therefore, a further investigation about emotions within such topics seems interesting.

Further content-related contextual antecedents of value and personal relevance

Hypothesized from general and teaching emotion theory, we propose contextual values as a measure of appraised value and psychological distance as an indicator of personal relevance/activation as further contextual antecedents. First of all, values and goals are central for the formation of emotional experiences, as appraisal happens based on prior experiences, worldview and values (Pekrun, 2006; Schutz et al., 2006). Furthermore, value significantly predicted enjoyment in an experience sample study about everyday emotions (Goetz, Frenzel, Stoeger, & Hall, 2010). This was also acknowledged in prior research about teacher emotions, with the exception that only goals for student behavior were investigated (Becker et al., 2015; Chang, 2013; Frenzel, 2014), but not further contextual goals like the prosperity of the earth's environment or well-being of other people.

This would be a context specific value, which corresponds with general aims of education, more specifically the aim of an equal and environmentally friendly society (Wals et al., 2014). Empirically, such values are included in the basic human value cluster of self-transcendence, namely the values of universalism and benevolence (Schwartz, 1994). While *universalism* depicts the value of "understanding, appreciation, tolerance, and protection of nature for the welfare of all people and for nature" (Schwartz, 1994, p. 22), *benevolence* concentrates on the "preservation and enhancement of the welfare of all people with whom one is in frequent personal contact" (Schwartz, 1994, p. 22).

Several researchers started to investigate the connection of values and emotions for explaining human behavior (cf. Brosch & Sander, 2014) and prior studies already found connections between basic human values such as benevolence and the reported general frequency of emotions in daily life (Nelissen et al., 2007). Furthermore, universalism and benevolence also predicted emotions and also prosocial tendencies like empathic concern and perspective taking in a quantitative study (Silfver, Helkama, Lönnqvist, & Verkasalo, 2008). These results fit nicely to research about teacher emotions, which showed a tight connection between emotions and teacher identity (O'Connor, 2008). For

example, a qualitative study showed how positive emotions based on positive experiences build the foundation of professional identity and contribute to professional development (Timoštšuk & Ugaste, 2012). As values may be used as an empirical indicator of identity (Hitlin, 2003), the selected universal values paradigmatically capture the teachers identity for two contextual domains of preserving the welfare of nature (universalism) and other people (benevolence). Teachers with a general universalistic worldview might (unconsciously) also transfer this worldview into their teaching, which is why the selected values may be connected to the appraisal of enjoyment towards teaching. Therefore, the study investigated the first general research question:

> **RQ_1:** Are universal values of universalism and benevolence predictors of the enjoyment towards teaching in relevant contexts?

As a second contextual antecedent, we selected the respective perceived relevance of the concrete context. Personal relevance within a respective situation is a general prerequisite for an emotional reaction, as only as relevantly evaluated situations will lead to an emotional reaction at all (Scherer, 2005). We operationalized the relevance to the topics by closeness to the issue, measured as psychological distance. *Psychological distance* refers to the perceived distance to specific objects, events or actions (Liberman & Trope, 2008; McDonald et al., 2015) and is constituted by the four dimensions of temporal, spatial, social, and hypothetical distance (Liberman & Trope, 2014). This means, a psychologically distant individual will evaluate the respective object as being temporal and geographically far away, being personally not concerned by the object, which will finally be not likely to happen/be existing at all.

Prior studies showed how personal relevance increases emotional reactions (Harmon-Jones, Lueck, Fearn, & Harmon-Jones, 2006) and was connected to intrapersonal variables like reasoning (Caparos & Blanchette, 2017). Therefore, the contextual relevance of the respective topic as operationalized by psychological distance might also be connected to the enjoyment towards teaching about the respective topic, which constitutes our second major research question:

> **RQ_2:** Is psychological distance a predictor of enjoyment towards teaching?

Selected teaching contexts and corresponding hypotheses

As the strength of the contextual connection will vary according to different concrete contexts, we finally selected three specific teaching contexts from the subject of biology to answer the two central research questions. We explicitly selected *socio-scientific issues* (SSI), which may be used as a progressive teaching approach facilitating student discussion and decision-making based on controversial scientific issues (Zeidler, 2014). Such controversial issues describe open-ended learning problems recurring to deeply rooted conflicts between a substantial number of people (Levinson, 2006). As these conflicts may finally be not solved by evidence alone, people rely on values and beliefs to

decide their behavior towards these issues (Levinson, 2006; Rundgren, Eriksson, & Rundgren, 2016). While the utilization of such topics has shown to increase student learning for example in the subject of biology (Klosterman & Sadler, 2010), prior studies demonstrated how teachers' attitudes may affect their teaching approaches and knowledge about such issues (Liu et al., 2015; Plutzer et al., 2016). Because deeper values lay the foundation for attitudes (Whittaker et al., 2006), the investigation of values as appraisal dimension of enjoyment towards teaching seems reasonable. Furthermore, the subject of biology involves SSIs from different contextual domains such as ecological or health-related issues (Zeyer & Dillon, 2014). This may be interesting for the investigation of differences between the relevance of universalism and benevolence as appraisal basis for enjoyment towards teaching, due to their different value focus. Furthermore, we chose topics with enough variation for the variables of interest (universalism, benevolence and psychological distance).

Returning wolves

As the first SSI we selected the return of the wolf to Germany as a topic with an ecological background. After their eradication in the 19th century, wolves have naturally migrated back into parts of Europe (Chapron et al., 2014). This leads to value-based conflicts with stakeholders (Nie, 2002), who are faced with economic damage based on livestock killings (Enserink & Vogel, 2006). Besides this economic dimension, people also fear the wolf based on deeply rooted implicit beliefs and feelings which led to the stereotype of the "Big Bad Wolf" (Jürgens & Hackett, 2017). In biology education, the issue may be used to foster students understanding of ecology and conservation, based on the discussion about consequences of wolves on ecosystem biodiversity (Grace, 2009). Due to the economic and social dimension the issue may also be of high interest when implementing Education for Sustainable Development (ESD), which aims for the integration of these domains (Leicht, Heiss et al., 2018). A qualitative study found the personal involvement and locality as fostering factors for students' interests and motivation when discussing the issue in school (Hermann & Menzel, 2013b).

Prior studies showed how universalism was connected to pro-environmental motivations (Gifford & Nilsson, 2014; Schultz, 2005). Therefore, we hypothesize a predictive relationship between universalism and enjoyment towards teaching about this ecological issue. Besides this, a decreased psychological distance also showed an increased motivation for pro-environmental behaviors (Carmi & Kimhi, 2015; McDonald et al., 2015), why we hypothesize a similar relationship for enjoyment towards teaching.

H_{1A}: Universalism positively predicts enjoyment towards teaching about the ecological topic of returning wolves.

H_{1B}: Psychological distance towards the return of the wolves negatively predicts the enjoyment towards teaching about the topic.

Climate change

To ensure a greater variance between the issues while controlling the domain, we selected the global environmental problem of climate change as second SSI for our investigation. Like the topic of returning wolves, climate change also involves value-based and emotionally charged dimensions, and might be integrated into biology education to learn about ecosystems on a global level (Busch & Osborne, 2014; Monroe, Plate, Oxarart, Bowers, & Chaves, 2017). But instead of being concentrated on specific regions like returning wolves, climate change describes a rather global problem (The Core Writing Team et al., 2015). Because of the inherent environmental dimension, we also hypothesize a positive relationship with universalism and a negative relationship with psychological distance.

H_{2A}: Universalism positively predicts enjoyment towards teaching about the ecological topic of climate change.

H_{2B}: Psychological distance towards climate change negatively predicts the enjoyment towards teaching about the topic.

Pre-implantational genetic diagnosis

Besides these two environmental issues, we intentionally selected pre-implantational genetic diagnosis as a third issue from a different domain. Pre-implantational genetic diagnosis refers to the usage of genetic modification methods for human embryos, and constitutes a recent open societal health issue debated in science and biology education (Sadler & Zeidler, 2004). Like environmental topics, contextual health issues might be used to foster student interests (Zeyer & Dillon, 2014). As this issue is mainly based within health-education, we hypothesize a connection between benevolence and enjoyment towards teaching, different to the other two topics. Concerning the psychological distance, we also propose a negative relationship according to the other topics for this final context:

H_{3A}: Benevolence positively predicts enjoyment towards teaching about the health topic of pre-implantational genetic diagnosis.

H_{3B}: Psychological distance towards the return of the wolves negatively predicts the enjoyment towards teaching about the topic.

Besides the presented directed hypotheses we finally included age and gender as control variables into our analyses based on effects in prior studies (Lohbeck et al., 2018). All variables and corresponding hypotheses are displayed in Figure 4.11.

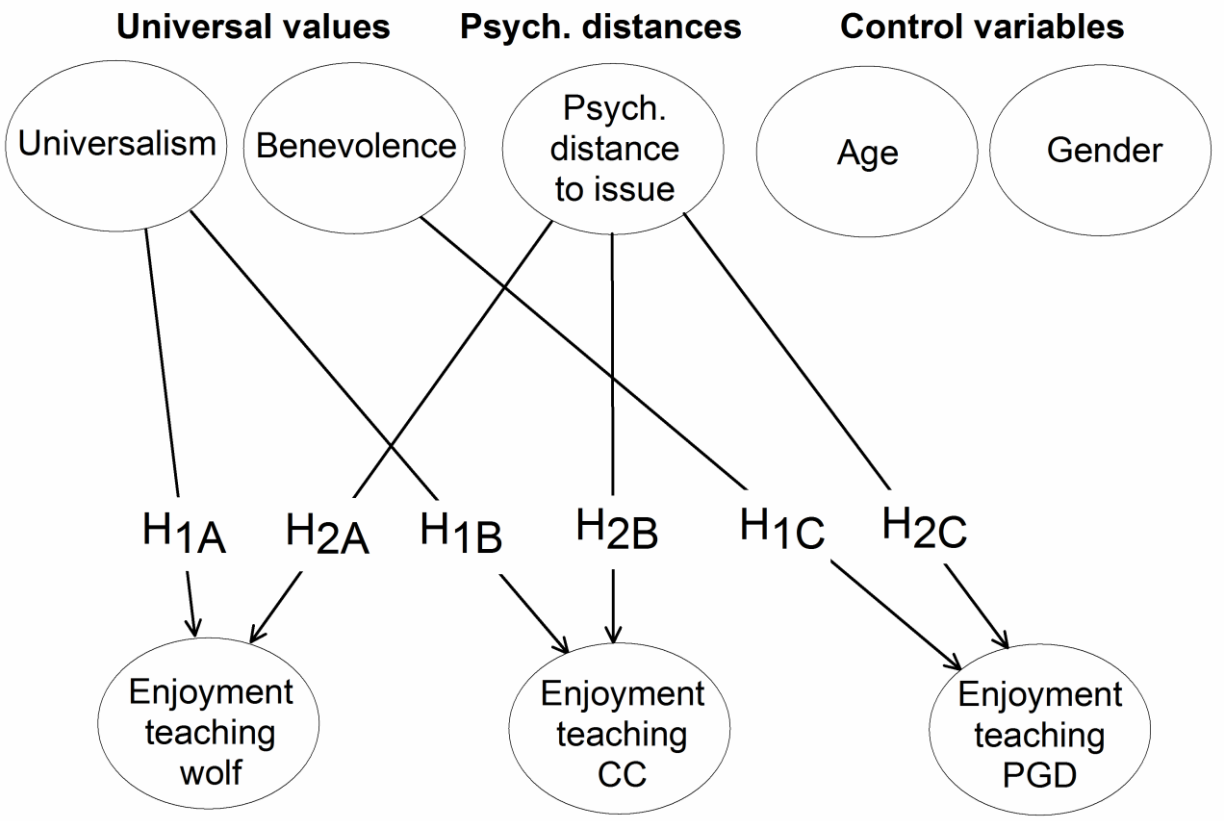

Figure 4.11 Overview of hypotheses and variables of the present study.

Methods

Research design and participants

As we were interested in differences and connections between specific variables, we followed a cross-sectional quantitative research design, using a paper-and-pencil questionnaire. While data from self-report studies such as questionnaires might be slightly biased based on social considerations by the participants, questionnaires remain an important and efficient way to measure teaching emotions (Frenzel, 2014). All questionnaires were distributed in July and August 2016 at four universities from north-western, southern and eastern Germany. We selected these locations to ensure a sufficient variance within the sample for the local teaching topic of returning wolves. The species is pretty long established in eastern Germany (since around the year 2000), rather new in north-western part of the country and has not yet entered southern Germany (Ansorge et al., 2010; Landesjägerschaft Niedersachsen e.V., 2016).

As we were investigating the enjoyment towards teaching about biology topics, we only surveyed biology teachers. We assured this, by handing out the questionnaires in biology-only university lectures and courses. Overall, 189 students participated in the survey (73.5 % female, age range from 19 to 50, M_{age} = 23.45 years, SD_{age} = 3.71).

All procedures were in accordance with the ethical standards of the institutional and national research committees, APA`s Code of Conduct and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. We obtained informed consent verbally and written, guaranteed anonymity as well as provided information about the purpose of the study. All participants had the chance to ask questions about the questionnaire and the overall research, or to decline their participation at any time.

Measures

General approach

The questionnaire started with an introductory text explaining the purpose and aims of the study, followed by questions about demographic data. After this general part, three context-specific parts including the presented constructs completed the questionnaire. These parts started with a short description about contextual background information about the SSIs to ensure a common understanding and gave examples of possible contents for lessons. Furthermore, the order of the contexts within the questionnaires were randomized using different versions with all possible combinations of contexts to rule out any effects based on the order of the contexts within the questionnaire. Participants needed approximately 25 minutes to complete the questionnaires.

As demographic data, we asked for the age, gender, intended degree. While age and the intended degree were open questions, gender was asked in a closed format and coded with 1 (female) and 2 (male). The intended degree was only used to ensure the affiliation to the intended sample as was not further analyzed. We also excluded this variable in the uploaded dataset to ensure anonymity.

Almost all the variables as used in the current study were tested by multiple items to enhance the validity of the constructs. If not described differently, all items were measured on a 6-point Likert scale, ranging from 1 (*do not agree at all*) to 6 (*agree completely*) and were worded as statements to allow the construction of a Likert scale (Bryman, 2008). The wording of all items can be viewed either in the corresponding results for the exploratory factor analysis or in the supplemental material.

Universal values

We used the German version of the 40 item Portrait-Value-Questionnaire (PVQ-40) to measure the value dimensions of universalism and benevolence (Schmidt, Bamberg, Davidov, Herrmann, & Schwartz, 2007). This scale is established and validated within varied sample populations and countries (cf. Cieciuch & Davidov, 2012), and includes six items for universalism and four items for benevolence. One example item for the universalism scale is ‘I strongly believe that people should care for nature. Looking after the environment is important to me’ and ‘It is very important for me to help the people around me. I want to care for their well-being.’ for the benevolence scale.

The scales showed sufficient measurement reliability (~.7), but the exploratory factor analysis indicated a measurement problem of one item for the universalism scale, which was excluded from the scale for the analysis. The Cronbach`s Alpha remained acceptable after the exclusion (.75 for universalism and .70 for benevolence). Further information about the excluded item and the factorial analysis can be obtained from the supplemental material.

Psychological distance

As described in the introduction, psychological distance is constituted by the four dimensions of temporal, spatial, social and hypothetical distance (Liberman & Trope, 2014). To capture all these dimensions we constructed the overall scale by one item per dimension, which resulted in four items for each context, and 12 items for all three contexts. We asked for the concern about the selected contexts to ensure comprehension by all participants. As the results from the exploratory factor analysis showed, all items loaded according to their formulation on the respective factor (Table 4.9). The only exception was the fourth item from the psychological distance measuring the hypothetical dimension of pre-implantational genetic diagnosis. We believe the participants could have seen no sense to indicate the probability of a process, which is obviously already happening. Therefore, we excluded this item from the scale. While the other hypotheticality items also showed the smallest loading on their corresponding factor, we nonetheless used them to construct the scales based on their theoretical contribution to psychological distance (Liberman & Trope, 2014).

Table 4.9 Results from exploratory factor analysis (EFA) for the psychological distance scales with rotated factor solution (Varimax).

Item	1	2	3
Psychological distance to returning wolves (PDwolf)			
I am personally concerned by the return of the wolf.	.04	**.83**	.12
I am concerned by the return of the wolf in my geographical surrounding.	.02	**.80**	.21
I am concerned by the return of the wolf in the near future.	-.01	**.87**	.14
The return of the wolf is likely.	.15	**.46**	-.10
Psychological distance towards climate change (PDclimate)			
I am personally concerned by climate change.	**.80**	.00	.10
I am concerned by climate change in my geographical surrounding.	**.90**	.07	.03
I am concerned by climate change in the near future.	**.84**	.05	-.01
Climate change is likely.	**.51**	.08	.00
Psychological distance to returning wolves (PDpgd)			
I am personally concerned by the pre-implantational genetic diagnosis.	.01	.00	**.82**
I am concerned by pre-implantational genetic diagnosis in my geographical surrounding.	.05	.14	**.85**
I am concerned by pre-implantational genetic diagnosis in the near future.	.13	.06	**.81**
The pre-implantational genetic diagnosis is likely.	-.09	.08	.12
Factor characteristics			
Sum squared of loadings	2.47	2.34	2.17
Proportion of explained variance	.21	.20	.18
Cumulative proportion of explained variance		.58	

Note. Loadings above .4 were used for the construction of the scales and appear in bold.

As described in Table 4.11, all scales showed a sufficient internal reliability (>.70). To construct the final scales we coded all items reversely, based on its theoretical definition as distance and not proximity.

Enjoyment towards teaching

For the enjoyment towards teaching we used the German version of the established and validated general Teacher Emotion Scale (TES; Frenzel et al., 2016). This scale measures the general enjoyment towards teaching, and we adapted the items to capture the enjoyment towards teaching the specific topics by directly adding the respective contexts to the items. The scale compromised four items per topic, which resulted in overall 12 items. As the results from the exploratory factor analysis showed, all items loaded according to their formulation on the respective factor, which also showed a very good internal reliability with Cronbach's Alpha above .85 (Tables 4.10 and 4.11).

Table 4.10 Results from exploratory factor analysis (EFA) for scales measuring enjoyment towards teaching with rotated factor solution (Varimax).

Item	1	2	3
Enjoyment towards teaching about returning wolves (ENJwolf)			
I generally enjoy teaching about the topic of the return of the wolf.	**.82**	.18	.05
I generally have so much fun teaching about the topic of the return of the wolf that I gladly prepare and teach my lessons.	**.85**	.22	.08
I often have reasons to be happy while I teach about the topic of the return of the wolf.	**.77**	.18	.01
I generally teach the topic of the return of the wolf with enthusiasm.	**.92**	.23	.00
Enjoyment towards teaching about returning wolves (ENJclimate)			
I generally enjoy teaching about the topic of climate change.	.20	**.80**	.16
I generally have so much fun teaching about the topic of climate change that I gladly prepare and teach my lessons.	.19	**.80**	.19
I often have reasons to be happy while I teach about the topic of climate change.	.22	**.53**	.10
I generally teach the topic of climate change with enthusiasm.	.18	**.88**	.13
Enjoyment towards teaching about returning wolves (ENJpgd)			
I generally enjoy teaching about the topic of pre-implantational genetic diagnosis.	.00	.18	**.85**
I generally have so much fun teaching about the topic of pre-implantational genetic diagnosis that I gladly prepare and teach my lessons.	.00	.04	**.76**
I often have reasons to be happy while I teach about the topic of pre-implantational genetic diagnosis.	.07	.15	**.57**
I generally teach the topic of pre-implantational genetic diagnosis with enthusiasm.	.06	.15	**.87**
Factor characteristics			
Sum squared of loadings	3.01	2.60	2.50
Proportion of explained variance	.25	.22	.21
Cumulative proportion of explained variance		.68	

Note. Loadings above .4 were used for the construction of the scales and appear in bold.

