

MASTERARBEIT | MASTER'S THESIS

Titel | Title

Pro-environmental Behavior in Children and Adolescents
Does Austrian children's pro-environmental behavior change
with age?

verfasst von | submitted by
Lena Spiegel BSc BA

angestrebter akademischer Grad | in partial fulfilment of the requirements for the degree of
Master of Science (MSc)

Wien | Vienna, 2024

Studienkennzahl lt. Studienblatt | Degree
programme code as it appears on the
student record sheet:

UA 066 840

Studienrichtung lt. Studienblatt | Degree
programme as it appears on the student
record sheet:

Masterstudium Psychologie

Betreut von | Supervisor:

Univ.-Prof. Dipl.-Psych. Sabine Pahl MSc PhD

Mitbetreut von | Co-Supervisor:

Sari Nijssen BA MSc Ph.D.

Abstract

Recent research shows that nature connectedness functions as a motivator for pro-environmental behavior all through life. Several studies in the field of developmental psychology found that both, nature connectedness as well as pro-environmental behavior decrease when transitioning from childhood into adolescence, showing a diverging bond with the natural environment during puberty. Another line of research investigates the role of the moralization of pro-environmental behavior as a motivator to act in favor of the natural environment. However, there is a scarcity of studies on the development of the moralization of pro-environmental behavior. The present study investigates the development of pro-environmental behavior in Austrian children and adolescents between the age of 9 and 16 from Vorarlberg and Lower Austria. Specifically, it examines whether nature connectedness and moralization function as mediators between age and pro-environmental behavior. The findings reveal a significant indirect negative correlation between age and pro-environmental behavior, fully mediated by nature connectedness. Although, no significant correlation between moralization and pro-environmental behavior could be found, Austrian children and adolescents see the pollution of the environment as a moral issue. These findings can help to develop educational programs specifically designed for Austrian students. Furthermore, they suggest the deployment of educational programs that strengthen children's nature connectedness to prevent a potentially following decrease in pro-environmental behavior during adolescence.

Introduction

Humanity is currently facing global climate change, which brings along damaging and threatening consequences for everyone (IPCC, 2023). According to the latest IPCC report, a drastic warming of 1.1 degrees over the last century was caused by human activities. Continuous nature-harming contributions and an ongoing rise in temperature will result in even greater hunger, several negative health and geographical impacts, and adverse socioeconomic changes (UNICEF, 2014). Especially younger generations and their descendants will experience these consequences firsthand (Thiery et al., 2021). In response, researchers investigate motivators as well as leverage points for people's pro-environmental behavior to find possible ways to enhance it (Manfredo et al., 2017).

The concept of nature connectedness, which is the subjective feeling of the affective, cognitive and experiential relationship people have with the natural environment (Schultz, 2002), is a fundamental motivator for pro-environmental behavior (Liu et al., 2022; Whitburn et al., 2020; Zelenski et al., 2015). Its strong correlation to pro-environmental behavior is evident in childhood, adolescence and adulthood, suggesting that a strong connection to nature can effectively motivate pro-environmental behavior at any stage of life (Cheng & Monroe, 2012; Hughes et al., 2018; Keith et al., 2021; Krettenauer, 2017; Krettenauer et al., 2020; Martin et al., 2020; Rosa et al., 2018).

Although this connection between nature connectedness and pro-environmental behavior can be found all over the span of life, nature connectedness systematically changes with age. Studies indicate a drop in nature connectedness and pro-environmentalism during adolescence, often referred to as the "adolescent dip" (Keith et al., 2021; Krettenauer, 2017; Krettenauer et al., 2020; Olsson & Gericke, 2016). Adolescents show different nature preferences compared to older and younger age groups, indicating a diverging bond with the natural environment (Kaplan & Kaplan, 2002). Kaplan and Kaplan (2002) call the adolescent years a "time out" in the relationship with nature, attributing this to stronger peer-orientation and higher sensation-seeking during those years.