Further statistical analysis

After investigating the measurement results with exploratory factor analysis and Cronbach's Alpha, we constructed the scales from the resulting items. The resulting scales were then investigated for their bivariate correlations and descriptive statistics. To get further information about the differences between the different SSIs we investigated possible mean differences. Following this, we inspect the theoretical hypotheses based on bivariate correlations and regressions. For the regressions we used a three step approach. First of all we only investigated the predictive ability of the values and psychological distance, continued with the demographic control variables and finally calculated an overall path model to account for the connections between all variables based on the hypothesized structure between the variables (Figure 4.11). As the skewness and kurtosis indicated a skew for some variables (Table 4.11), we used robust statistical methods, based on Field and Wilcox (2017). This included robust versions for mean difference tests and regressions and spearman-rho as a correlation coefficient. For the final path model we used a robust maximum likelihood estimator based on *lavaan* (Rosseel, 2012). All calculations were done in R-Studio Version 1.1.456 running R Version 3.5.1 (R Core Team, 2018). The script and data for the replication of our analysis is available in the supplemental material of the paper.

Table 4.11 Overview of the correlations (Spearman rho) and descriptive statistics for the measured variables.

	1	2	3	4	5	6	7	8	9	10
1. Age	-									
2. Gender	.11	-								
3. Universalism	.25***	-.02	-							
4. Benevolence	.05	-.11	.39***	-						
5. PD_{WOLF}	.08	-.15*	-.11	-.12	-					
6. PD_{CC}	-.03	-.17*	-.35***	-.20*	.09	-				
7. PD_{PGD}	.05	-.08	-.01	-.08	.26***	.04	-			
8. $Enjoyment_{WOLF}$	.27***	.27***	.30***	.14	-.27***	-.25*	-.06	-		
9. $Enjoyment_{CC}$	.10	.23***	.24***	.21*	-.15*	-.36***	-.01	.40***	-	
10. $Enjoyment_{PGD}$	.03	-.22*	.09	.24*	.00	-.16*	-.23*	.09	.24***	-
Number of Items	1	1	5	4	4	4	4	4	4	4
Mean	23.45	-	5.08	4.99	3.68	2.10	4.81	3.91	4.09	4.00
Standard deviation	3.71	-	.57	.55	1.04	.88	.85	1.00	.91	.86
Median	23.00	-	5.00	5.00	3.75	2.00	5.00	4.00	4.00	4.00
Skewness	-	-	-.36	-.26	-.29	.53	-.89	-.44	-.22	-.51
Kurtosis	-	-	-.51	-.03	-.45	-.41	.48	.17	.38	.58
Cronbach's α	-	-	.75	.70	.83	.84	.72	.92	.87	.85

Note. * = $p < .05$, ** = $p < .01$, *** = $p < .001$. Gender was coded with male (1) and female (2). $_{WOLF}$ = Return of the wolf, $_{CC}$ = Climate change, $_{PGD}$ = Pre-implantational genetic diagnosis.

Results

Differences for psychological distance and enjoyment towards teaching between the issues

Overall, the participants showed remarkable differences between the psychological distances towards the selected issues (Table 4.11). First of all, the pre-service teachers reported a high amount of psychological distance to the pre-implantational genetic diagnosis (*M* = 4.81, *SD* = .85, *Mdn* = 5.00), followed by a smaller psychological distance towards the return of the wolf (*M* = 3.68, *SD* = 1.04, *Mdn* = 3.75). Overall, the participants finally showed a very small psychological distance towards the climate change (*M* = 2.10, *SD* = .88, *Mdn* = 2.00). The pre-service teachers reported only small differences between the contexts concerning their enjoyment towards teaching. While the biggest enjoyment was reported for the context of climate change (*M* = 4.09, *SD* = .91, *Mdn* = 4.00), the pre-service teachers reported slightly less enjoyment towards teaching about pre-implantational genetic diagnosis (*M* = 4.00, *SD* = .86, *Mdn* = 4.00) and the least enjoyment towards teaching about the return of the wolf (*M* = 3.91, *SD* = 1.00, *Mdn* = 4.00).

Table 4.12 Results from robust between group and post-hoc difference tests between the psychological distances towards the issues

Between groups	ANOVA: F(2, 207) = 383.951***		
Post-hoc	Wolf	Climate change	PGD
Wolf	-	M_{DIFF} = 1.71 [1.49, 1.93]	M_{DIFF} = 1.20 [1.03, 1.38]
Climate change	t(110) = 15.196***, *d* = 1.52	-	M_{DIFF} = 2.89 [2.68, 3.11]
PGD	t(110) = 13.43***, *d* = 1.21	t(111) = 26.63***, *d* = 2.74	-

Note. *** = $p < .001$. M_{DIFF} = Difference between trimmed means, *d* = Cohen's *d*.

Consistent with these descriptive statistics we found as displayed in Table 4.12 significant differences between the psychological distances towards all issues using a robust ANOVA ($F(2,207) = 383.951$, $p < .001$). The subsequent post-hoc t-tests revealed the largest difference between the psychological distance towards climate change and the pre-implantational genetic diagnosis ($t(111) = 26.63$, $p < .001$, $d = 2.74$) followed by the difference between the psychological distance between the return of the wolf and climate change ($t(110) = 15.196$, $p < .001$, $d = 1.52$). Finally, the psychological distance between the return of the wolf and the pre-implantational genetic diagnosis also differed with a large effect size ($t(110) = 13.43$, $p < .001$, $d = 1.21$). The differences are illustrated in Figure 4.12.

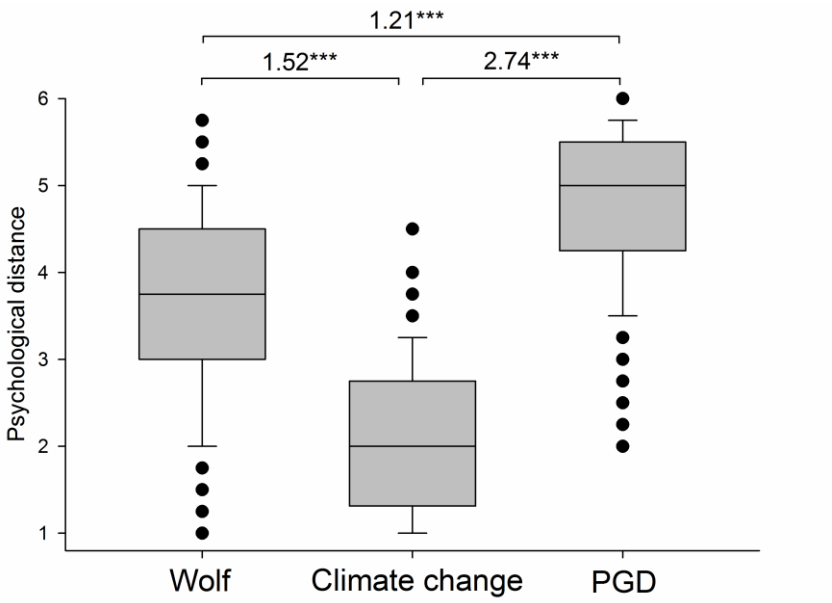

Figure 4.12 Differences between the psychological distances towards the respective issues with standardized results (Cohen`s d) from robust t-tests. *** = p < .001.

As implied by the descriptive statistics, the robust ANOVA reported no significant differences for the enjoyment towards teaching between the issues ($F(2,200) = .71$, $p > .05$), why we did not calculate any post-hoc tests between the issues.

Bivariate correlations

Consistent with the hypotheses we found correlations between the basic human value dimensions of universalism and benevolence towards the enjoyment towards teaching about the selected issues (Table 4.11). While universalism correlated with the enjoyment towards teaching about returning wolves ($r = .30$, $p < .001$) as well as the enjoyment towards teaching about climate change ($r = .24$, $p < .001$), there was no correlation with the enjoyment towards teaching about pre-implantational genetic diagnosis ($r = .09$, $p > .05$). But enjoyment towards teaching about pre-implantational genetic diagnosis was correlated with benevolence ($r = .24$, $p < .05$). Furthermore, there were also correlations between benevolence and the enjoyment towards teaching about climate change ($r = .21$, $p < .05$), but not about returning wolves ($r = .14$, $p > .05$).

Concerning the psychological distances towards the issues, we found psychological distance towards all issues correlated with enjoyment towards teaching, all consistent with our hypotheses. The biggest connection was found between the psychological distance towards climate change and enjoyment towards teaching about the issue ($r = -.36$, $p < .001$), followed by the psychological distance towards returning wolves and the enjoyment towards teaching about the issue ($r = -.27$, $p < .001$). Finally, also the psychological distance towards pre-implantational genetic diagnosis correlated with the enjoyment towards teaching about the topic ($r = -.23$, $p < .05$).

Concerning the demographic variables, age was correlated with the enjoyment towards teaching about returning wolves (r = .27, p < .001). This means, older pre-service teachers showed a higher enjoyment towards teaching. This effect may be due to the higher universalistic orientation of older people, which was indicated by the correlation between universalism and age (r = .25, p < .001). While age was not correlated with the enjoyment towards teaching about the other contexts, gender was consistently correlated with the enjoyment towards teaching about all SSIs. The variable was positively correlated with the enjoyment towards teaching about returning wolves (r = .27, p < .001) and climate change (r = .23, p < .001), but showed a negative correlation with the enjoyment towards teaching about pre-implantational genetic diagnosis (r = -.22, p < .05). Based on the coding of gender as female (1) and male (2), female pre-service teachers showed a higher enjoyment towards teaching about the pre-implantational genetic diagnosis and male pre-service teachers about the other two topics.

Prediction of enjoyment towards teaching

In the robust regression analysis (Table 4.13), universalism was a predictor for the enjoyment towards teaching the more ecologically oriented teaching topics of the return of the wolf (β = .51, p < .01), but not for the other topics of climate change (β = .13, p > .05) and pre-implantational genetic diagnosis (β = -.02, p > .05). Similarly to this, benevolence predicted only the enjoyment towards teaching about the topic of pre-implantational diagnosis (β = .37, p < .01), but neither the enjoyment towards teaching about the return of the wolf (β = .01, p > .05) nor about climate change (β = .16, p > .05). Psychological distance was the only predictor for all three topics of the return of the wolf (β = -.25, p < .01), climate change (β = -.31, p < .001) as well as pre-implantational genetic diagnosis (β = -.21, p < .01).

Table 4.13 Results from the regression analysis for the prediction of enjoyment towards teaching about the topics of returning wolves, climate change and pre-implantational genetic diagnosis (PGD)

	Wolf	Climate change	PGD
	β (SE)	β (SE)	β (SE)
Step 1			
Universalism	.51** (.15)	.13 (.12)	-.02 (.14)
Benevolence	.01 (.18)	.16 (.13)	.37** (.12)
Psychological distance	-.25** (.07)	-.31** (.09)	-.21** (.07)
Adjusted R^2	.15	.14	.09
Step 2			
Universalism	.41** (.14)	.17 (.12)	-.01 (.14)
Benevolence	.19 (.15)	.24 (.13)	.36*** (.11)
Psychological distance	-.15* (.07)	-.28** (.10)	-.22*** (.06)
Age	.02 (.02)	.00 (.02)	.00 (.01)
Gender	.47** (.15)	.43** (.15)	-.47*** (.14)
Adjusted R^2	.19	.19	.17

Note. * = p < .05, ** = p < .01, *** = p < .001. R^2 = Explained variance within the respective dependent variable. Gender was coded as female (1) and male (2).

In the second regression step we included age and gender as control variables. While the regression coefficients slightly decreased, the significant predictors kept their predictive ability for the enjoyment towards teaching. Overall, enjoyment towards teaching about the return of the wolf was still predicted by universalism (β = .41, p < .01), psychological distance (β = -.15, p < .05) and additionally by gender (β = .47, p < .01). The enjoyment towards teaching about climate change was only predicted by psychological distance (β = -.28, p < .01) and gender (β = .43, p < .01). Finally, the enjoyment towards teaching about pre-implantational genetic diagnosis was predicted by benevolence (β = .36, p < .001), psychological distance (β = -.22, p < .01) and also gender (β = -.47, p < .001). Due to the coding of gender as female (1) and male (2), female pre-service teachers showed smaller enjoyment towards teaching about the return of the wolf as well as about climate change, due to the positive predictive effect. For the enjoyment towards teaching about pre-implantational genetic diagnosis this effect reversed, as gender was a negative predictor. Therefore, female participants showed an increased enjoyment towards teaching about this topic than male participants.

The explained variance differed between the models and was increased by the second regression step. While the first step explained about 15% of the variance in the enjoyment towards teaching about the return of the wolf (Adjusted R^2_{WOLF} = .15), the second step explained about 19% (Adjusted R^2_{WOLF} = .19). Similarly, the first step for the regression of enjoyment towards teaching explained 14% (Adjusted R^2_{CC} = .14) and the second 19% of the variance in the dependent variable (Adjusted R^2_{CC} = .19). Overall, the predictors explained the least variance for the enjoyment towards teaching about pre-implantational genetic diagnosis, by explaining only 09% (Adjusted R^2_{PGD} = .09) in the first and 17% (Adjusted R^2_{PGD} = .17) of the variance in the second regression step.

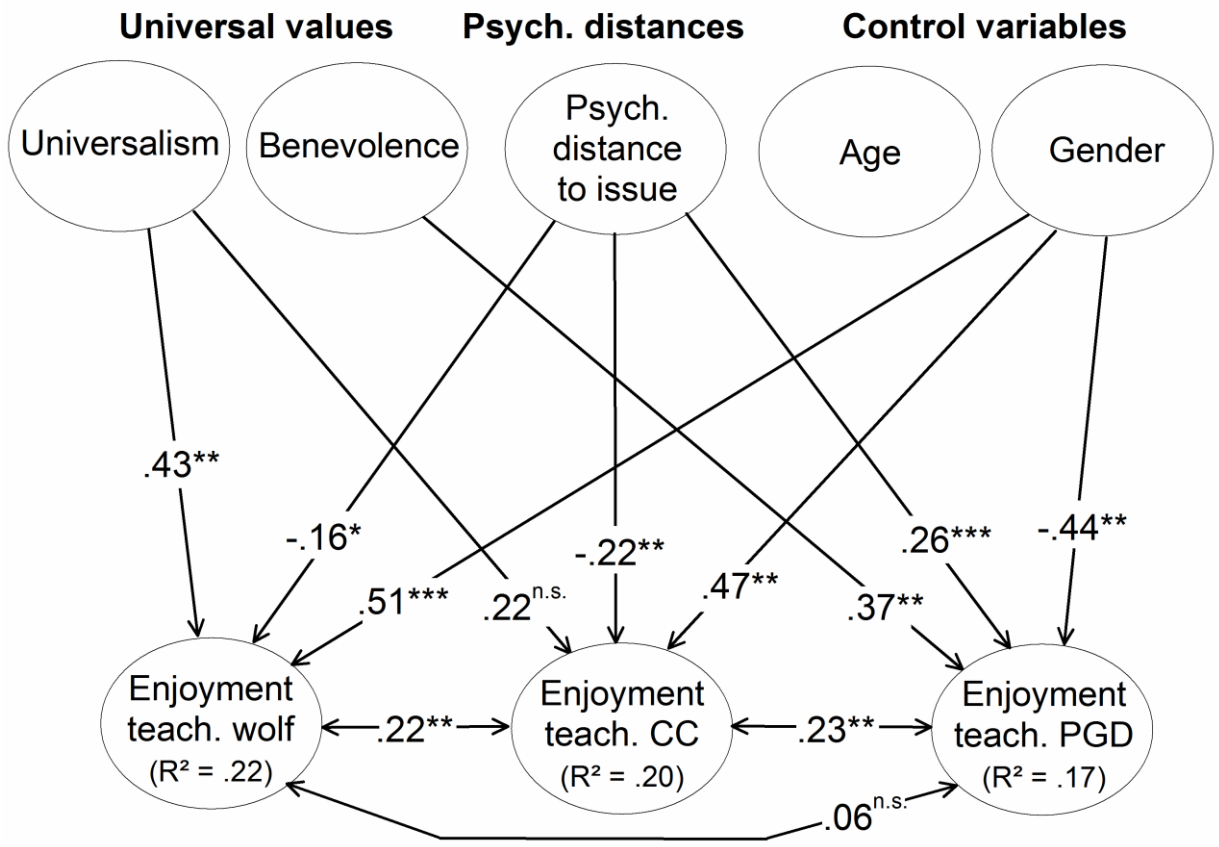

Figure 4.13 Path model illustrating the connections between the study variables (Fit: RMSEA = .03, CFI = .99, SRMR = .03). Directed arrows indicate predictive abilities and double arrows correlations between the variables, non-significant relations were omitted due to clarity of display. Gender was coded as female (1) and male (2). * = p < .05, ** = p < .01, *** = p < .001. R^2 = Explained variance.

Path model

Finally, we calculated a path model to account for the structure between all variables. While the path model showed a sufficient fit to the data (RMSEA = .03, CFI = .99, SRMR = .03), the predictive effects from the regressions were replicated (Figure 4.13). Universalism only predicted the enjoyment towards teaching about returning wolves (β = .43, p < .01) and benevolence only the enjoyment towards teaching about pre-implantational genetic diagnosis (β = .37, p < .01). Psychological distance and gender predicted all dependent variables, consistent with the prior single regression models. Based on the integration of all variables as predictors, the explained variance was increased for all dependent variables.

Discussion

Values and psychological distance as causes of enjoyment towards teaching

As the results of the present study have shown, psychological distance can be described as general and basic human values as contextual predictors of enjoyment towards teaching in the selected topics of returning wolves, climate change and pre-implantational genetic diagnosis. Speaking of the universal

values (RQ_1), we found universalism as a value for the preservation and the well-being of all people and for nature as a predictor of enjoyment towards teaching about returning wolves. At the same time, universalism was also correlated with the enjoyment towards teaching about climate change, but explained no variance in the regression analysis. Interestingly, benevolence only predicted the enjoyment towards teaching about the health-related topic of pre-implantational genetic diagnosis, while it was also correlated to the enjoyment towards teaching the two other topics. This is in line with our hypotheses H_{1A} and H_{1C}, but contradicts our second hypothesis H_{1B}.

While prior studies about teaching emotions most often contributed the appraisal of emotions only based on student behavior (Becker et al., 2015; Frenzel, 2014), this prediction of enjoyment towards teaching by the values of universalism and benevolence illustrates how further contextual variables play a role for the underlying appraisal processes. This adds important knowledge about the antecedents of teaching emotions and assumes a more positive emotional view of teachers, when they teach about topics consistent with their own value structure. Hence, teachers who are faced with teaching about topics with a higher level obligation such as ESD might appraise teaching about these issues more positively when they possess a corresponding underlying value structure. This result is in line with prior research, which found values and deeper personality variables as contributor to teach about the topic of climate change (McNeal et al., 2017). Future studies should investigate if this result may be replicated for other topics such as the motivation to include students with special needs into education, which also depends on a coherent underlying belief structure (Florian, 2008).

Besides this general connection of values and emotions, we also found specific differences. For example, universalism only predicted the enjoyment towards teaching the most ecological topic of returning wolves, while benevolence only predicted the enjoyment towards teaching about the health-related topic of pre-implantational genetic diagnosis. These differences in the predictive ability of the universal values point to a contextual specificity of the values for particular topics. This specifity seems logical based on the motivational effects of values as the foundation of personality and identity (Hitlin, 2003). For the case of teaching emotions, this implies severe differences for the emotional experience when teaching about positively against negatively valued topics. Based on the nature of the present study we are unable to answer if the underlying value structure may lead to a higher resilience based on more idealism for teaching about the topic because also the reverse connection may be plausible. Our sample also may differ due to the transforming role of an integration into existing external structures such as a new school, which may also change pre-service teachers' behavior and value structures (Rust, 1994). Therefore, a future study should adopt the approach of selecting specific contexts for their differences and connections with other variables such as anger about student behavior or perceived behavioral control towards teaching. But while our results should only cautiously be generalized to in-service teachers, they still allowed for a first investigation of the effect of values as contextual determinants for the appraisal of enjoyment towards teaching. Furthermore, teacher preparation courses should implement professional development activities to reflect on existing value structures and if

necessary utilize transformative learning experiences to develop required understandings (Mezirow, 2009).

Besides this, we found psychological distance as the second major predictor of enjoyment towards teaching due to its predictive ability for all three dependent variables (RQ_2). This is in line with all our hypotheses (H_{1A-C}) and indicates a higher enjoyment towards teaching psychologically close contexts. As the integration of this scale is rather new for educational research, we believe this finding to be of a more explorative nature. Nonetheless, the predictive ability in the regressions makes sense based on the underlying psychological processes. When teachers feel close to a specific issue, they might rate this topic as more important to them, which also could indicate a higher relevance (Stuckey et al., 2013). Furthermore, teachers might have more direct experiences about close issues in comparison to distant issues they might have barely heard of. This could also affect knowledge structures, which we have not integrated in the present study but might be interesting for further investigation.

When deeper investigating the differences between the psychological distances towards the issues, we found large differences between pre-service teachers' perceived distance to the selected issues. This is partly also contrasted prior studies, as climate change was often described as a rather distant event (cf. Hufnagel, 2015), but the pre-service teachers in our sample reported to feel only a very small psychological distance to the issue. We believe this result might be explainable by the most recent developments around the issue of climate change, as for example the election of Donald Trump as the president of the United States has not strengthened but rather weakened the global aspirations to fight human-caused climate change. This might have increased the pre-service teachers' awareness for the issue and their perceived obligation to protect the planet through teaching about the issue, as for example a prior study showed connection between the awareness and general protection motivation for the issue (Dal, Alper, Özdem-Yilmaz, Öztürk, & Sönmez, 2015). This interpretation would be consistent with the highest anticipation of enjoyment towards teaching about climate change. Nonetheless, further studies should investigate how teachers who are concerned to teach about a specific SSI might differ to other samples based on their evaluation of the perceived distance.

Finally, the predictive effects of psychological distance are important for teacher professional development and might be utilized either in targeted interventions or in the selection of appropriate issues for teacher education. Concerning targeted interventions, prior experimental studies showed decreases of psychological distance as a way to foster pro-environmental action (Jones et al., 2017). In a similar manner, teacher educators could think about integrating a decrease of psychological distance to relevant SSIs into their teacher professional development activities. This could be used as an additional way to foster teaching motivation for the relevant issues. Speaking of these relevant issues, educators should also utilize our results and purposefully select SSIs with a small psychological distance based on the underlying interest about the topics.

Gender and anticipated enjoyment towards teaching

As described in our results, we found gender as the strongest predictor of the enjoyment towards teaching for the respective topics. While gender explained variance in the enjoyment towards teaching about all three issues, male participants showed a higher motivation for the topics of returning wolves and climate change and female pre-service teachers for the context of pre-implantational genetic diagnosis.

These results are in line with general psychological studies about gender as a determinant of emotional experience for a wide variety of behaviors (Brody & Hall, 2008), but are rather inconsistent with prior studies about teaching emotions. While some studies found gender connected to a higher elicitation of anxiety (cf. Lohbeck et al., 2018), other studies showed no differences between male and female teachers (Sutton & Wheatley, 2003). While many studies disregarded the content dimension and concentrated on general classroom processes, the explicit integration of this subject-specific dimension is the first major difference of our study to previous approaches to teaching emotions and may explain some of the inconsistencies. Based on content-related dimensions, we found coherent differences for female and male pre-service teachers, as male teachers may generally show higher enjoyment towards teaching for controversial issues based on their higher elicitation of positive emotions (Burke, 2015; Lohbeck et al., 2018). This effect reversed for the SSI of pre-implantational genetic diagnosis. The nature of this issue in connection to pregnancy may explain this result, as female teachers may be more interested in the required background knowledge about the topic (Krapp & Prenzel, 2011). While these explanations remain hypothetical due to the quantitative nature of the study, future studies should pay attention to gender differences between female and male pre-service teachers when including topic specific dimensions.

Affective and subject-specific teacher professional development

The presented and discussed explanatory connections between values, psychological distance, and the enjoyment towards teaching illustrated how contextual variables such as identity may affect appraisal processes for the positive emotion of enjoyment. As particularly for SSIs these underlying beliefs are of primal interest (Heuckmann, Hammann, & Asshoff, 2018), future studies should further integrate these personality related results to teacher professional development.

Based on our results, professional development activities should also be planned in a context-specific manner, as we found large differences between the psychological distances, which imply also differences in the closeness to these issues. Furthermore, as enjoyment may capture the inherent motivational orientation for teaching and determines enthusiasm towards teaching (Keller et al., 2016; Kunter, 2013), the correlations of enjoyment between the issues implied differences for the motivation to teach about these issues. As the enjoyment towards teaching about the SSIs of returning wolves and pre-implantational genetic diagnosis were not correlated with each other, they may not rely on a general underlying tendency to teach about SSIs. This entails important consequences for the approach to

teaching emotions, which previously were conceptualized as subject- rather than context-specific phenomena (Frenzel et al., 2016). Based on our results, teacher educators should keep such motivational differences between issues in mind because teacher professional development activities should engage teachers instead of only providing new information to them (Korthagen, 2017). The investigated value dimensions of universalism and benevolence demonstrated to be relevant deeper identity structures within teachers, which may be addressed in teacher professional development (Day & Leitch, 2001; Korthagen, 2004). Such an integration may nonetheless be difficult due to the stability of values (Schwartz, 1994; Whittaker et al., 2006). Some studies showed real-world experiences and other affectively oriented learning activities as suitable to address these deeper personality variables (Molderez & Fonseca, 2018). But obviously, this is a challenge for teacher educators.

Besides the predictive effects of values, psychological distance showed to be a general predictor of enjoyment towards teaching and should therefore also be reflected in professional development activities. This integration seems easier than for the identity-based variables such as values because teacher educators may select appropriate SSIs based on pre-service teachers' psychological distance towards the issues. Such a selection may increase interest based on the higher personal relevance and interest of the issues (Stuckey et al., 2013). While SSIs may be utilized to facilitate this relevance due to their real-life connection (Sadler, 2009), the measure of psychological distance has shown to be interesting for further studies. Despite its novelty the scale showed good measurement results and enabled the distinction of pre-service teachers' closeness to the three selected SSIs. Future studies may also utilize the scale to investigate emotional involvement with SSIs. Such an involvement was proposed as a major strength of contextual learning (Sadler, 2009; Stuckey et al., 2013), but excessive involvement may also inhibit individuals from objective decision-making. This was implied by prior studies, which showed how students may "getting lost in the complexity of a context" (Parchmann et al., 2006, p. 1058) when to close to the issue.

Finally, the results also imply a rather affectively oriented view on teachers, which may be viewed as a counterweight to prior approaches of professional competence due to their concentration on cognitive outcomes such as knowledge (for example Kunter, Baumert et al., 2013). Of course teachers require a certain knowledge to explain content to students, but based on values' and beliefs' function as filters of teacher behavior (Fives & Buehl, 2012; Raveendran & Chunawala, 2015), teachers may not be able to transfer these theoretical competencies into practice when they contrast their value structures. This should be further investigated in future field studies because our study did not integrate practical teaching. But based on our results, values may affect teachers' appraisal processes and therefore also their in-class teaching (Frenzel, 2014).

Conclusion and outlook

Based on the results from our cross-sectional study, we found psychological distance and gender as general and universal values as context-specific antecedent of enjoyment towards teaching. While these

results should be reflected in contemporary teacher professional development, we believe them to be only the first step towards investigating the relevance of further contextual appraisal dimensions for teaching emotions. As a next step the integration of classroom field data would enable for a deeper look into the practical relevance of our results. This could be underpinned by the integration of other measures of emotional experience like physiological or expressiveness measures (Tobin et al., 2016).

Furthermore, possible differences may occur between the explicitly chosen SSIs and other teaching topics, without such distinct content structures. While lessons always need some kind of content (Anderson et al., 1996), we nonetheless were able to reproduce these effects for three topics from different domains implying the relevance of values for emotional appraisal. Particularly in these times of post-truth we need a further understanding of how a specific world view may shape the way individuals approach scientific contents (Peters, 2017). While our study illustrated this for the emotions towards teaching about the selected contexts, the results may also be reflected in further educational research about SSIs and advance teaching emotion theory.

5 Discussion

5.1. Synthesis of results

5.1.1. Connection of emotions and motivation (Research Focus I)

As described in the first two chapters of the empirical section, emotions were connected with the motivation to teach about the return of the wolves as well as the motivations to protect the Andean bear with likes on social media, money donation, and volunteering. Overall, the positive emotion of enjoyment showed the highest motivational relevance because it served as a predictor in the regression analyses, while other emotions such as anger and fear were only bivariatly correlated to the dependent variables or showed no connection at all (Table 5.1).

Table 5.1 Overview of connections between tested emotions and the respective desires towards teaching about returning wolves (Chapter 4.1) and protecting the Andean bear (Chapter 4.2).

Tested independent emotions	Connection	Dependent variables
Enjoyment towards teaching	→	Teaching motivation about returning wolves
Anger towards teaching	←→	
Fear towards teaching	X	
Enjoyment towards protecting the Andean bear	→	Liking motivation
	→	Motivation to donate money
	→	Motivation to volunteer
Anger towards protecting the Andean bear	←→	Liking motivation
	←→	Motivation to donate money
	←→	Motivation to volunteer

Note. → = Predictor in regression analysis, ←→ = Correlation, X = No connection.

Based on these results, enjoyment serves as an important motivational requirement for teaching and pro-environmental motivations. This result is in line with the theoretical assumptions because such a connection was assumed for example by self-determination theory, which states that positive emotions such as interest and enjoyment are indicators of intrinsic motivation (Deci & Ryan, 2000). But as described in the introduction, emotions have not been explicitly investigated to describe the selected motivations. Furthermore, prior studies regarding teaching emotions did not utilize a larger theoretical framework such as the MGB.

Concerning the results of the first study (Chapter 4.1), the adaptation of this larger framework allowed for the comparison of teaching emotions as predictors of teaching motivation in relation to other relevant variables. As described previously, the emotion of enjoyment towards teaching was a

stronger predictor than perceived behavioral control, which served as a major contributor to teaching intentions in prior studies (Lumpe et al., 1998b; Zint, 2002). Both variables were also correlated with each other. While emotional states are described as one major source of efficacy (Bandura, 1977), this interesting connection should be further investigated for the suitability as a possible intervention point to increase teaching motivation for specific topics. But these results also have to be critically reflected with respect to the selected sample because the sample selection may explain the missing connection between the negative emotions and teaching motivation. While future studies might further illustrate how these connections may differ for in-service teachers' emotions, the second study (Chapter 4.2) underlined some of the findings from the first study in an abstracted way.

This underlining particularly concerned the motivational relevance of enjoyment because this variable was in the regression analysis the only variable with a nearly equal predictive quality for every dependent environmental behavior. This result further underlines how enjoyment for a specific behavior translates into motivation and is in line with prior research (Bagozzi et al., 1998; Kals & Müller, 2012). Different to these prior studies, the empirical results of the dissertation illustrated how the predictive ability of enjoyment may be connected to more pronounced forms of environmental behavior such as money donation and volunteering by liking on social media as a mediator. Even when the covariate of perceived behavioral control remained the strongest predictor of the motivation to donate money and volunteer, enjoyment might constitute an important requirement for protection motivations.

Summarizing these results, we found enjoyment towards teaching as well as enjoyment towards the protection of the Andean bear as motivationally relevant variables for the selected behaviors. Because emotion theory indicates the positive evaluation within an emotional episode as the main requirement for the elicitation of enjoyment (Scherer, 2005), the second research focus investigated the relevant contextual variables for such a positive evaluation for the context of teaching.

5.1.2. Explanation of emotional appraisal (Research Focus II)

Based on its theoretical relevance for classroom learning (Frenzel, Goetz, Lüdtke et al., 2009) and motivational relevance from research focus I, the following two chapters aimed at better understanding the underlying appraisal processes for enjoyment towards teaching. The results from this second research focus are also important for the motivation because it is impossible to understand motivation without taking into account further contextual factors (Eccles & Wigfield, 2002). This relevance of context was also illustrated by the results because we found mutualistic wildlife values, attitudes and protection motivation towards the wolf as well as psychological distance as predictors of enjoyment towards teaching. In the subsequent transfer of these connections to the other socioscientific issues of climate change and pre-implantational genetic diagnosis, similar connections emerged due to the general connection of psychological distance and contextual predictive ability of basic human values for enjoyment towards teaching (Table 5.2).

Table 5.2 Overview of connections between tested contextual variables and enjoyment towards teaching about returning wolves (Chapter 4.3) and about returning wolves, climate change and pre-implantational genetic diagnosis (PGD; Chapter 4.4).

Contextual variables	Enjoyment towards teaching about		
	Wolf	Climate change	PGD
Mutualism	←→, $\rightarrow_{IND}$	-	-
Attitudes wolf	←→, $\rightarrow_{IND}$	-	-
Protection motivation wolf	→	-	-
Psychological distance	→, →	→	→
Universalism	→	←→	X
Benevolence	X	←→	→
Gender	→	→	→

Note. PGD = Pre-implantational genetic diagnosis. → = Predictor variable, $\rightarrow_{IND}$ = Indirect predictor variable, ←→ = Correlation, X = No connection, - = Not included in study.

In the third chapter (Chapter 4.3), protection motivation as the ultimate indicator of a positive mindset towards the protection of wolves explained the largest amount of variance for the enjoyment towards teaching about the topic. As the further results showed, this protection motivation is motivated by deeper personality variables like positive attitudes and values towards the protection of the wolf. A very interesting connection was found between enjoyment towards teaching and the mutualistic wildlife value orientation because this deepest personality variable was able to explain variance for the enjoyment towards teaching but none of the other dependent variables. This result indicated the relevance of values as a contributor to appraisal processes and laid the foundation for the final study. Further, also psychological distance was also able to directly explain the variance in all tested dependent variables. While this predictive ability indicated a direct connection between the variables, the subsequent median split showed a more nuanced view. These tests demonstrated significant differences for participants with small and a large distance towards the return of the wolves for the attitudes and perceived behavioral control, but not for the enjoyment towards teaching. This result may be explainable by the general distribution of the variable because the participants overall reported a very high distance towards the issue. Based on the selection of different issues, the fourth study showed a greater variance of psychological distance towards the selected issues and finally illustrated the predictive ability of psychological distance for enjoyment towards teaching.

In this final study (Chapter 4.4), psychological distance emerged as a general predictor of the enjoyment towards teaching. Furthermore, the participants reported large differences for the psychological distances between the issues. Interestingly, the participants also showed a smaller psychological distance to the return of the wolves than in the previous study. Because the items were the same in both studies, the datasets allow this direct comparison. The difference might be explainable by the selection of the contrasting contexts. Climate change could be perceived as an issue with increased societal significance, while pre-implantational genetic diagnosis may be only perceived as close when people are confronted with the concrete situation. Due to the fact that the study controlled

for the order of the issues, the findings imply a high variability within participants' psychological distance but also illustrate the need for further work to understand this rather new construct. Contrary to the unspecific effect of psychological distance, the basic human values of universalism and benevolence showed a contextual dependence in the regression analyses. While universalism only predicted the enjoyment towards teaching about returning wolves, benevolence only explained variance within the enjoyment towards teaching about pre-implantational genetic diagnosis. This result is very interesting because the positive appraisal of specific situations may rely on the respective value dimension which is coherent with the teaching context. Hence, people with a positive value set towards ecological topics such as returning wolves may also show a more positive evaluation when teaching about the context. Because the same applies for other contexts, this is a difficult message for teacher educators due to the implied contextual arbitrariness.

Thus, based on the summarized results, positive emotions can be described as opportunities for subject-specific teacher professional development because they were shown to increase the teaching motivation for the selected teaching contexts. This increased motivation may be particularly desirable for topics with an increased societal interest such as ESD. But based on the dependence of these positive emotions in deeper personality structures like values and attitudes, an explicit usage or consideration of emotions in teacher education may be difficult.

5.2. Emotions, personality, and motivation towards teaching

5.2.1. Challenges and opportunities

While prior studies have often concentrated on the social function of emotions and shown how teaching enjoyment may be connected to students' enjoyment and motivation (Frenzel, Goetz, Lüdtke et al., 2009), this dissertation aimed for a more intrapsychological view of emotions and found a connection between emotions towards teaching and the motivation to teach about the topic of returning wolves. This aspect adds another important internal function of teaching enjoyment to prior findings of connections to internal variables such as job satisfaction, emotional exhaustion, or self-efficacy (Frenzel et al., 2016). But different to these studies, the investigation was integrated into the larger theoretical framework of the MGB. This approach enabled the further description of the inherent entanglement between positive emotions like enjoyment and motivation in consideration of other relevant variables such as efficacy beliefs. This entanglement was illustrated by the predictive power of enjoyment for the teaching motivation, which exceeded the effect of perceived behavioral control. This result partly contradicted prior studies about teaching intentions (Lumpe et al., 1998b; Zint, 2002), but fits with the research regarding the persuasive nature of emotions (Dolan, 2002). Because emotions have to be seen as an integrative part of cognition, they may be of high interest for teaching motivation. While such an integration of emotions was not really minded into prior studies about teaching motivation (Han & Yin, 2016), the persuasive nature of emotions may be interesting for future intervention planning.

These interventions could aim at explicitly giving (pre-service) teachers the experience of positive emotions when teaching. This aim could be achieved by using simulations in which the teachers are confronted with complex situations and solve everyday teaching problems (Badiee & Kaufman, 2014). While these simulations have already been integrated in selected teacher education programs (Dieker, Rodriguez, Lignugaris/Kraft, Hynes, & Hughes, 2014), based on the results of the dissertation, these simulations could aid pre- and in-service teacher professional development when they explicitly integrate situations which would be suitable to elicit positive teaching emotions. One example may be successful learning experiences of learners, which were reported as a possible source of positive emotions by in-service teachers (Büssing, Michailidis, & Menzel, 2016). While the description of further possible teaching situations under consideration of the respective teaching topics may be an objective of future research, such simulations could also entail positive feedback on efficacy beliefs, based on their close relationship with enjoyment (Brígido et al., 2013; Hascher & Hagenauer, 2016).

From a theoretical perspective, it may be fair to assume a reciprocal relationship between the two variables. Hence, teachers with a higher perceived efficacy for teaching about a specific topic might also show more positive emotions when teaching the topic. But based on the ability of positive emotional experiences to be sources of efficacy beliefs (Bandura, 1977), the past experience of positive emotions may also increase perceived efficacy beliefs. Such a reciprocal connection was already shown for self-concepts and may also explain the close relationship of enjoyment and perceived behavioral control (Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2005). Because these results are at the moment mainly based on correlational connections, increased experimental variation may be required to further investigate the causal connection between the variables. This approach could be combined with the prior-mentioned simulation approaches. Besides this limitation for causal conclusions, the overall frequency of positive emotions and connections may not be representative for in-service teaching.

Even when enjoyment was demonstrated to be the most prevalent teaching emotion in the empirical part of the dissertation in concordance with prior in-service teacher studies (Frenzel, 2014), we also have to reflect the negative side of teaching emotions. But overall, these negative emotions were not really reproduced within the data. Based on the causation of negative emotions by a low control in negatively valued contexts, the perceived distance of pre-service teachers to real teaching situations could explain the overall small frequency of negative emotions. Because the pre-service teachers were not confronted with a concrete situation with a low control over their behavior, they will neither experience a low control nor evaluate the situation as being negative. While emotions generally may be conceptualized in a current perception in a specific situation (state), individuals also experience trait emotions in anticipation or retrospective to specific events (Pekrun, 2006). Prior studies have also shown how anticipated affective reactions are connected to behavioral decisions (Onwezen, Antonides, & Bartels, 2013; Richard, van der Pligt, Joop, & Vries, 1996). Because this effect can be explained by the reactivation of anticipated emotions in the specific situations (Bagozzi et al., 1998), a further

investigation of the reactivation of prior emotions in concrete teaching situations may be interesting. Even though this approach would underline the relevance of anticipated emotions, such studies should context-dependently reflect the effect of anticipated affective reactions on behavior (Ajzen & Sheikh, 2013). Furthermore, mixed methods approaches such as teaching diaries might allow for further insight into the nature of teaching emotions (Ritchie et al., 2016). The quantitative approach within the presented studies was nonetheless reasonable because the dissertation specifically aimed for the investigation of connections and differences and not the nature of emotions. In particular, the second major aim of the dissertation required quantitative data to investigate the relevant underlying personality variables for the emergence of enjoyment towards teaching.

Speaking of this emergence of enjoyment, the findings illustrated the required personality traits for an increased intrinsic motivation for teaching about the selected contexts. First of all, contextual variables such as the protection motivation towards the wolf, but also the underlying attitudes and values were shown to be predictive for enjoyment towards teaching. This result is in line with prior research because people with a specific mindset about something may act accordingly to this mindset in their teaching, as was shown for the context of climate change (Liu et al., 2015; Plutzer et al., 2016). For the present dissertation particularly, values emerged as an important contributor to the positive emotion of enjoyment. This result is interesting and further clarifies the role of identity for the appraisal of emotional situations to teaching. More clearly, when confronted with an emotional situation, individuals appraise the situation based on prior experiences and their momentary goals. For the context of teaching, our results imply that in contrast to other studies these goals might not only be constituted by student behavior (Frenzel, 2014), but also content-related goals such as the protection of nature. Because values may be an indicator of identity (Hitlin, 2003), the applied measures of values were able to capture this often unconscious part of appraisal (Moors, 2009). This result should be reflected in future theoretical considerations of teacher appraisal, which until today have neglected this content-dependent nature of teachers' emotional appraisal.

Besides the predictive effects of values, psychological distance emerged as an important contributor to enjoyment towards teaching within every tested teaching topic. This variable was demonstrated to be a very general predictor of enjoyment towards teaching in contrast to the contextual differences for the basic human values. This result is in line with prior research because these studies showed stronger emotional reactions for more emotional events (Scherer, 2005) and more close objects may also be perceived as being more important for the individual (Liberman & Trope, 2014). Concerning the overall results, the non-correlation with the variables of attitudes and protection motivation are notable. Prior experimental studies showed psychological distance as a way to increase concern and consumer mitigation intentions within the topic of climate change (Jones et al., 2017). For the context of returning wolves, participants with a smaller distance to the issue based on residence next to a wolf territory may hold more positive attitudes and subsequently higher protection intentions towards the species (Dressel et al., 2015; Hermann & Menzel, 2013a). But within the presented study,

there was no correlation between the variables. To further explain this result, future studies should investigate how the measure of psychological distance is related to the real distance to the issue. One possible hypothesis could refer to the strength of the social dimension of the scale which could prevent connections because people who are based on their social world not directly concerned will rate differently than people who are. Pre-service teachers may overall be concerned to a medium degree by the issue. While biology teachers may someday teach the topic this group is not as strongly affected as direct stakeholders. While these connections have to be investigated in further studies, the reasonable differences between the psychological distances showed its ability to differentiate between specific issues. But based on the results from the factor analysis, the inclusion of the fourth dimension of psychological distance (hypothetical distance) might point to measurement problems for some issues. In the light of context-based learning with close contexts (Sadler, 2009), the construct may nonetheless be of high interest. For example, Parchmann et al. (2006) found an excessive emotional involvement as a source of problems, with learners potentially becoming "lost in the complexity of a context" (Parchmann et al., 2006, p. 1058). The variable of psychological distance may now be an efficient way to measure this perceived closeness to specific issues because it showed good measurement results in the presented studies and also contributed to the description of teacher emotion appraisal.

The relevance of psychological distance for emotional appraisal also underlined the contextual nature of teaching emotions. However, due to the demonstrated differences between the measured scores for the psychological distance towards the wolf, individuals may show a high variance for this scale based on the specific situation of measurement. This result further undermines prior research, which was dominated by a rather rational view on teacher behavior (Harms & Riese, 2018).

5.2.2. Towards a more holistic view of (biology) teachers

Even when schools and particularly science education have been described as a shelter of reason, people rather remember emotional episodes when reflecting about their own school time instead of factual content (Pekrun, 2005; Sinatra et al., 2014). While this phenomenon may be explained by the persuasive function of emotions on memory (Hostler, Wood, & Armitage, 2018; LaBar & Cabeza, 2006), it also illustrates how (science) classrooms are emotional places. As prior studies have shown, the teacher is one of the main contributors to the emotional climate in a given classroom situation (Mainhard, Oudman, Hornstra, Bosker, & Goetz, 2018). Therefore, the description of teachers as unemotional individuals may not live up to the reality in schools. Particularly with respect to contexts with a higher obligation like teaching about topics of ESD, which largely rely on emotions and identity (Ojala, 2013), teachers should be viewed from a more holistic perspective.

Building on the work of Korthagen (2017) teacher identity and teachers' overall goals may be seen as the core of teacher behavior. Based on this identity, teachers build specific beliefs in particular contexts and subsequently utilize their competencies for their teaching. Because these competencies may be filtered through the lens of beliefs (Fives & Buehl, 2012), there is a requirement for further

understanding of teacher belief systems and identity. More concretely, even when teachers know a lot about a specific topic but may hold incoherent key beliefs or values towards the issue, this knowledge will not be of use in the concrete teaching situation and therefore not contribute to student learning. Such a holistic view of teachers should be viewed as complementing rather than substituting prior (rational) approaches to teacher behavior and personality. For example, of course teachers need first of all a specific content knowledge about the respective contexts because this lays the foundation for further pedagogical content knowledge (Großschedl et al., 2015). But as illustrated by the dissertation, this view alone may underestimate teacher personality and behavior.

As described previously, most of the studies (also from this dissertation) utilize a trait approach to emotions. As empirical results show, trait characteristics explain about half of the variance in state emotional experiences (Nett, Bieg, & Keller, 2017). Thus, even when they may not capture the momentary emotional experience, trait emotions are nonetheless of relevance for research and practice. But the further exploration should obviously also investigate state emotions and teacher behavior in class (Hollins, 2011). This requirement could be further supported by the triangulation with other data types, such as physiological measurements of heart rate or blood oxygenation using for example smart watches (Tobin et al., 2016). To integrate such approaches in a larger theoretical framework, these studies may also benefit from integrating the theory of embodied cognition. The main hypothesis behind embodied cognition states that every sort of cognition is embodied, meaning located in a specific situation, context, and environment (Walter, 2014; Wilson, 2002). Therefore, all description and analysis should always be reflected based on the specific situation, including the momentary emotions. Such an approach to teacher behavior was able to further illustrate the discrepancy between teaching and practice, based on the different goals in teacher education and teaching practice (Hutner & Markmann, 2017). This area is also interesting concerning the connection of values and emotions because the situated cognition approach might be used to further illustrate this result. In some occasions the pursuit of specific goals might be more reasonable than in other situations, entailing important consequences for teacher practice.

When there is a normative precondition of integrating further normative goals into education, such as the establishment of sustainable development, then this situated approach should always be kept in mind. While this dissertation gave examples for motivationally relevant variables, future studies could investigate how school cultures relate to such contextual values and promote or hinder the adoption of innovative ideas like sustainable development. Besides topics of ESD, similar relations might also be important for other school development contexts. One recent example may be the further integration of children with special needs. Besides the knowledge about suitable scaffolds in science lessons (Villanueva, Taylor, Therrien, & Hand, 2012) teachers need coherent beliefs about the integration of more diverse learners into the classroom (Florian, 2008). The value dimension of universalism might be interesting for such an investigation because it aims at the welfare of all people regardless of special educational needs and may lay the foundation for further subsequent belief

dimensions such as the *Sentiments, Attitudes, Concerns about Inclusive Education* (Forlin, Earle, Loreman, & Sharma, 2011). Based on this hypothesized connection, universalism and similar personality variables might potentially be viewed as part of teachers' professional competencies and should be considered in professional development activities.

5.3. Subject-specific teacher professional development

As described in the introduction, prior conceptualizations of teacher professional competence have concentrated mainly on knowledge and rational parts of teacher behavior. Based on the results of the present dissertation, the question emerges regarding how further personality factors such as values or attitudes towards specific species may constitute additional requirements for teacher professional competence. May teachers who are not committed to sustainability be good teachers for ESD? While the dissertation is not aimed at explaining this specific question, it can nonetheless formulate specific hypotheses.

First of all, motivated teachers may be described as a normative aim of all professional development due to the positive effect of teaching motivation on student learning (Keller et al., 2017; Roth, Assor, Kanat-Maymon, & Kaplan, 2007). Besides decreased student motivation, faked emotions may lead to problematic consequences for teachers because studies have found an increase of emotional exhaustion and decreased mental as well as physical health when teachers excessively fake their emotional reactions (Taxer & Frenzel, 2015). Therefore, teachers should also possess the underlying personality traits for this enthusiastic teaching style to ensure motivated students and healthy teachers. Because variables such as protection motivation and underlying deeper personality traits lay the foundation for enjoyment towards teaching, these variables should play a bigger role in future teacher professional development.

Besides these outcome-oriented arguments for the further recognition of teachers' personality variables, recent developments in the greater school culture may also point to a further broadening of teachers' competencies. For example, biology teachers are compelled by expanded obligations to include issues with a societal impetus (SSIs) in teaching (Sadler & Zeidler, 2009). As described in the introduction, some teachers are highly skeptical about this and perceive such approaches as a rejection from content dimensions (Sadler et al., 2006). But as studies have shown, SSIs are suitable to also foster cognitive outcomes such as knowledge (Klosterman & Sadler, 2010). Therefore, the findings from this dissertation should be used to foster the teaching motivation for the respective topics. Besides the integration of further topic dimensions, teachers and schools are faced with a variety of superior obligations based on recent school development activities (Kremer, Brannen, & Glennerster, 2013).

One concrete example may be the already-mentioned integration of students with special needs into classrooms. Another one may be the successful organization of digitalization in schools, which also requires an open mindset of teachers due to the transformation of learning processes in digital school

environments (Bates, 2015; Tapscott & Williams, 2010). Finally, because universalistic teachers may hold a progressive view on teaching and learning, more conservation-oriented teachers may also hold traditionalistic views about teaching. This issue could possibly inhibit student motivation due to the confounding effects of controlling teacher behaviors on student motivation (Hofferber, Basten, Großmann, & Wilde, 2016). Therefore, also for in-school contexts a specific positive and open mindset may constitute a requirement for professional teaching.

These further requirements may also be integrated in prior conceptualizations of teachers' professional competence, such as the competence model of Baumert and Kunter (2013). Some studies have already aimed for a further adaptation of this model for example to pre-service teachers subjective learning theories about the subject of biology (Berding et al., 2017; Schumacher et al., 2018), or further added contextually relevant variables like multicultural beliefs (Hachfeld, Hahn, Schroeder, Anders, & Kunter, 2015). Based on the previous conceptualization, Table 5.3 suggests further teacher characteristics as additional facets of teacher professional competence.

Table 5.3 Already established parts of teachers' professional competence following the model of Baumert and Kunter (2013) and possible additions based on results of the dissertation.

Competence dimension	Previous conceptualization	Further characteristics
Professional knowledge	Content knowledge (CK), pedagogical knowledge (PK), pedagogical content knowledge (PCK), organizational knowledge, counseling knowledge	Professional knowledge about ESD
Beliefs & values	Epistomological beliefs, subjective theories of learning, subjective theories about teaching of the subject, self-related ability cognitions	Universalism, Benevolence, Attitudes towards teaching the respective topic^{SPEC}, Attitudes towards wolves, Attitudes towards climate change
Motivational orientations	Enthusiasm towards teaching	Enjoyment towards teaching^{SPEC}, Perceived behavioral control^{SPEC},
Self-regulative functions	Self-regulatory skills	Emotion regulation strategies

Note. ^{SPEC} = Using a more specific manifestation.

First of all, in concordance to prior approaches (Bertschy et al., 2013), a further adaptation of professional competence to ESD seems reasonable, based on the obligation for ESD on all educational levels (Haan, 2010). Besides such a general modification, the model could also integrate more concrete variables of specific values or attitudes and utilize an overall more specified approach to professional development. This area particularly concerns the motivational orientations because these orientations may vary substantially between specific topics. The empirical data of the dissertation showed no correlations between the enjoyment towards teaching about returning wolves and pre-implantational genetic diagnosis. In combination with the empirical separation of the topics in the exploratory factor analysis implies a more context- rather than subject-specific nature of enjoyment towards teaching. This result partly contrasts prior studies, which concentrated on subject-specific approaches (Frenzel et al.,

2016). Of course the efficiency of the further conceptualization should always be critically reflected, but teachers are confronted with teaching specific topics to students, not only subjects. Because such a context-dependent nature was also was found for pedagogical content knowledge (Campbell et al., 2017), teacher professional development activities should always be as specific as possible (Tricot & Sweller, 2014). Finally, based on the role of emotions in education, the trait of emotion regulation may be viewed as an additional component of teachers' self-regulative functions and should gain further interest in future research. The competence to regulate one's own emotions may for example be a way to prevent teachers from burnout (Chang, 2013).

While all of these processes represent significant challenges to teachers, teacher educators, and schools, it should be clear that even when specific parts of personality may be seen as compromising part of competent teachers, these characteristics may not constitute exclusion criteria for teachers. While several studies found specific instruments for teacher selection such as the Gallup Teacher Perceiver Interview suitable to identify successful teachers (Metzger & Wu, 2008), schools have an interest and obligation to represent the societal diversity also within their school staff due to their function of socialization (Lindsay & Ginsburg, 2013). This is particularly true for controversial environmental issues such as returning wolves or climate change (Overwien, 2016).

Besides being context-specific, professional development activities should be conceptualized in a rather short and specialized manner (Basma & Savage, 2018) as well as aiming at whole system approach (Ferreira, Ryan, & Tilbury, 2007). Hence, prior to any further integration educators should aim for broad consensus and integrate stakeholder interests to anticipate possible barriers. Finally, the results of the dissertation should be kept in mind for all professional learning activities because "attendance is mandatory but learning not" (Kennedy, 2016, p. 954). Thus, the further knowledge about teacher motivation should be used in professional development activities because such activities not only aim at presenting new information to teachers, but engage them with the topics (Kennedy, 2016; Korthagen, 2017). This is particularly also true for organization change and school development (Straatmann, Kohnke, Hattrup, & Mueller, 2016).

5.4. Conclusion

As described in the introduction and illustrated by the empirical results, emotions challenge our view of teacher behavior because they may be difficult to predict and are highly contextual. While this issue was often mentioned as a general problem to the scientific approach of teacher emotions (Frenzel, 2014), the first part of the empirical results (Chapters 4.1 and 4.2) illustrated the persuasive nature of emotions for the motivation to teach and to act pro-environmentally. Therefore, emotions may also be seen as opportunities for professional development activities. The empirical results from the second part of the dissertation (Chapters 4.3 and 4.4) illustrated some of the context-specific relevant factors for the elicitation of emotions. Based on these results, teacher emotions and their underlying value structures

may be seen from a functional perspective and could be a step for the advancement of biology education research.

As described in the introduction, starting with Darwin in 1847 several researchers proposed a functional approach to emotions (Darwin, 1872; Plutchik, 2001). Hence, emotions evolved due to functional requirements to human experience and enabled the survival of our primal ancestors. While modern societies have significantly decreased the mortality risks based on natural enemies, this is still in line with the results of the dissertation. When teachers experience specific emotions when teaching, these are indicators in accordance to teachers' overall aims, based on an evaluation of their current state in specific situations. Even when teachers will not be confronted with fear towards saber-toothed tigers but rather with fear towards teaching about topics without (perceived) sufficient preparation, emotions often unconsciously point the right direction. This was also mentioned in prior studies, which proposed a "deeper wisdom" of intuitive decision-making (Haidt, 2001; Stets, 2016).

Therefore, emotions may be described as an indicator of valuation of specific contents. When teachers show enjoyment when teaching about a particular topic, students will evaluate the new content based on their perception of how teachers relate to the content. Further studies which could investigate how strong teachers transfer the presented contextual goals like the conservation and well-being of all people and nature into their classes. This could counterbalance prior approaches to teacher emotions, which solely concentrated on student behavior as a source of teacher emotion (Frenzel, 2014). Such studies could finally lead to a more affectively informed biology education.

Based on the emotion nature of teaching and learning, biology education may start to further appreciate the affective dimension of learning and teaching. As prior studies showed, this could be done even for very specialized biology topics like microbiology (Vlaardingerbroek, Taylor, Bale, & Kennedy, 2017). Of course, such affective approaches may challenge teachers and students because of their short-lived nature and more difficult measurement (Cohen, Spillane, & Peurach, 2018). Nonetheless, due to the findings from this dissertation in line with prior studies from social neurosciences (Ansari & Coch, 2006; Byrnes & Fox, 1998; Immordino-Yang & Damasio, 2007), a further integration of affective domains into teaching and learning may lead to a new and more persuasive science of learning (Meltzoff, Kuhl, Movellan, & Sejnowski, 2009). This might be particularly important for topics with a higher obligation like ESD (Sipos et al., 2008) and should in future studies also further integrate the societal perspective (Buerke, Straatmann, Lin-Hi, & Müller, 2017).

All these approaches could finally be useful to overcome the negative emotional bias against biodiversity, which is not able to elicit strong emotions due to its invisibility (Nee, 2004). Nonetheless, this dissertation and future studies may contribute to a further mainstreaming of ESD, another 70 years of existence for the IUCN, and the celebration of its 140th birthday in 2088.

6 References

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7 Summary

Contrary to ongoing conservation efforts, declining global biodiversity remains an unsolved ecological problem. In addition to other processes such as a functioning global climate, this environmental resource represents a fundamental planetary boundary for humanity's survival on the planet. As part of the expansion of international environmental protection activities, a key response to these issues is Education for Sustainable Development (ESD). ESD aims for a holistic picture of sustainability accounting for knowledge but also for emotions, environmental motives, and their underlying values as learning outcomes. However, this holistic picture has not yet been applied to teachers, since research and university teacher education primarily focusing on knowledge as a core competence of teachers' professional competencies. But this underestimates the importance of affective reactions, which are central to human experience, behavior, and thus also of teaching and learning processes. Especially with regard to topics related to local biodiversity such as the protection of wild animals, affective dimensions require a better understanding because human-wildlife conflicts often cause strong emotional reactions by affected stakeholders. As these topics are also part of biology education, the dissertation aims at a better understanding of the meaning of emotions as a central affective process for biology teaching.

For this purpose, the dissertation builds on the model of goal-directed behavior and focuses in the first part on the relationship between emotion and motivation (Research Focus I). Based on the theoretical model, the first study examines possible connections between teaching emotions and the motivation to teach the topic "the return of wolves to Germany". While the surveyed 120 pre-service biology teachers reported enjoyment towards teaching as the most frequently experienced emotion, negative emotions of fear and anger were generally poorly anticipated. Of the emotions examined, enjoyment was positively and anger negatively correlated with the motivation to teach, while fear towards teaching showed no correlation with motivation at all. In the final structural equation model, positive attitudes towards teaching the subject and sufficient perceived behavioral control towards teaching were besides enjoyment towards teaching identified as significant predictors. The study illustrates the connection between emotions towards teaching and motivation for the topic of returning wolves.

In order to investigate the role of emotions in motivational processes outside this very specific teaching context, the study compared three general conservation motivations for connections between emotion and motivation. Liking on social media, money donations, and volunteering were selected as dependent environmental behaviors. In order to explain possible differences, the independent variables were varied while controlling the corresponding dependent variables based on the model of goal-

directed behavior within the wildlife conservation context of the Andean bear (*Tremarctos ornatus*) in Ecuador. Overall, the surveyed 407 Ecuadorian students from various study programs reported the highest motivation for liking on social media, followed by volunteering and ultimately money donation as the least desired environmental behavior. These differences were explained by the lack of predicitve quality of perceived behavioral control for the behavior of liking on social media. Enjoyment towards the protection of the Andean Bears was the only predictor with a consistent predictive ability for all three environmental behaviors. In addition to this crucial contribution of emotions to environmental motivations, the sub-study provides a more detailed description of the novel environmental behavior of the Liking on social media. For example, mediator analyzes have identified the role of social media as a potential easy pathway behavior to more pronounced forms of environmental action.

Based on the demonstrated relationships between emotions and motivation, the second part of the empirical results focuses on the appraisal determinants of emotions (Research Focus II). Using the same dataset of the first study, the third study investigated which further contextual variables explain motivational variables towards teaching about returning wolves. In particular, protection motivation and psychological distance towards the return of the wolf were predictive for positive attitudes, anticipated enjoyment, as well as an increased perceived behavioral control towards teaching about the topic. As the protection motivation was based on deeper values and attitudes towards the wolf, the sub-study also illustrated possible factors of a holistic and context-specific teacher professionalization in the context of ESD.

In the fourth and final sub-study, these results were transferred to two other teaching topics. In addition to the environmental context of the return of wolves, climate change was selected as another environmental and pre-implantational genetic diagnosis as an additional health-related teaching topic. Due to this cross-contextual nature of the study, we selected the basic human values of universalism and benevolence, as well as the psychological distance to the topics as possible predictor variables. While the 189 surveyed biology pre-service teachers reported very different psychological distances to the topics, this factor was the only predictor of the enjoyment towards teaching for all topics. The selected values showed a very context-specific predictive ability for the dependent variables. Universalism predicted only the enjoyment towards teaching about returning wolves, benevolence only the enjoyment towards teaching about pre-implantational genetic diagnosis. These effects also persisted when controlling for relevant demographic factors such as age and gender.

In summary, the empirical results illustrate the role of emotions as independent and dependent variables for teaching as well as environmental conservation motivations. The results are essential for the design of teacher professional development activities and should also be considered in the further design of ESD. Furthermore, particularly the second research focus revealed the psychological prerequisites of positive teaching emotions. While the integration of the identified value, attitudes, and other affective factors such as psychological distance represents a major challenge to the ongoing

teacher professionalization, the results also point to opportunities for increasing teaching motivation in the context of transformative learning for ESD.

Zusammenfassung

8

Entgegen andauernder Naturschutzbestrebungen bleibt der Rückgang der globalen Artenvielfalt ein bisher ungelöstes ökologisches Problem. Neben dem funktionierenden globalen Klima kommt dieser als Biodiversität bezeichneten Umweltressource die Rolle einer planetaren Grenze für das Überleben der Menschheit auf dem Planeten zu. Im Rahmen der Erweiterung des internationalen Umweltschutzes besteht eine zentrale Antwort auf diese Probleme in einer Bildung für Nachhaltige Entwicklung. Diese zielt auf ein ganzheitliches Bild von Nachhaltigkeit, bei dem nicht nur Wissen sondern auch Emotionen, Umweltschutzmotivationen und die zugrunde liegenden Werteinstellungen beachtet werden. Dieses holistische Bild wurde bisher jedoch nur beschränkt auf Lehrkräfte übertragen, da sich die Forschung sowie die universitäre Lehrerbildung vor allem auf Wissen als Kernkompetenz von Lehrprofessionalität konzentriert. Doch dies unterschätzt die Bedeutung affektiver Reaktionen wie Emotionen, die zentraler Bestandteil des menschlichen Erlebens, Verhaltens und damit auch von Lehr- und Lernprozessen sind. Gerade bei Themen die sich auf lokale Biodiversität beziehen wie dem Schutz von Wildtieren ist ein besseres Verständnis affektiver Dimensionen nötig, da Mensch-Wildtier-Konflikte häufig starke emotionale Reaktionen bei Betroffenen hervorrufen. Diese Themen sind ebenfalls Teil des Biologieunterrichts, weshalb die Dissertation auf ein besseres Verständnis der Bedeutung von Emotionen als zentraler affektiver Prozess im Biologieunterricht abzielt.

Zu diesem Zweck baut die Arbeit auf dem Model des zielgerichteten Verhaltens („Model of goal-directed behavior“) auf und widmet sich im ersten Teil den Zusammenhängen von Emotion und Motivation (Forschungsfokus I). Ausgehend vom theoretischen Modell untersucht die erste Teilstudie mögliche Zusammenhänge zwischen unterrichtsbezogenen Emotionen und der Lehrmotivation für das Unterrichten des Themas die „Rückkehr der Wölfe nach Deutschland“. Während die befragten 120 Lehramtsstudierenden des Faches Biologie Freude gegenüber dem Unterrichten als die am stärksten empfundene Unterrichtsemotion berichteten, wurden die negativen Emotionen Angst und Ärger generell nur im geringen Maße antizipiert. Von den untersuchten Emotionen korrelierten Freude positiv und Ärger negativ mit der Unterrichtsmotivation, während Angst gegenüber dem Unterrichten des Themas keine Korrelation mit der Motivation aufwies. Im abschließenden Strukturgleichungsmodell stellten sich neben der Freude zu Unterrichten ebenfalls eine positive Einstellungen gegenüber dem Thema und eine ausreichende wahrgenommene Verhaltenskontrolle gegenüber dem Unterrichten als signifikante Prädiktoren heraus. Die Studie zeigt damit erstmals und beispielhaft für das Thema die Rückkehr der Wölfe auf, wie Emotionen gegenüber dem Unterrichten mit der Lehrmotivation zusammenhängen.

Um die Rolle von Emotionen für Motivationsprozesse auch außerhalb dieses sehr speziellen Unterrichtskontextes zu untersuchen, wurden in der zweiten Teilstudie drei allgemeine Naturschutzmotivationen miteinander verglichen. Als abhängige Verhaltensausprägungen wurden dabei das Liken von schutzrelevanten Inhalten auf sozialen Medien sowie Geldspenden und Freiwilligendienst ausgewählt. Um mögliche Unterschiede zwischen diesen Verhalten zu erklären wurden die auf dem Modell des zielgerichteten Verhaltens basierenden unabhängigen Variablen kontrolliert und die entsprechenden abhängigen Variablen gezielt variiert. Insgesamt wurden dabei alle Variablen auf den ebenfalls auf den Schutz der Biodiversität bezogengen Wildtierkontext des Andenbären (*Tremarctos ornatus*) in Ecuador ausgerichtet. Die befragten 407 ecudorianischen Studierenden diverser Studiengänge berichteten insgesamt die höchste Motivation für das Liken auf sozialen Medien, gefolgt vom Freiwilligendienst und letztlich dem Geldspenden als das am wenigsten gewünschtes Schutzverhalten. Aufgrund des theoretischen Modells konnten diese Unterschiede vor allem mit dem Fehlen eines Effekts der wahrgenommenen Verhaltenskontrolle für das Liken auf sozialen Medien erklärt werden. Die Freude gegenüber dem Schutz des Andenbären war der einzige Prädiktor mit einer durchgängigen prädiktiven Qualität für alle drei Schutzverhalten. Neben diesem entscheidenden Beitrag von Emotionen für Umweltschutzmotivationen ermöglicht die Teilstudie die genauere Beschreibung des neuartigen umweltbezogenen Verhaltens des Likens in sozialen Medien. Dabei konnten beispielsweise Mediatoranalysen die Rolle von sozialen Medien als ein mögliches ökologisches Einstiegsverhalten aufzeigen.

Ausgehend von den aufgefundenen Zusammenhängen zwischen Emotionen und Motivation fokussiert der zweite Teil der empirischen Ergebnisse auf den Voraussetzungen für emotionale Reaktionen (Forschungsfokus II). Hierbei stellt die dritte Teilstudie ausgehend vom gleichen Datensatz der ersten Teilstudie dar, wie die signifikanten Prädiktoren für die Unterrichtsmotivation durch weitere kontextuelle Faktoren erklärt werden können. Hierbei zeigten vor allem die Schutzmotivation sowie die psychologische Distanz gegenüber dem Wolf Zusammenhänge mit einer positiven Einstellung, antizipierter Freude sowie einer gesteigerten wahrgenommene Verhaltenskontrolle gegenüber dem Unterrichten des Themas. Da die Schutzmotivationen durch tieferliegende Werte und Einstellungen gegenüber dem Wolf begründet wurden, zeigt die Teilstudie zudem erstmals mögliche Faktoren einer holistischen und kontextspezifischen Lehrerprofessionalisierung im Rahmen einer Bildung für Nachhaltige Entwicklung auf.

In der vierten und letzten Teilstudie wurde dieser Ansatz vertieft und auf zwei weitere Unterrichtskontexte übertragen, um die Bedingungsfaktoren der Freude gegenüber dem Unterrichten dieser Themen zu untersuchen. Neben dem Umweltkontext der Rückkehr der Wölfe wurde der Klimawandel als weiteres Thema mit Bezug zur nachhaltigen Entwicklung sowie Präimplantationsdiagnostik als gesundheitsbezogener Unterrichtskontext ausgewählt. Als mögliche Prädiktoren wurden sowohl die allgemeinen Wertetypen Universalismus und Benevolenz als auch die psychologische Distanz gegenüber den Themen ausgewählt. Während die 189 befragten

Biologielehramtsstudierenden sehr unterschiedliche psychologische Distanzen zu den Themen berichteten, war dieser Faktor der einzige Prädiktor für die Freude gegenüber dem Unterrichten aller Themen. Die ausgewählten Werte konnten nur sehr kontextspezifisch Varianz in den abhängigen Variablen erklären: Universalismus war dabei nur für die Freude gegenüber dem Unterrichten des Themas die Rückkehr der Wölfe, Benevolenz nur für die Freude gegenüber dem Unterrichten des Themas Präimplantationsdiagnostik Prädiktor. In einem weiteren Schritt blieben diese Effekte auch bei der Kontrolle relevanter demografischer Faktoren wie Alter und Geschlecht bestehen.

Zusammenfassend zeigen die empirischen Ergebnisse zum einen die Rolle von Emotionen als unabhängige Variable und damit als bestimmender Faktor von Unterrichts- und Naturschutzmotivationen auf. Die Ergebnisse sind essentiell für die Gestaltung von Lernangeboten für Lehrende und sollten ebenfalls bei der weiteren gesellschaftlichen Verankerung von Umweltschutzmaßnahmen Beachtung finden. Zum anderen zeigt insbesondere der zweite Teil der empirischen Ergebnisse die psychologischen Voraussetzungen positiver Unterrichtsemotionen auf. Die Integration der herausgearbeiteten Werteinstellungen und weiterer affektiven Faktoren wie der psychologischen Distanz stellt zwar eine große Herausforderung für die fortschreitende Professionalisierung des Lehrberufs dar, kann jedoch ebenfalls als Möglichkeit angesehen werden die Ausbildung von Lehrerinnen und Lehrern im Rahmen von transformativem Lernen motivational förderlicher zu gestalten.

9 Appendix

Supplemental material

Supplemental material for the reproduction of the analyses can be found in the Open Science Framework under the following link:

https://osf.io/wu9n7/

Questionnaire study 1

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UNIVERSITÄT OSNABRÜCK

Die Bereitschaft die Rückkehr der Wölfe nach Deutschland durch Bildung zu unterstützen

Liebe Studierende,

vielen Dank, dass Sie mich mit dem Ausfüllen des Fragebogens bei meiner Masterarbeit in der Abteilung Biologiedidaktik unterstützen. Ihre Antworten helfen mir Aufschluss zu erhalten, welche Faktoren im Zusammenhang mit der Bereitschaft stehen, das Thema „Rückkehr der Wölfe nach Deutschland" im Kontext der Bildung für nachhaltige Entwicklung zu unterstützen.

Sie bearbeiten den Fragebogen freiwillig. Es ist wichtig, dass Sie die Fragen ehrlich beantworten. Die Ergebnisse bleiben anonym und es kann nicht auf Ihre Identität zurückgeschlossen werden.

Beantworten Sie den Fragebogen der Reihenfolge nach ganz spontan und beachten Sie, dass immer nur eine Antwortmöglichkeit pro Frage angekreuzt werden darf.

Bitte benutzen Sie einen Kugelschreiber, bzw. einen dunklen Filzstift, weil der Fragebogen elektronisch ausgewertet wird.
Wenn Sie sich geirrt haben, malen Sie ein Kästchen ganz aus und kreuzen Sie danach das richtige Kästchen an.

Viel Spaß beim Ausfüllen!

Bei weiteren Fragen stehen Alexander Büssing (alexander.buessing@biologie.uni-osnabrueck.de) oder ich Ihnen gern zur Verfügung.

Maike Schleper (mschleper@uni-osnabrueck.de)

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Die Wölfe kehren zurück nach Deutschland

Obwohl der Wolf einst Lebensräume auf der ganzen Welt besiedelt hat, gab es in Deutschland seit etwa 1850 aufgrund von menschlicher Verfolgung keine Wölfe mehr.

Im Jahr 2000 siedelte sich ein erstes Wolfspärchen aus Polen in Ostdeutschland an und bekam Junge.

Heute sind circa 100 Wölfe in Deutschland wieder heimisch und auch in Niedersachen sind bisher fünf Wolfsrudel bestätigt. Die Wölfe sind aus überlebenden Populationen in Osteuropa wieder eingewandert und werden nun in immer neuen Regionen in Richtung Westen vermehrt heimisch.

Geschlecht: ☐ M ☐ W Ich bin _____ Jahre alt.

Ich studiere im Bachelor ☐ Master ☐

für das Lehramt an:
Grundschule ☐ Hauptschule ☐ Realschule ☐ Gymnasium ☒ Gesamtschule ☐ Berufsschule ☐

Mein Zweitfach ist _____ Mein Drittfach ist _____

Ich bin eher auf dem Land ☐ eher in der Stadt ☐ aufgewachsen.

Ich wohle aktuell eher auf dem Land ☐ eher in der Stadt ☐

Ich bin Jäger/in. Ja ☐ Nein ☐

Jemand aus meinem persönlichen Umfeld ist Jäger/in. Ja ☐ Nein ☐

Ich besitze ein Haustier. ☐ Ja ☐ Nein ☐ in der Vergangenheit

Meine Familie besitzt ein Haustier. ☐ Ja ☐ Nein ☐ in der Vergangenheit

---

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Ich bin persönlich von der Rückkehr der Wölfe betroffen.	☐	☐	☐	☐	☐	☐
Ich bin persönlich von der Rückkehr der Wölfe bedroht.	☐	☐	☐	☐	☐	☐
Ich bin persönlich vom Rückgang der Artenvielfalt bedroht.	☐	☐	☐	☐	☐	☐
Ich bin in meinem geographischen Umfeld von der Rückkehr der Wölfe betroffen.	☐	☐	☐	☐	☐	☐
Ich bin in meinem geographischen Umfeld von der Rückkehr der Wölfe bedroht.	☐	☐	☐	☐	☐	☐
Ich bin in meinem geographischen Umfeld vom Rückgang der Artenvielfalt bedroht.	☐	☐	☐	☐	☐	☐
Ich bin in nächster Zeit von der Rückkehr der Wölfe betroffen	☐	☐	☐	☐	☐	☐
Ich bin in nächster Zeit von der Rückkehr der Wölfe bedroht.	☐	☐	☐	☐	☐	☐
Ich bin in nächster Zeit vom Rückgang der Artenvielfalt bedroht.	☐	☐	☐	☐	☐	☐
Die Rückkehr der Wölfe ist sehr wahrscheinlich.	☐	☐	☐	☐	☐	☐
Die Bedrohung durch die Rückkehr der Wölfe ist sehr wahrscheinlich.	☐	☐	☐	☐	☐	☐
Der Rückgang der Artenvielfalt ist sehr wahrscheinlich.	☐	☐	☐	☐	☐	☐

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Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Wir sollten uns um eine Welt bemühen, in der Menschen und wildlebende Tiere ohne Angst Seite an Seite leben können.	☐	☐	☐	☐	☐	☐
Egal, ob ich hinausgehe, um freilebende Wildtiere zu sehen oder nicht, für mich ist es wichtig zu wissen, dass es sie in Deutschland gibt.	☐	☐	☐	☐	☐	☐
Für mich ist es wichtig zu wissen, dass für zukünftige Generationen Wildtierpopulationen erhalten werden.	☐	☐	☐	☐	☐	☐
Wenn es eine hohe Anzahl wildlebender Tiere gibt, ist Jagd akzeptabel.	☐	☐	☐	☐	☐	☐
Wildlebende Tiere dürfen von Menschen genutzt werden.	☐	☐	☐	☐	☐	☐
Ich sorge mich genauso viel um Tiere, wie um andere Menschen.	☐	☐	☐	☐	☐	☐
Die Anwesenheit von wildlebenden Tieren in meiner näheren Umgebung ist wichtig für mich.	☐	☐	☐	☐	☐	☐
Es ist in Ordnung, dass Wildtierpopulationen reguliert werden, um menschliche Interessen zu schützen.	☐	☐	☐	☐	☐	☐
Für mich ist es wichtig zu wissen, dass es gesunde Wildtierpopulationen in Deutschland gibt.	☐	☐	☐	☐	☐	☐
Jagd ist grausam und unmenschlich für Tiere.	☐	☐	☐	☐	☐	☐
Ich nehme Vögel und andere wildlebende Tiere in meiner Umgebung jeden Tag wahr.	☐	☐	☐	☐	☐	☐
Es ist akzeptabel, dass wildlebende Tiere für Forschungszwecke genutzt werden, auch wenn einige Tiere verletzt oder getötet werden.	☐	☐	☐	☐	☐	☐
Ein wichtiger Teil meiner Wohnumgebung sind wildlebende Tiere, die ich dort von Zeit zu Zeit sehe.	☐	☐	☐	☐	☐	☐
Es wäre eine sehr große Anerkennung für mich, Tieren zu helfen – mehr noch als Menschen.	☐	☐	☐	☐	☐	☐
Ich sehe alle lebenden Geschöpfe als Teil einer großen Familie an.	☐	☐	☐	☐	☐	☐
Beziehungen, die ich mit Tieren habe, spenden mir viel Trost.	☐	☐	☐	☐	☐	☐
Ich schätze das Verbundenheitsgefühl, das mir Tiere geben.	☐	☐	☐	☐	☐	☐
Menschliche Bedürfnisse sollten höhere Priorität besitzen, als der Schutz von wildlebenden Tieren.	☐	☐	☐	☐	☐	☐
Die Jagd respektiert nicht das Leben von Tieren.	☐	☐	☐	☐	☐	☐
Tiere sollten Rechte haben, die ähnlich den Rechten der Menschen sind.	☐	☐	☐	☐	☐	☐
Ich fühle mich Tieren stark emotional verbunden.	☐	☐	☐	☐	☐	☐
Es ist zulässig, dass Menschen wildlebende Tiere töten, wenn sie denken, dass die Tiere eine Gefahr für ihr Leben darstellen.	☐	☐	☐	☐	☐	☐
Menschen, die jagen wollen, sollte die Möglichkeit dazu gegeben werden.	☐	☐	☐	☐	☐	☐
Wildlebende Tiere sind wie meine Familie und ich möchte sie beschützen.	☐	☐	☐	☐	☐	☐
Es ist tragbar, dass Menschen wildlebende Tiere töten, wenn sie denken, dass die Tiere eine Bedrohung für ihren Besitz darstellen.	☐	☐	☐	☐	☐	☐

3363182040

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Es ist mir wichtig, neue Ideen zu entwickeln und kreativ zu sein. Ich mache Sachen gern auf meine eigene originelle Art und Weise.	☐	☐	☐	☐	☐	☐
Es ist mir wichtig, reich zu sein. Ich möchte viel Geld haben und teure Sachen besitzen.	☐	☐	☐	☐	☐	☐
Es ist mir wichtig, dass alle Menschen auf der Welt gleich behandelt werden. Jeder Mensch im Leben sollte gleiche Chancen haben.	☐	☐	☐	☐	☐	☐
Es ist mir wichtig, meine Fähigkeiten zu zeigen. Ich möchte, dass Leute bewundern, was ich tue.	☐	☐	☐	☐	☐	☐
Es ist mir wichtig, in einem sicheren Umfeld zu leben. Ich vermeide alles, was meine Sicherheit gefährden könnte.	☐	☐	☐	☐	☐	☐
Ich mag Überraschungen und halte immer Ausschau nach neuen Aktivitäten. Im Leben ist Abwechslung wichtig.	☐	☐	☐	☐	☐	☐
Ich glaube, dass die Menschen tun sollten, was man ihnen sagt und denke, dass Menschen sich immer an Regeln halten sollten, selbst dann, wenn es niemand sieht.	☐	☐	☐	☐	☐	☐
Es ist mir wichtig, Menschen zuzuhören, die anders sind als ich. Auch wenn ich anderer Meinung bin als andere, will ich sie trotzdem verstehen.	☐	☐	☐	☐	☐	☐
Es ist mir wichtig, zurückhaltend und bescheiden zu sein. Ich versuche, die Aufmerksamkeit nicht auf mich zu lenken.	☐	☐	☐	☐	☐	☐
Es ist mir wichtig, Spaß zu haben. Ich gönne mir selbst gern etwas.	☐	☐	☐	☐	☐	☐
Es ist mir wichtig, selbst zu entscheiden, was ich tue. Ich bin gern frei und unabhängig von anderen.	☐	☐	☐	☐	☐	☐
Es ist mir sehr wichtig, den Menschen um mir herum zu helfen. Ich will für deren Wohl sorgen.	☐	☐	☐	☐	☐	☐
Es ist mir wichtig, sehr erfolgreich zu sein. Ich hoffe, dass die Leute meine Leistungen anerkennen.	☐	☐	☐	☐	☐	☐
Es ist mir wichtig, dass der Staat meine persönliche Sicherheit vor allen Bedrohungen gewährleistet. Ich will einen starken Staat, der seine Bürger verteidigt.	☐	☐	☐	☐	☐	☐
Ich suche Abenteuer und gehe gern Risiken ein. Ich will ein aufregendes Leben haben.	☐	☐	☐	☐	☐	☐
Es ist mir wichtig, mich jederzeit korrekt zu verhalten. Ich vermeide es, Dinge zu tun, die andere Leute für falsch halten könnten.	☐	☐	☐	☐	☐	☐
Es ist mir wichtig, dass andere mich respektieren. Ich will, dass die Leute tun, was ich sage.	☐	☐	☐	☐	☐	☐
Es ist mir wichtig, meinen Freunden gegenüber loyal zu sein. Ich will mich für Menschen einsetzen, die mir nahe stehen.	☐	☐	☐	☐	☐	☐
Ich bin fest davon überzeugt, dass die Menschen sich um die Natur kümmern sollten. Umweltschutz ist mir wichtig.	☐	☐	☐	☐	☐	☐
Tradition ist mir wichtig. Ich versuche, mich an die Sitten und Gebräuche zu halten, die mir von meiner Religion und meiner Familie überliefert wurden.	☐	☐	☐	☐	☐	☐
Ich lasse keine Gelegenheit aus, Spaß zu haben. Es ist mir wichtig, Dinge zu tun, die mir Vergnügen bereiten.	☐	☐	☐	☐	☐	☐

5060182046

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Ich habe eine positive Einstellung zur Rückkehr der Wölfe nach Deutschland.	☐	☐	☐	☐	☐	☐
Es ist wichtig für Deutschland eine lebendige Population an Wölfen zu haben.	☐	☐	☐	☐	☐	☐
Es ist wichtig, dass Wölfe in Deutschland leben, egal, ob ich jemals einen Wolf zu sehen bekomme.	☐	☐	☐	☐	☐	☐
Wölfe sind ein Zeichen für eine intakte Natur.	☐	☐	☐	☐	☐	☐
Es gibt genug Wölfe in anderen Ländern, so dass es in Deutschland nicht auch noch welche geben muss.	☐	☐	☐	☐	☐	☐
Die Wolfpopulation in Deutschland sollte so hoch sein, dass Wölfe sich weiter ausbreiten können.	☐	☐	☐	☐	☐	☐
Wölfe sollten in Deutschland generell nicht gejagt werden.	☐	☐	☐	☐	☐	☐
Wenn Wölfe gejagt werden, sollte das Jagen in bestimmten Gebieten verboten werden.	☐	☐	☐	☐	☐	☐
Wölfe sollten in Deutschland das ganze Jahr gejagt werden dürfen.	☐	☐	☐	☐	☐	☐
Die Wolfpopulation sollte vergrößert werden.	☐	☐	☐	☐	☐	☐
Es gibt schon genug Wölfe in Deutschland.	☐	☐	☐	☐	☐	☐
Wölfe sollten nur in begrenzten Gebieten in Deutschland leben dürfen.	☐	☐	☐	☐	☐	☐
Wölfe sollten in Gebieten, in denen Konflikte mit Schafen bestehen, beseitigt werden.	☐	☐	☐	☐	☐	☐

Bitte kreuzen Sie an, inwiefern Sie zustimmen.		stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Wenn ich einem Wolf begegnen würde, wäre ich...							
	konzentriert.	☐	☐	☐	☐	☐	☐
	abgestoßen.	☐	☐	☐	☐	☐	☐
	entspannt.	☐	☐	☐	☐	☐	☐
	furchtsam.	☐	☐	☐	☐	☐	☐
	verärgert.	☐	☐	☐	☐	☐	☐
	angespannt.	☐	☐	☐	☐	☐	☐
	glücklich.	☐	☐	☐	☐	☐	☐
	verwundert.	☐	☐	☐	☐	☐	☐

9991182043

Fortsetzung: Emotionen zu Wölfen

	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
angeekelt.	☐	☐	☐	☐	☐	☐
gelassen.	☐	☐	☐	☐	☐	☐
gereizt.	☐	☐	☐	☐	☐	☐
interessiert.	☐	☐	☐	☐	☐	☐
verängstigt.	☐	☐	☐	☐	☐	☐
angewidert.	☐	☐	☐	☐	☐	☐
erfreut.	☐	☐	☐	☐	☐	☐
aufmerksam.	☐	☐	☐	☐	☐	☐
wütend.	☐	☐	☐	☐	☐	☐
überrascht.	☐	☐	☐	☐	☐	☐
zufrieden.	☐	☐	☐	☐	☐	☐
mutlos.	☐	☐	☐	☐	☐	☐
nervös.	☐	☐	☐	☐	☐	☐
erstaunt.	☐	☐	☐	☐	☐	☐
besorgt.	☐	☐	☐	☐	☐	☐
ruhig.	☐	☐	☐	☐	☐	☐

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Ich würde für Projekte Geld spenden, die die Rückkehr der Wölfe aktiv unterstützen.	☐	☐	☐	☐	☐	☐
Ich würde die Ansiedlung der Wölfe bei einer Abstimmung befürworten.	☐	☐	☐	☐	☐	☐
Ich würde für die Wiederansiedlung der Wölfe sofort meine Unterschrift geben.	☐	☐	☐	☐	☐	☐

5337182043

Die Bereitschaft die Rückkehr der Wölfe durch Bildung zu unterstützen

Im Kontext der Bildung für nachhaltige Entwicklung sollen Schülerinnen und Schüler lernen nachhaltig zu handeln und sich an gesellschaftlichen Entscheidungsprozessen zu beteiligen. Um diese Fähigkeiten und Fertigkeiten zu schulen eignen sich unter anderem kontroverse Themen, wie die Rückkehr der Wölfe nach Deutschland.

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Es wäre gut, wenn das Thema „Rückkehr der Wölfe nach Deutschland" im Biologieunterricht thematisiert wird.	☐	☐	☐	☐	☐	☐
Es wäre gut, wenn das Thema „Rückkehr der Wölfe nach Deutschland" in der Schule durch Bildung unterstützt wird.	☐	☐	☐	☐	☐	☐
Es wäre gut, wenn die Rückkehr der Wölfe nach Deutschland in der Schule im Zusammenhang einer Projektwoche thematisiert wird.	☐	☐	☐	☐	☐	☐
Das Thema „Rückkehr der Wölfe nach Deutschland" ist ein guter Kontext für die Schule.	☐	☐	☐	☐	☐	☐
Es wäre gut, wenn Schülerinnen und Schüler Wissen über den Wolf und seine Rückkehr nach Deutschland erlangen.	☐	☐	☐	☐	☐	☐
Die Mehrheit der Menschen denkt, dass es richtig wäre, die Rückkehr der Wölfe nach Deutschland im Biologieunterricht zu thematisieren.	☐	☐	☐	☐	☐	☐
Die Mehrheit der Menschen denkt, dass es richtig wäre, die Rückkehr der Wölfe nach Deutschland in der Schule zu thematisieren.	☐	☐	☐	☐	☐	☐
Die Mehrheit der Menschen denkt, dass es richtig wäre, die Rückkehr der Wölfe nach Deutschland in einer Projektwoche zu thematisieren.	☐	☐	☐	☐	☐	☐
Das Thema „Die Rückkehr der Wölfe nach Deutschland" ist zu komplex, um es im Biologieunterricht zu thematisieren.	☐	☐	☐	☐	☐	☐
Ich habe bisher zu wenig Wissen und Informationen zu dem Thema, um es in der Schule zu thematisieren.	☐	☐	☐	☐	☐	☐
Das Thema „Die Rückkehr der Wölfe nach Deutschland" ist zu kontrovers, um es im Biologieunterricht zu thematisieren.	☐	☐	☐	☐	☐	☐
Ich wüsste nicht, wie man das Thema „Die Rückkehr der Wölfe nach Deutschland" im Unterricht umsetzen sollte.	☐	☐	☐	☐	☐	☐
In meinem Biologieunterricht habe ich zu wenig Zeit, um die Rückkehr der Wölfe zu thematisieren	☐	☐	☐	☐	☐	☐

1875182046

Die Rückkehr der Wölfe ist ein gesellschaftlich heikles Thema. Lehrerinnen und Lehrer der Naturwissenschaften finden es manchmal schwierig, heikle Themen in den Unterricht aufzunehmen. Andere hingegen sehen kontroverse Themen im Naturwissenschaftsunterricht deutlich positiver. Wie stehen Sie dazu?

Wenn ich mir vorstelle das Thema "Die Rückkehr der Wölfe" im Biologieunterricht zu unterrichten, würde ich mich ... fühlen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
zufrieden	☐	☐	☐	☐	☐	☐
verärgert	☐	☐	☐	☐	☐	☐
gereizt	☐	☐	☐	☐	☐	☐
angespannt	☐	☐	☐	☐	☐	☐
verlegen	☐	☐	☐	☐	☐	☐
interessiert	☐	☐	☐	☐	☐	☐
glücklich	☐	☐	☐	☐	☐	☐
selbstsicher	☐	☐	☐	☐	☐	☐
wütend	☐	☐	☐	☐	☐	☐
besorgt	☐	☐	☐	☐	☐	☐
schuldig	☐	☐	☐	☐	☐	☐
konzentriert	☐	☐	☐	☐	☐	☐
beschämt	☐	☐	☐	☐	☐	☐
aufmerksam	☐	☐	☐	☐	☐	☐
erfreut	☐	☐	☐	☐	☐	☐
stolz	☐	☐	☐	☐	☐	☐
selbstbewusst	☐	☐	☐	☐	☐	☐
ängstlich	☐	☐	☐	☐	☐	☐

4264182041

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Ich könnte mich in meinem zukünftigen Biologieunterricht dafür entscheiden die Rückkehr der Wölfe nach Deutschland zu thematisieren.	☐	☐	☐	☐	☐	☐
Ich hätte die Möglichkeit die Rückkehr der Wölfe nach Deutschland an meiner zukünftigen Schule zu thematisieren.	☐	☐	☐	☐	☐	☐
Ich hätte die Möglichkeit die Rückkehr der Wölfe nach Deutschland in einer zukünftigen Projektwoche zu thematisieren.	☐	☐	☐	☐	☐	☐
Ich wünsche mir die Rückkehr der Wölfe nach Deutschland im Biologieunterricht thematisieren zu können.	☐	☐	☐	☐	☐	☐
Ich wünsche mir die Rückkehr der Wölfe nach Deutschland in der Schule thematisieren zu können.	☐	☐	☐	☐	☐	☐
Ich wünsche mir die Rückkehr der Wölfe nach Deutschland in einer Projektwoche thematisieren zu können.	☐	☐	☐	☐	☐	☐
Ich plane zukünftig in meine Biologieunterricht die Rückkehr der Wölfe nach Deutschland zu thematisieren.	☐	☐	☐	☐	☐	☐
Ich plane zukünftig die Rückkehr der Wölfe nach Deutschland in der Schule zu thematisieren.	☐	☐	☐	☐	☐	☐
Ich plane zukünftig die Rückkehr der Wölfe nach Deutschland in einer Projektwoche zu thematisieren.	☐	☐	☐	☐	☐	☐

Bitte kreuzen Sie die Aktualität an.	nie	vor langer Zeit	vor kurzer Zeit
Ich habe die Rückkehr der Wölfe nach Deutschland im Biologieunterricht thematisiert.	☐	☐	☐
Ich habe die Rückkehr der Wölfe nach Deutschland in der Schule thematisiert.	☐	☐	☐
Ich habe die Rückkehr der Wölfe nach Deutschland in einer Projektwoche thematisiert.	☐	☐	☐

Bitte kreuzen Sie die Häufigkeit an.	noch nie	selten	gelegentlich	häufig	sehr häufig
Wie oft haben Sie die Rückkehr der Wölfe nach Deutschland im Biologieunterricht thematisiert?	☐	☐	☐	☐	☐
Wie oft haben Sie die Rückkehr der Wölfe nach Deutschland in der Schule thematisiert?	☐	☐	☐	☐	☐
Wie oft haben Sie die Rückkehr der Wölfe nach Deutschland in einer Projektwoche thematisiert?	☐	☐	☐	☐	☐

Questionnaire study 2

6464644868

Queridos estudiantes,

El cuestionario que están a punto de completar aporta a mi tesis del máster, que trata sobre la conservación de los osos andinos. ¡Muchas gracias por ayudarme!

Es importante que conteste estas preguntas de forma honesta debido a que estamos interesados en su opinión personal. No hay respuestas falsas ni correctas. La encuesta es anónima, no tiene que dar su nombre y los datos son confidenciales, es decir la información que consigamos no será divulgada. Además sus profesores no tienen acceso a los datos.

Por favor, responda las siguientes preguntas en orden y de forma espontánea. Además tenga presente que solamente se puede elegir una sola respuesta. Si se da cuenta que ha cometido un error, por favor pinte toda la casilla y después marca la casilla correcta. Como se explica en el gráfico siguiente:

Totalmente en desacuerdo	Desacuerdo	Algo en desacuerdo	Algo de acuerdo	Acuerdo	Totalmente de acuerdo
☐	☒	☐	■	☐	☐
	casilla correcta		casilla falsa		

Por favor, utiliza un esfero para completar el cuestionario.

¡Muchas gracias por su colaboración!

Si tiene alguna pregunta por favor contáctenos vía e-mail:

Alexander Büssing: alexander.buessing@uni-osnabrueck.de

Annelene Thielking: athielking@uni-osnabrueck.de

¡Muchas gracias por su participación!

Universidad de Osnabrück
FB 05 Biología/Química
Departamento Didáctica de Biología
Prof. Dr. Susanne Menzel-Riedl
Barbarastraße 11, 49076 Osnabrück
www.biologiedidaktik.uni-osnabrueck.de

9384644862

Sexo: ☐ femenino ☐ masculino Edad: _____ años

Asignatura: _____

¿Dónde creció usted?

☐ Solo en la ciudad. ☐ La mayoría del tiempo en la ciudad. ☐ Tanto en la ciudad como en el campo. ☐ La mayoría del tiempo en el campo. ☐ Solo en el campo.

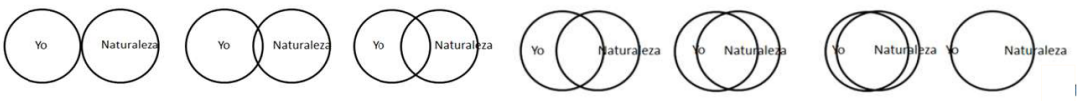
Tengo una mascota. ☐ Sí ☐ No ☐ En el pasado

Mi familia tiene una mascota: ☐ Sí ☐ No ☐ En el pasado

Soy cazador/a ☐ Sí ☐ No

Alguno de mis conocidos es cazador/a: ☐ Sí ☐ No

Por favor, marque la imagen que se caracteriza mejor. ¿En qué medida está conectado/a con la naturaleza?



1. ☐ 2. ☐ 3. ☐ 4. ☐ 5. ☐ 6. ☐ 7. ☐

	Totalmente en desacuerdo	Desacuerdo	Algo en desacuerdo	Algo de acuerdo	Acuerdo	Totalmente de acuerdo
En general, las creencias religiosas y espirituales son importantes en mi vida cotidiana.	☐	☐	☐	☐	☐	☐
Cuando tengo dificultades o problemas en mi vida laboral, familiar o privada frecuentemente busco apoyo y estabilidad espiritual.	☐	☐	☐	☐	☐	☐
La mayor parte del tiempo me siento cerca de Dios.	☐	☐	☐	☐	☐	☐
Me considero una persona religiosa.	☐	☐	☐	☐	☐	☐
Personalmente me siento afectado/a por la pérdida de biodiversidad.	☐	☐	☐	☐	☐	☐
En mi entorno geográfico me siento afectado/a por la pérdida de biodiversidad.	☐	☐	☐	☐	☐	☐
En un futuro próximo me sentiré afectado/a por la pérdida de biodiversidad.	☐	☐	☐	☐	☐	☐
La pérdida de biodiversidad es muy probable.	☐	☐	☐	☐	☐	☐

1738644867

	Totalmente en desacuerdo	Desacuerdo	Algo en desacuerdo	Algo de acuerdo	Acuerdo	Totalmente de acuerdo
Sin importar que esté en la naturaleza para ver animales salvajes o no, para mí es importante saber que todavía existen en Ecuador.	☐	☐	☐	☐	☐	☐
Valoro el sentido de compañerismo que recibo de los animales.	☐	☐	☐	☐	☐	☐
Es aceptable que las personas maten a los animales salvajes, si piensan que presentan una amenaza para su vida.	☐	☐	☐	☐	☐	☐
Considero a todos los seres vivos como parte de una gran familia.	☐	☐	☐	☐	☐	☐
Cada día percibo la existencia de aves y animales salvajes en mi entorno.	☐	☐	☐	☐	☐	☐
Para mi es importante saber que poblaciones de animales salvajes sean manejadas para generaciones siguientes.	☐	☐	☐	☐	☐	☐
Nos debemos esforzar por un mundo en el que exista una gran cantidad de animales salvajes para la caza.	☐	☐	☐	☐	☐	☐
Las necesidades humanas deberían tener prioridad sobre animales salvajes.	☐	☐	☐	☐	☐	☐
Todos los animales deberían tener derechos similares a los derechos de los seres humanos.	☐	☐	☐	☐	☐	☐
Las personas que quieren cazar deben tener la oportunidad para hacerlo.	☐	☐	☐	☐	☐	☐
Sería más grátificante ayudar a los animales en lugar que a las personas.	☐	☐	☐	☐	☐	☐
La existencia de animales salvajes en mi entorno cercano es importante para mí.	☐	☐	☐	☐	☐	☐
Nos debemos esforzar por un mundo en el que los seres humanos puedan convivir juntos con los animales salvajes sin temor.	☐	☐	☐	☐	☐	☐
La caza no respeta la vida de los animales.	☐	☐	☐	☐	☐	☐
Los animales salvajes son como mi familia y quiero protegerlos.	☐	☐	☐	☐	☐	☐
Los animales salvajes están en la tierra principalmente para el uso de los seres humanos.	☐	☐	☐	☐	☐	☐
Siento una fuerte vinculación afectiva con los animales.	☐	☐	☐	☐	☐	☐
La caza es cruel e inhumana para los animales.	☐	☐	☐	☐	☐	☐
Una gran parte de mi entorno residencial es habitada por animales salvajes los cuales veo de vez en cuando.	☐	☐	☐	☐	☐	☐

9312644863

	Totalmente en desacuerdo	Desacuerdo	Algo en desacuerdo	Algo de acuerdo	Acuerdo	Totalmente de acuerdo
Me preocupo por los animales tanto como por cualquier otra persona.	☐	☐	☐	☐	☐	☐
Es aceptable que las personas utilicen los animales salvajes en la investigación, incluso si puede dañar o matar algunos animales.	☐	☐	☐	☐	☐	☐
Para mí es importante saber que todavía existen poblaciones de animales salvajes en Ecuador.	☐	☐	☐	☐	☐	☐
Los seres humanos deben manejar poblaciones de animales salvajes, de manera que ellos se beneficien.	☐	☐	☐	☐	☐	☐
Es aceptable que las personas maten a los animales salvajes, si piensan que presenta una amenaza para sus propiedades.	☐	☐	☐	☐	☐	☐
Recibo gran consuelo de las relaciones que tengo con los animales.	☐	☐	☐	☐	☐	☐

El oso andino también conocido como oso de anteojos (*Tremarctos ornatus*), está en peligro de extinción por razones como la expansión de la frontera agropecuaria y la acusada pérdida y fragmentación de su hábitat. Además la cacería representa una amenaza para el oso andino.

Es un carnivoro aunque se alimenta principalmente de plantas. A veces come también ganado, lo cual provoca un conflicto con la población residente.

	Totalmente en desacuerdo	Desacuerdo	Algo en desacuerdo	Algo de acuerdo	Acuerdo	Totalmente de acuerdo
Es importante conservar la existencia del oso andino en Ecuador, para que nuestros hijos puedan disfrutarlos.	☐	☐	☐	☐	☐	☐
El oso andino es un signo de una naturaleza intacta.	☐	☐	☐	☐	☐	☐
Sin importar que vea un oso andino o no, es importante para mí que todavía existan en Ecuador.	☐	☐	☐	☐	☐	☐
Ya que existen osos andinos en otras partes de América Latina, no importa que existan en Ecuador.	☐	☐	☐	☐	☐	☐
La existencia del oso andino en Ecuador es positiva.	☐	☐	☐	☐	☐	☐
Es importante tener una población viable de osos andinos en Ecuador.	☐	☐	☐	☐	☐	☐

2521644868

Si encontrara un oso andino en el páramo, me sentiría...	Totalmente en desacuerdo	Desacuerdo	Algo en desacuerdo	Algo de acuerdo	Acuerdo	Totalmente de acuerdo
feliz.	☐	☐	☐	☐	☐	☐
tenso/a.	☐	☐	☐	☐	☐	☐
tranquilo/a.	☐	☐	☐	☐	☐	☐
nervioso/a.	☐	☐	☐	☐	☐	☐
miedoso/a.	☐	☐	☐	☐	☐	☐
enfadado/a.	☐	☐	☐	☐	☐	☐
satisfecho/a.	☐	☐	☐	☐	☐	☐
irritado/a.	☐	☐	☐	☐	☐	☐
deleitado/a.	☐	☐	☐	☐	☐	☐
preocupado/a.	☐	☐	☐	☐	☐	☐
relajado/a.	☐	☐	☐	☐	☐	☐
sereno/a.	☐	☐	☐	☐	☐	☐
intimidado/a.	☐	☐	☐	☐	☐	☐
desanimado/a.	☐	☐	☐	☐	☐	☐
enojado/a.	☐	☐	☐	☐	☐	☐

Ahora siguen preguntas relacionadas con la conservación del oso andino.

Pienso que <u>la conservación del oso andino</u> es una actitud...	Totalmente en desacuerdo	Desacuerdo	Algo en desacuerdo	Algo de acuerdo	Acuerdo	Totalmente de acuerdo
positiva.	☐	☐	☐	☐	☐	☐
valiosa.	☐	☐	☐	☐	☐	☐
útil.	☐	☐	☐	☐	☐	☐
necesaria.	☐	☐	☐	☐	☐	☐

Si apoyara a <u>la conservación del oso andino</u>, la mayoría de las personas importantes para mi...	Totalmente en desacuerdo	Desacuerdo	Algo en desacuerdo	Algo de acuerdo	Acuerdo	Totalmente de acuerdo
estaría de acuerdo.	☐	☐	☐	☐	☐	☐
me apoyaría.	☐	☐	☐	☐	☐	☐
lo entendería.	☐	☐	☐	☐	☐	☐
me lo recomendaría.	☐	☐	☐	☐	☐	☐

6434644865

Si apoyara a <u>la conservación del oso andino</u>, me sentiría...	Totalmente en desacuerdo	Desacuerdo	Algo en desacuerdo	Algo de acuerdo	Acuerdo	Totalmente de acuerdo
feliz.	☐	☐	☐	☐	☐	☐
melancólico/a.	☐	☐	☐	☐	☐	☐
interesado/a.	☐	☐	☐	☐	☐	☐
enfadado/a.	☐	☐	☐	☐	☐	☐
irritado/a.	☐	☐	☐	☐	☐	☐
desconsolado/a.	☐	☐	☐	☐	☐	☐
satisfecho/a.	☐	☐	☐	☐	☐	☐
enojado/a.	☐	☐	☐	☐	☐	☐
preocupado/a.	☐	☐	☐	☐	☐	☐
miedoso/a.	☐	☐	☐	☐	☐	☐
intimidado/a.	☐	☐	☐	☐	☐	☐
desalentado/a.	☐	☐	☐	☐	☐	☐
deleitado/a.	☐	☐	☐	☐	☐	☐
tenso/a.	☐	☐	☐	☐	☐	☐
desanimado/a.	☐	☐	☐	☐	☐	☐
concentrado/a.	☐	☐	☐	☐	☐	☐
nervioso/a.	☐	☐	☐	☐	☐	☐
atento/a.	☐	☐	☐	☐	☐	☐

	Totalmente en desacuerdo	Desacuerdo	Algo en desacuerdo	Algo de acuerdo	Acuerdo	Totalmente de acuerdo
Estoy seguro que si quiero apoyar a la conservación del oso andino, lo puedo hacer.	☐	☐	☐	☐	☐	☐
Tengo los suficientes recursos económicos para apoyar a la conservación del oso andino.	☐	☐	☐	☐	☐	☐
Soy capaz de apoyar a la conservación del oso andino.	☐	☐	☐	☐	☐	☐
Tengo el suficiente tiempo para apoyar a la conservación del oso andino.	☐	☐	☐	☐	☐	☐

7549644863

Hoy en día ya hay algunas organizaciones que luchan por la conservación del oso andino, como la "Fundación Oso Andino" en Ecuador. Su objetivo es salvar al oso andino de la extinción a través de actividades de investigación, educación, conservación y prevención de conflictos. Es una fundación pequeña y no recibe fondos del estado. Por eso depende de voluntarios y donaciones para continuar con su trabajo. Además muchas organizaciones ya están presentes en redes sociales como Facebook, Instagram o Twitter, en que se puede darle me gusta.
A continuación, por favor responde las siguientes preguntas.

	Totalmente en desacuerdo	Desacuerdo	Algo en desacuerdo	Algo de acuerdo	Acuerdo	Totalmente de acuerdo
Me gustaría hacer un voluntariado para ayudar a organizaciones como la "Fundación Oso Andino".	☐	☐	☐	☐	☐	☐
Deseo donar para la conservación del oso andino.	☐	☐	☐	☐	☐	☐
Deseo darle me gusta por medio de redes sociales a organizaciones que conservan al oso andino.	☐	☐	☐	☐	☐	☐
Tengo un impulso de hacer un voluntariado para ayudar a organizaciones como la "Fundación Oso Andino".	☐	☐	☐	☐	☐	☐
Me gustaría darle me gusta por medio de redes sociales a organizaciones que conservan al oso andino.	☐	☐	☐	☐	☐	☐
Quiero donar para la conservación del oso andino.	☐	☐	☐	☐	☐	☐
Deseo hacer un voluntariado para ayudar a organizaciones como la "Fundación Oso Andino".	☐	☐	☐	☐	☐	☐
Quiero darle me gusta por medio de redes sociales a organizaciones que conservan al oso andino.	☐	☐	☐	☐	☐	☐
Me gustaría donar para la conservación del oso andino.	☐	☐	☐	☐	☐	☐
Tengo un impulso de darle me gusta por medio de redes sociales a organizaciones que conservan al oso andino.	☐	☐	☐	☐	☐	☐
Quiero hacer un voluntariado para apoyar a organizaciones como la "Fundación Oso Andino".	☐	☐	☐	☐	☐	☐
Tengo un impulso de donar para la conservación del oso andino.	☐	☐	☐	☐	☐	☐

8217644866

	Totalmente en desacuerdo	Desacuerdo	Algo en desacuerdo	Algo de acuerdo	Acuerdo	Totalmente de acuerdo
Estoy pensando en donar para la conservación del oso andino.	☐	☐	☐	☐	☐	☐
Me esfuerzo por darle me gusta por medio de redes sociales a organizaciones que conservan al oso andino.	☐	☐	☐	☐	☐	☐
Estoy dispuesto/a a darle me gusta por medio de redes sociales a organizaciones que conservan al oso andino.	☐	☐	☐	☐	☐	☐
Tengo la intención de hacer un voluntariado para apoyar a fundaciones como la "Fundación Oso Andino".	☐	☐	☐	☐	☐	☐
Estoy dispuesto/a a donar para la conservación del oso andino.	☐	☐	☐	☐	☐	☐
Estoy pensando en darle me gusta por medio de redes sociales a organizaciones que conservan al oso andino.	☐	☐	☐	☐	☐	☐
Me esfuerzo por donar para la conservación del oso andino.	☐	☐	☐	☐	☐	☐
Estoy dispuesto/a a hacer un voluntariado para apoyar a fundaciones como la "Fundación Oso Andino".	☐	☐	☐	☐	☐	☐
Tengo la intención de donar para la conservación del oso andino.	☐	☐	☐	☐	☐	☐
Me esfuerzo por hacer un voluntariado para apoyar a fundaciones como la "Fundación Oso Andino".	☐	☐	☐	☐	☐	☐
Tengo la intención de darle me gusta por medio de redes sociales a organizaciones que conservan al oso andino.	☐	☐	☐	☐	☐	☐
Estoy pensando en hacer un voluntariado para apoyar a organizaciones como la "Fundación Oso Andino".	☐	☐	☐	☐	☐	☐

¿Cuantas veces usted ya ha...	Nunca	Raramente	A veces	Frecuente	Muy frecuente
donado para la conservación del oso andino?	☐	☐	☐	☐	☐
hecho un voluntariado para apoyar a fundaciones como la "Fundación Oso Andino"?	☐	☐	☐	☐	☐
dado me gusta por medio de redes sociales a organizaciones que conservan al oso andino?	☐	☐	☐	☐	☐

¡Muchas gracias!

8

Questionnaire study 3

0311649903

Ein paar Daten für die Statistik

Geschlecht: ☐ M ☐ W Ich bin _____ Jahre alt.

Ich studiere im Bachelor ☐ Master ☐ Hochschulsemester _____

für das Lehramt an:
Grundschule ☐ Hauptschule ☐ Realschule ☐ Gymnasium ☐ Gesamtschule ☐ Berufsschule ☐

Mein Zweitfach ist _____ Mein Drittfach ist _____

	nur auf dem Land	eher auf dem Land	in der Stadt und auf dem Land	eher in der Stadt	nur in der Stadt	
Ich bin	☐	☐	☐	☐	☐	aufgewachsen.
Ich wohne aktuell	☐	☐	☐	☐	☐	

Die ersten beiden Ziffern der Postleitzahl meines aktuellen Wohnortes: _____

Ich bin Jäger/in. Ja ☐ Nein ☐

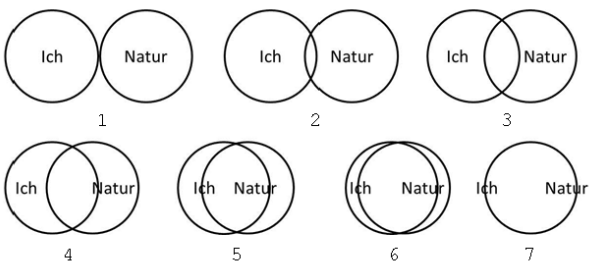
Jemand aus meinem persönlichen Umfeld ist Jäger/in. Ja ☐ Nein ☐

Ich besitze ein Haustier. ☐ Ja ☐ Nein ☐ in der Vergangenheit

Meine Familie besitzt ein Haustier. ☐ Ja ☐ Nein ☐ in der Vergangenheit

Verbindung zur Natur

Bitte kreuzen Sie das Kästchen mit der Nummer der Abbildung an, die Ihre Beziehung zur Natur am besten beschreibt.
Wie verbunden sind Sie mit der Natur?



☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

3653649905

Was ist Ihnen im Leben wichtig?

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Es ist mir wichtig, dass alle Menschen auf der Welt gleichbehandelt werden. Jeder Mensch sollte im Leben die gleichen Chancen haben.	☐	☐	☐	☐	☐	☐
Ich glaube, dass die Völker der Welt in Harmonie zusammenleben sollten. Es ist mir wichtig, den Frieden zwischen allen Gruppen der Welt zu fördern.	☐	☐	☐	☐	☐	☐
Es ist mir wichtig, mich der Natur anzupassen und zu ihr zu passen. Ich glaube, dass die Menschen die Natur nicht verändern sollten.	☐	☐	☐	☐	☐	☐
Mir ist es wichtig, auf die Bedürfnisse der Anderen einzugehen. Ich bemühe mich, die Menschen, die ich kenne, zu unterstützen.	☐	☐	☐	☐	☐	☐
Es ist mir wichtig, den Menschen zuzuhören, die anders sind als ich. Auch wenn ich anderer Meinung bin als andere, will ich sie trotzdem verstehen.	☐	☐	☐	☐	☐	☐
Ich bin fest davon überzeugt, dass die Menschen sich um die Natur kümmern sollten. Umweltschutz ist mir wichtig.	☐	☐	☐	☐	☐	☐
Mir ist es sehr wichtig, den Menschen in meinem Umfeld zu helfen. Ich möchte mich um ihr Wohlbefinden kümmern.	☐	☐	☐	☐	☐	☐
Mir ist es wichtig, Menschen zu verzeihen, die mich verletzt haben. Ich versuche, in Ihnen das Gute zu sehen und nicht nachtragend zu sein.	☐	☐	☐	☐	☐	☐
Mir ist es wichtig, meinen Freunden treu zu sein. Ich möchte mich den Menschen, die mir nahestehen, widmen.	☐	☐	☐	☐	☐	☐
Ich möchte, dass jeder gerecht behandelt wird, sogar Leute, die ich nicht kenne. Es ist mir wichtig, die Schwachen in der Gesellschaft zu beschützen.	☐	☐	☐	☐	☐	☐

6506649905

Ein paar Definitionen

Im Biologieunterricht besteht die Möglichkeit kontroverse Themen zu behandeln, die sich auf biologische Sachverhalte beziehen. Diese Themen werden meistens in der Gesellschaft kritisch diskutiert, und behandeln sowohl wissenschaftliche als auch gesellschaftliche Aspekte. In der Forschung werden solche Themen als ***Socio-scientific Issues (SSI)*** bezeichnet.

Einige dieser kontroversen Themen können als Themen einer ***Bildung für Nachhaltige Entwicklung (BNE)*** bezeichnet werden. Bei der Anwendung sollen sowohl die ökologischen, als auch ökonomischen und sozialen Aspekte behandelt werden.

Hierunter können beispielsweise folgende Aspekte fallen:

1) Ökologisch
- Biodiversität
- Belastbarkeit von Ökosystemen

2) Ökonomisch
- Minimierung des Einsatzes von Energie
- Internalisierung externer Kosten (Umweltkosten)

3) Sozial
- Individuelle, kollektive und globale Verantwortung für umwelt- und entwicklungsbezogenes Handeln
- Überschaubarkeit der Prozesse zur Umsteuerung der Gesellschaft

Auf den folgenden Seiten würden wir gerne von Ihnen wissen, wie Sie drei beispielhafte SSIs für den Biologieunterricht bewerten.

Vorab jedoch noch zwei allgemeine Fragen zu SSIs:

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	sehr schwierig	schwierig	eher schwierig	eher einfach	einfach	sehr einfach
Die Bewertung von Schülerleistungen im Biologieunterricht beim Unterrichten SSIs empfinde ich als ...	☐	☐	☐	☐	☐	☐

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
SSIs sollten im Biologieunterricht behandelt werden.	☐	☐	☐	☐	☐	☐

Viel Spaß!

9415649907

Die Rückkehr des Wolfes

Der Wolf war ursprünglich in ganz Europa verbreitet. In weiten Teilen seines ursprünglichen Verbreitungsgebietes wurde die Art aber durch menschliche Einflüsse vertrieben. Seit einigen Jahren nehmen die Wolfsbestände in Europa wieder zu. In Deutschland siedelten sich erste Rudel im Jahr 2000/2001 in Sachsen an, und aktuell verbreiten sich Wölfe auch in anderen Bundesländern. In einigen Bundesländern gibt es aufgrund des hohen Anteils an Landwirtschaft und Viehzucht ein gesteigertes Konfliktpotenzial. Die Entscheidung, wie mit den Wölfen in Deutschland verfahren werden soll, ist eine offene Diskussion, weshalb sich das Thema als ein möglicher SSI für den Biologieunterricht eignet.

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Das Thema *Die Rückkehr des Wolfes* ist im Biologieunterricht neu für mich.	☐	☐	☐	☐	☐	☐
Mein Informationsstand zum Thema *Die Rückkehr des Wolfes* ist hoch.	☐	☐	☐	☐	☐	☐
Woher stammen Ihre Informationen zum Thema Die Rückkehr des Wolfes?						
Print- und Online-Medien (z.B. Zeitschriften, Zeitungen, etc.)	☐	☐	☐	☐	☐	☐
Bücher	☐	☐	☐	☐	☐	☐
Schule	☐	☐	☐	☐	☐	☐
Umfeld	☐	☐	☐	☐	☐	☐
Filme und Dokumentationen	☐	☐	☐	☐	☐	☐

Weitere Informationen habe ich aus folgenden Quellen:

_____

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Ich bin persönlich von der *Rückkehr der Wölfe* betroffen.	☐	☐	☐	☐	☐	☐
Ich bin in meinem geographischen Umfeld von der *Rückkehr der Wölfe* betroffen.	☐	☐	☐	☐	☐	☐
Ich bin in nächster Zeit von der *Rückkehr der Wölfe* betroffen.	☐	☐	☐	☐	☐	☐
Die Rückkehr der Wölfe ist sehr wahrscheinlich.	☐	☐	☐	☐	☐	☐
Das Thema *Die Rückkehr des Wolfes* wurde in meiner eigenen Schulzeit behandelt.	☐	☐	☐	☐	☐	☐

Wie geeignet erscheint Ihnen das Thema *Die Rückkehr des Wolfes* um die drei Dimensionen einer Bildung für Nachhaltige Entwicklung (BNE) im Unterricht umzusetzen?

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Ökologisch	☐	☐	☐	☐	☐	☐
Ökonomisch	☐	☐	☐	☐	☐	☐
Sozial	☐	☐	☐	☐	☐	☐

4292649905

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	sehr unemotional	unemotional	eher unemotional	eher emotional	emotional	sehr emotional
Wie emotional schätzen Sie das Thema *Die Rückkehr des Wolfes* im Biologieunterricht generell ein?	☐	☐	☐	☐	☐	☐

Wenn Sie an Ihre zukünftige Zeit als Lehrerin oder Lehrer denken, inwiefern würden Sie folgenden Aussagen zustimmen?

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Die Rückkehr des Wolfes ist ein wichtiges Thema für den Biologieunterricht.	☐	☐	☐	☐	☐	☐
Im Allgemeinen macht mir das Unterrichten des Themas *Die Rückkehr des Wolfes* Freude.	☐	☐	☐	☐	☐	☐
Ich würde gerne das Thema *Die Rückkehr des Wolfes* im Biologieunterricht thematisieren.	☐	☐	☐	☐	☐	☐
Das Thema *Die Rückkehr des Wolfes* ist für die Schule, bzw. den Unterricht geeignet.	☐	☐	☐	☐	☐	☐
Ich besitze genügend Informationen zur *Rückkehr des Wolfes* um das Thema zu unterrichten.	☐	☐	☐	☐	☐	☐
Während des Unterrichtens des Themas *Die Rückkehr des Wolfes* habe ich oft Grund mich zu freuen.	☐	☐	☐	☐	☐	☐
Ich denke daran das Thema *Die Rückkehr des Wolfes* im Biologieunterricht zu thematisieren.	☐	☐	☐	☐	☐	☐
Im Allgemeinen macht mir das Unterrichten des Themas *Die Rückkehr des Wolfes* so viel Spaß, dass ich den Unterricht gerne vorbereite und durchführe.	☐	☐	☐	☐	☐	☐
Es wäre gut, wenn Schülerinnen und Schülern im Biologieunterricht Wissen über den Wolf und seine Rückkehr erlangen.	☐	☐	☐	☐	☐	☐
Ich weiß, wie ich das Thema *Die Rückkehr des Wolfes* im Biologieunterricht methodisch umsetzen könnte.	☐	☐	☐	☐	☐	☐
Ich möchte das Thema *Die Rückkehr des Wolfes* im Biologieunterricht thematisieren.	☐	☐	☐	☐	☐	☐
Im Allgemeinen unterrichte ich das Thema *Die Rückkehr des Wolfes* mit Begeisterung.	☐	☐	☐	☐	☐	☐
Ich habe genügend Zeit um das Thema *Die Rückkehr des Wolfes* in meinem Biologieunterricht zu unterrichten.	☐	☐	☐	☐	☐	☐
Ich weiß, wie ich mit meiner eigenen Meinung während dem Unterrichten des Themas *Die Rückkehr des Wolfes* umgehen kann.	☐	☐	☐	☐	☐	☐
Die Rückkehr des Wolfes ist ein spannendes Thema für die Schülerinnen und Schüler im Biologieunterricht.	☐	☐	☐	☐	☐	☐
Ich bin dazu bereit das Thema *Die Rückkehr des Wolfes* im Biologieunterricht zu thematisieren.	☐	☐	☐	☐	☐	☐

5873649901

Die Klimaerwärmung

Als Klimaerwärmung wird die globale Erhöhung der Durchschnittstemperatur der Erde bezeichnet und sie ist ein wichtiges Umweltproblem der internationalen Gemeinschaft. Diese wird zum Beispiel durch einen erhöhten Ausstoß klimawirksamer Gase ausgelöst. Das Vorhandensein des Klimawandels wird von einigen Menschen infrage gestellt, da ähnliche Veränderungen des globalen Klimas in der Geschichte der Erde häufiger beobachtet wurden. Da die Debatte um die Klimaerwärmung nicht durch wissenschaftliche Erkenntnis allein gelöst werden kann, ist sie ein möglicher SSI für den Biologieunterricht.

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Das Thema *Klimaerwärmung* ist im Biologieunterricht neu für mich.	☐	☐	☐	☐	☐	☐
Mein Informationsstand zum Thema *Klimaerwärmung* ist hoch.	☐	☐	☐	☐	☐	☐
Woher stammen Ihre Informationen zum Thema *Klimaerwärmung*?						
Print- und Online-Medien (z.B. Zeitschriften, Zeitungen, etc.)	☐	☐	☐	☐	☐	☐
Bücher	☐	☐	☐	☐	☐	☐
Schule	☐	☐	☐	☐	☐	☐
Umfeld	☐	☐	☐	☐	☐	☐
Filme und Dokumentationen	☐	☐	☐	☐	☐	☐

Weitere Informationen habe ich aus folgenden Quellen:

_____

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Ich bin persönlich von der *Klimaerwärmung* betroffen.	☐	☐	☐	☐	☐	☐
Ich bin in meinem geographischen Umfeld von der *Klimaerwärmung* betroffen.	☐	☐	☐	☐	☐	☐
Ich bin in nächster Zeit von der *Klimaerwärmung* betroffen.	☐	☐	☐	☐	☐	☐
Die *Klimaerwärmung* ist sehr wahrscheinlich.	☐	☐	☐	☐	☐	☐
Das Thema *Klimaerwärmung* wurde in meiner eigenen Schulzeit behandelt.	☐	☐	☐	☐	☐	☐

Wie geeignet erscheint Ihnen das Thema *Klimaerwärmung* um die drei Dimensionen einer Bildung für Nachhaltige Entwicklung (BNE) im Unterricht umzusetzen?

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Ökologisch	☐	☐	☐	☐	☐	☐
Ökonomisch	☐	☐	☐	☐	☐	☐
Sozial	☐	☐	☐	☐	☐	☐

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Bitte kreuzen Sie an, inwiefern Sie zustimmen.	sehr unemotional	unemotional	eher unemotional	eher emotional	emotional	sehr emotional
Wie emotional schätzen Sie das Thema *Klimaerwärmung* im Biologieunterricht generell ein?	☐	☐	☐	☐	☐	☐

Wenn Sie an Ihre zukünftige Zeit als Lehrerin oder Lehrer denken, inwiefern würden Sie folgenden Aussagen zustimmen?

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Im Allgemeinen macht mir das Unterrichten des Themas *Klimaerwärmung* Freude.	☐	☐	☐	☐	☐	☐
Ich besitze genügend Informationen zur *Klimaerwärmung* um das Thema zu unterrichten.	☐	☐	☐	☐	☐	☐
Während des Unterrichtens des Themas *Klimaerwärmung* habe ich oft Grund mich zu freuen.	☐	☐	☐	☐	☐	☐
Ich möchte das Thema *Klimaerwärmung* im Biologieunterricht thematisieren.	☐	☐	☐	☐	☐	☐
Es wäre gut, wenn Schülerinnen und Schülern im Biologieunterricht Wissen über die *Klimaerwärmung* erlangen.	☐	☐	☐	☐	☐	☐
Ich bin dazu bereit das Thema *Klimaerwärmung* im Biologieunterricht zu thematisieren.	☐	☐	☐	☐	☐	☐
Ich habe genügend Zeit um das Thema *Die Klimaerwärmung* in meinem Biologieunterricht zu unterrichten.	☐	☐	☐	☐	☐	☐
Im Allgemeinen macht mir das Unterrichten des Themas *Klimaerwärmung* so viel Spaß, dass ich den Unterricht gerne vorbereite und durchführe.	☐	☐	☐	☐	☐	☐
Die *Klimaerwärmung* ist ein spannendes Thema für die Schülerinnen und Schüler im Biologieunterricht.	☐	☐	☐	☐	☐	☐
Ich weiß, wie ich mit meiner eigenen Meinung während dem Unterrichten des Themas *Klimaerwärmung* umgehen kann.	☐	☐	☐	☐	☐	☐
Ich denke daran das Thema *Klimaerwärmung* im Biologieunterricht zu thematisieren.	☐	☐	☐	☐	☐	☐
Im Allgemeinen unterrichte ich das Thema *Klimaerwärmung* mit Begeisterung.	☐	☐	☐	☐	☐	☐
Das Thema *Klimaerwärmung* ist für die Schule, bzw. den Unterricht geeignet.	☐	☐	☐	☐	☐	☐
Ich würde gerne das Thema *Klimaerwärmung* im Biologieunterricht thematisieren.	☐	☐	☐	☐	☐	☐
Die *Klimaerwärmung* ist ein wichtiges Thema für den Biologieunterricht.	☐	☐	☐	☐	☐	☐
Ich weiß, wie ich das Thema *Klimaerwärmung* im Biologieunterricht methodisch umsetzen könnte.	☐	☐	☐	☐	☐	☐

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Die Präimplantationsdiagnostik (PID)

PID bezeichnet die genetische Untersuchung von im Reagenzglas erzeugten Embryonen vor dem Einsetzen in die Gebärmutter. Ziel der PID ist es, genetische Erkrankungen bei Embryonen zu erkennen und dadurch nur ‚unauffällige' Embryonen in die Gebärmutter einzusetzen. Während die PID auf der einen Seite die frühe Erkennung von Krankheiten ermöglicht, stellen sich ethische Fragen, welche Folgen die Untersuchung und gegebenenfalls die Selektion von Embryonen nach sich zieht. Da die Technik zwar bei besonders schweren Fällen in Deutschland angewendet wird, jedoch die Folgen für die Gesellschaft noch nicht absehbar sind, ist die Anwendung ein möglicher SSI für den Biologieunterricht.

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Das Thema *Präimplantationsdiagnostik* ist im Biologieunterricht neu für mich.	☐	☐	☐	☐	☐	☐
Mein Informationsstand zum Thema *Präimplantationsdiagnostik* ist hoch.	☐	☐	☐	☐	☐	☐
Woher stammen Ihre Informationen zum Thema *Präimplantationsdiagnostik*?						
Print- und Online-Medien (z.B. Zeitschriften, Zeitungen, etc.)	☐	☐	☐	☐	☐	☐
Bücher	☐	☐	☐	☐	☐	☐
Schule	☐	☐	☐	☐	☐	☐
Umfeld	☐	☐	☐	☐	☐	☐
Filme und Dokumentationen	☐	☐	☐	☐	☐	☐

Weitere Informationen habe ich aus folgenden Quellen:

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Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Ich bin persönlich von der *Präimplantationsdiagnostik* betroffen.	☐	☐	☐	☐	☐	☐
Ich bin in meinem geographischen Umfeld von der *Präimplantationsdiagnostik* betroffen.	☐	☐	☐	☐	☐	☐
Ich bin in nächster Zeit von der *Präimplantationsdiagnostik* betroffen.	☐	☐	☐	☐	☐	☐
Es ist wahrscheinlich, dass *Präimplantationsdiagnostik* in Deutschland ohne Einschränkungen erlaubt wird.	☐	☐	☐	☐	☐	☐
Das Thema *Präimplantationsdiagnostik* wurde in meiner eigenen Schulzeit behandelt.	☐	☐	☐	☐	☐	☐

Wie geeignet erscheint Ihnen das Thema *Präimplantationsdiagnostik* um die drei Dimensionen einer Bildung für Nachhaltige Entwicklung (BNE) im Unterricht umzusetzen?

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Ökologisch	☐	☐	☐	☐	☐	☐
Ökonomisch	☐	☐	☐	☐	☐	☐
Sozial	☐	☐	☐	☐	☐	☐

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Bitte kreuzen Sie an, inwiefern Sie zustimmen.	sehr unemotional	unemotional	eher unemotional	eher emotional	emotional	sehr emotional
Wie emotional schätzen Sie das Thema *Präimplantationsdiagnostik* im Biologieunterricht generell ein?	☐	☐	☐	☐	☐	☐

Wenn Sie an Ihre zukünftige Zeit als Lehrerin oder Lehrer denken, inwiefern würden Sie folgenden Aussagen zustimmen?

Bitte kreuzen Sie an, inwiefern Sie zustimmen.	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme voll und ganz zu
Ich bin dazu bereit das Thema *PID* im Biologieunterricht zu thematisieren.	☐	☐	☐	☐	☐	☐
Im Allgemeinen macht mir das Unterrichten des Themas *PID* so viel Spaß, dass ich den Unterricht gerne vorbereite und durchführe.	☐	☐	☐	☐	☐	☐
Ich weiß, wie ich das Thema *PID* im Biologieunterricht methodisch umsetzen könnte.	☐	☐	☐	☐	☐	☐
Die *PID* ist ein wichtiges Thema für den Biologieunterricht.	☐	☐	☐	☐	☐	☐
Ich würde gerne das Thema *PID* im Biologieunterricht thematisieren.	☐	☐	☐	☐	☐	☐
Ich habe genügend Zeit um das Thema *PID* in meinem Biologieunterricht zu unterrichten.	☐	☐	☐	☐	☐	☐
Während des Unterrichtens des Themas *PID* habe ich oft Grund mich zu freuen.	☐	☐	☐	☐	☐	☐
Ich weiß, wie ich mit meiner eigenen Meinung während dem Unterrichten des Themas *PID* umgehen kann.	☐	☐	☐	☐	☐	☐
Im Allgemeinen macht mir das Unterrichten des Themas *PID* Freude.	☐	☐	☐	☐	☐	☐
Ich denke daran das Thema *PID* im Biologieunterricht zu thematisieren.	☐	☐	☐	☐	☐	☐
Ich besitze genügend Informationen zur *PID* um das Thema zu unterrichten.	☐	☐	☐	☐	☐	☐
Im Allgemeinen unterrichte ich das Thema *PID* mit Begeisterung.	☐	☐	☐	☐	☐	☐
Es wäre gut, wenn Schülerinnen und Schülern im Biologieunterricht Wissen über die *PID* erlangen.	☐	☐	☐	☐	☐	☐
Ich möchte das Thema *PID* im Biologieunterricht thematisieren.	☐	☐	☐	☐	☐	☐
Die *PID* ist ein spannendes Thema für die Schülerinnen und Schüler im Biologieunterricht.	☐	☐	☐	☐	☐	☐
Das Thema *PID* ist für die Schule, bzw. den Unterricht geeignet.	☐	☐	☐	☐	☐	☐

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Welche weiteren SSIs fallen Ihnen ein, die Sie gerne Unterrichten würden?

Kommentare

Hier haben Sie Platz für weitere Anmerkungen zur Befragung oder zum Thema:

Geschafft!
Habt noch einen tollen Tag!

Statement of authorship

Erklärung über die Eigenständigkeit der erbrachten wissenschaftlichen Leistung

Ich erkläre hiermit, dass ich die vorliegende Arbeit ohne unzulässige Hilfe Dritter und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe. Die aus anderen Quellen direkt oder indirekt übernommenen Daten und Konzepte sind unter Angabe der Quelle gekennzeichnet.

Bei der Erhebung von Daten haben mich die nachstehend aufgeführten Studierenden im Zuge ihrer Qualifikationsarbeiten unentgeltlich unterstützt: Maike Schleper (2016), Annelene Thielking (2016), Jacqueline Dupont (2017) und Marina Berling (2017).

Weitere Personen waren an der inhaltlichen materiellen Erstellung der vorliegenden Arbeit nicht beteiligt. Insbesondere habe ich hierfür nicht die entgeltliche Hilfe von Vermittlungs- bzw. Beratungsdiensten (Promotionsberater oder andere Personen) in Anspruch genommen. Niemand hat von mir unmittelbar oder mittelbar geldwerte Leistung für Arbeiten erhalten, die im Zusammenhang mit dem Inhalt der vorgelegten Dissertation stehen.

Die Arbeit wurde bisher weder im In- noch im Ausland in gleicher oder ähnlicher Form einer anderen Prüfungsbehörde vorgelegt.

_____ _____

Ort/Datum Unterschrift

Curriculum Vitae

Alexander Büssing, M.Ed.

Personal information

Birthday	01.12.1988
Birthplace	Vechta
Language skills	German, English, Spanish
Hobbies	Music, Theatre

Education and professional experience

Since October 2014	**Research assistant, Osnabrück University** Doctoral studies in biology education Thesis title: *Pre-service Biology Teachers' Emotions towards Teaching: Challenges and Opportunities for Subject-specific Teacher Professional Development* Supervisor: Prof. Dr. Susanne Menzel-Riedl
October 2011 – September 2014	**Student scientific assistant, Didactics of Biology Trier**
October 2011 – September 2014	**Master of Education, Universität Trier** Biology, German Studies, Education Sciences and Philosophy Thesis title: *Frequency and characteristics of practical work in hessian high, secondary and comprehensive schools* Supervisor: Prof. Dr. Andrea Möller
October 2008 – September 2011	**Bachelor of Education, Universität Trier** Biologie, Germanistik und Bildungswissenschaften
September 1999 – Juli 2008	**Abitur, Kolleg St. Thomas Vechta**

Publications

Scientific articles (with peer-review)

Büssing, A. G. & Menzel, S. (in review, *Teaching and Teacher Education*). Psychological distance and contextual basic human values predict enjoyment towards teaching.

Büssing, A. G., Thielking, A., & Menzel, S. (in review, *Frontiers in Psychology*). Can a like save the planet? Liking biodiversity content on social media compared to classical pro-environmental behaviors.

Büssing, A. G. Schleper, M. & Menzel, S. (2019). Do Pre-service Teachers Dance with Wolves? Subject-Specific Teacher Professional Development in A Recent Biodiversity Conservation Issue. *Sustainability*, *11*(47). 1-24. https://doi.org/10.3390/su11010047.

Büssing, A. G., Schleper, M. & Menzel, S. (2018). Emotions and pre-service teachers´ motivation to teach the context of returning wolves. *Environmental Education Research, Advance online publication.* 1-16. https://doi.org/10.1080/13504622.2018.1487034.

Book chapters and other publications

Fiebelkorn, F., Saffawi, A., Basten, M., Büssing, A., Lichtenstein, L., Sattler, S., & Sothmann, J.-N. (2017). *Fachwortschatz Biologie: deutsch – arabisch – englisch.* Seelze: Friedrich-Verlag.

Büssing, A., Priggemer, D., & Menzel, S. (2017). Lehrmotivation für das Unterrichten von Socio-scientific Issues – Qualitative Ergebnisse am Beispiel der Rückkehr der Wölfe. *Biologiedidaktik als Wissenschaft: Abstractband der 21. Internationalen Tagung der Fachsektion Didaktik der Biologie (FDdB) im VBIO.* 514-516. Halle-Wittenberg: Martin-Luther-Universität.

Büssing, A., Gehrs, V., Mochalski, A., Nakamura, Y., & Treichel, B. (2016). Profile Forschenden Lernens – Das Osnabrücker Konzept als ein Beispiel aus Niedersachsen. In R. Schüssler, A. Schöning, V. Schwier, S. Schicht, J. Gold, U. Weyland (Eds.), *Forschendes Lernen im Praxissemester: Zugänge, Konzepte, Erfahrungen*, 111-118. Bad Heilbrunn: Verlag Julius Klinkhardt KG.

Büssing, A., Schleper, M., & Menzel, S. (2016). Affective factors influencing the intentions of teachers to promote the return of the wolves in educational contexts. *Abstractband zur ERIDOB 2016 vom 5. – 6. September 2016.* 69. Karlstad: Karlstad University.

Büssing, A., Michailids, C., & Menzel, S. (2016). Die Rolle von Lehreremotionen in der Bildung für Nachhaltige Entwicklung (BNE) unter besonderer Berücksichtigung von Biodiversitätsaspekten. In H. Korn, & K. Bockmühl (Eds.), *Treffpunkt Biologische Vielfalt XV – Interdisziplinärer Forschungsaustausch im Rahmen des Übereinkommens über die biologische Vielfalt*, 49-56. Bonn: Bundesamt für Naturschutz.

Conferences

Büssing, A. (2018, Oktober). *Emotionen und Lehrerbildung: Mr. Spock als Rollenmodell für Biologielehrer/-innen?* Vortrag präsentiert auf dem Science Slam “Affentheater”, Universität Gießen.

Büssing, A. (2018, August). *Environmental social media as informal learning.* Vortrag präsentiert auf der Mini-Conference “Science|Environment|Health” der ESERA SIG 4, Leibniz-Institut für die Pädagogik der Naturwissenschaften und Mathematik (IPN) an der Universität zu Kiel.

Büssing, A., Thielking, A., & Menzel, S. (2017, November). Social networking as wildlife biodiversity protection behavior – a comparison to money donation and volunteering. Poster presentation at the symposium "Building an International Network for Biodiversity Education and Research", Universidad de Cuenca.

Büssing, A., Priggemeyer, D., Menzel, S. (2017, September). Lehrmotivation für das Unterrichten von Socio-scientific Issues – Qualitative Ergebnisse am Beispiel der Rückkehr der Wölfe. Paper presented at the 21. Internationalen Tagung der Fachsektion Didaktik der Biologie (FDdB) im VBIO, Martin-Luther-Universität Halle-Wittenberg.

Büssing, A. (2017, Juni). Ist Klimabildung postfaktisch? Positive Emotionen als Voraussetzung für klimabewusstes Handeln. Short presentation at the 7. Dialog-Forum BNE der Lokalen Agenda 21 in Osnabrück.

Büssing, A., Schleper, M., & Menzel, S. (2017, Februar). „Ich finde, dass der Wolf ein interessantes Tier ist" – Kontextuelle Zusammenhänge mit dem Wunsch, das Thema Wolf zu unterrichten. Paper presented at the 19. Internationalen Frühjahrsschule der Fachsektion Didaktik der Biologie, Universität Rostock.

Büssing, A., Schleper, M. & Menzel, S. (2016, Oktober). Affektive Einflussfaktoren auf die Unterrichtsbereitschaft die Rückkehr der Wölfe als Kontext einer BNE zu unterrichten. Poster presented at the conference Bildung und Emotion, Institut für Bildungswissenschaften Wien.

Büssing, A., Schleper, M., & Menzel, S. (2016, September). Affective factors related to intentions of teachers to promote the return of the wolf in educational contexts. Poster presented at the 11th Conference of European Researchers in Didactics of Biology (ERIDOB), Karlstad University.

Büssing, A., Schleper, M., & Menzel, S. (2016, Februar). Interesse, Bewunderung, Enttäuschung – Emotionen von Lehrenden in Kontexten einer Bildung für nachhaltige Entwicklung (BNE). Poster presented at the 18. Internationalen Frühjahrsschule der Fachsektion Didaktik der Biologie, Pädagogische Hochschule Weingarten.

Büssing, A., Schleper, M. & Menzel, S. (2016, Januar). Die Rolle von Lehreremotionen in einer Bildung für Nachhaltige Entwicklung (BNE). Poster presented at the DBU Forum Umweltbildung: Bildung für Nachhaltigkeit in Zeiten großer Herausforderungen, DBU Osnabrück.

Büssing, A. & Menzel, S. (2015, Oktober). Die Rolle von Lehreremotionen in der Bildung für Nachhaltige Entwicklung (BNE). Poster presented at the DGfE-Nachwuchstagung Bildung für nachhaltige Entwicklung – theoretische, konzeptionelle und empirische Perspektiven, Berlin.

Educational experience

School internships at the Huntetalschule Goldenstedt (Feburary/March 2009), Marienschule Goldenstedt (September/October 2009), Kolleg St. Thomas Vechta (February/March 2010), Gymnasium Saarburg (August/September 2010), St. Willibrod-Gymnasium Bitburg (March 2011) and Albert-Schweitzer-Realschule Lohne (March 2013)

Teaching of university courses and student supervision at the bachelor and master level

Statistical workshops at the Internationale Frühjahrsschule der Fachsektion Didaktik der Biologie im VBIO (2017, 2018) and at the University of Trier (2015)

Further acitivities

Doctoral representative for the Promovierendenvertretung Osnabrück (Elected member from April 2015 – March 2018; Chairman from April 2016 – March 2017)

Part of the faculty council, Deparment of Biology/Chemistry at Osnabrück University (April 2017 – March 2018)

Coordinator of the ZePrOs Umweltgruppe Osnabrück (2016 – 2017)

Organisation of digital charity soccer tournaments

Youth work in the community of Goldenstedt (2005 – 2014)