A study with Spanish participants between the age of 9 and 35 displayed a U-shaped pattern in pro-environmental behavior, with adolescents showing the lowest levels, gradually recovering in adulthood (Pol & Castrechini, 2014). A Swedish study supports this dip by reporting lower levels of sustainable consciousness in

adolescents (Olsson & Gericke, 2016). The lower levels of nature connectedness and pro-environmental behavior in adolescents compared to children highlight the need for educational programs aimed at maintaining the levels obtained already in childhood.

Even though several studies revealed that this change of pro-environmental behavior and nature connectedness during adolescence also occurs in European samples (Olsson & Gericke, 2016; Pol & Castrechini, 2014), conducting a study with Austrian children and adolescents allows for designing educational programs that are specifically tailored to maintain Austrian children's and enhance Austrian adolescents' pro-environmental behavior.

An already existing study with an Austrian sample reported a dip in nature connectedness when transitioning into adolescence (Bezcljak et al., 2023). The present study focuses on the development of pro-environmental behavior, while investigating whether nature connectedness functions as a mediator.

Investigating additional motivators for pro-environmental behavior beyond nature connectedness, could help enhancing people's conservation behavior to an even greater extent (Manfredo et al., 2017). Therefore, one line of research investigates the connection of pro-environmental behavior to its moralization (De Groot & Steg, 2009; Krettenauer, 2017; Schultz et al., 2005).

Equivalent to pro-social moral action, pro-environmental behavior involves overcoming self-interests for the benefit of others and especially future generations (Krettenauer, 2017). Studies in the field of environmental psychology, therefore, often focus on normative aspects of people's pro-environmental behavior, like values, social norms and moral reasoning (Collado & Sorrel, 2019; Kahn & Lourenço, 2002; Karpiak & Baril, 2008; Krettenauer, 2017).

Social Domain Theory (Turiel, 1983) often plays a role in examining pro-environmental behavior as an aspect of moral development (Krettenauer, 2017). Growing up, children must learn to understand different social contexts and situations for their personal social development (Smetana et al., 2014). In this process children develop moral concepts (Smetana et al., 2014). Moral concepts are "prescriptive, generalizable understandings of how individuals ought to behave toward others" (Smetana et al., 2014, p. 23). Furthermore, moral rules are immutable, obligatory and independent of authorities and given rules (Smetana et al., 2014). The resulting prescriptiveness, non-contingency as well as generalizability of moral concepts are all

present when children evaluate situations harmful to nature, especially because consequences do not only affect themselves (Krettenauer, 2017).

In developmental psychology, studies revealed that the majority of children tend to see the protection of the planet, animals and the natural world as their moral obligation (Kahn, 1999). Even though there are several studies on this feeling of being morally obliged to protect the environment (Karpiak & Baril, 2008; Turaga et al., 2010; van der Werff et al., 2013), there is a lack of studies on its development throughout life (Krettenauer, 2017). If the majority of children see nature protection as a moral issue, it is necessary to investigate whether this tendency is stable while growing up. A decrease in the feeling of being morally obliged to protect the environment could account for lower pro-environmental behavior in adolescents compared to children (Krettenauer, 2017). In relation, adolescence seems to be a period where young adults become more morally sensitive, which stands in contrast to the encountered decline of pro-environmental behavior (Eisenberg et al., 2002). These conflicting aspects exhibit the complexity of moral development in adolescent years and its relation to pro-environmental behavior, highlighting the need for its closer investigation.

Examining different motivators for pro-environmental behavior and their development in children and adolescents allows an improved development of new environmental educational programs and a refinement of already existing ones, as these programs have often been found to be inefficient (Rousell & Cutter-Mackenzie-Knowles, 2020). An important goal of future investigation is to enhance children's and adolescents' life-long pro-environmental behavior (for overview see Fang et al., 2023) and control for a potentially existing adolescent dip. Results of the present study will help to design educational programs specifically tailored for Austrian children and adolescents based on their moral development and their nature connectedness.

The aim of the current study was to investigate the development of pro-environmental behavior in Austrian children and adolescents. More specifically, if nature connectedness and the moralization of pro-environmental behavior function as mediators between age and pro-environmental behavior. Based on previous studies, a decrease in pro-environmental behavior with age was expected, with nature connectedness and the moralization of pro-environmental behavior as mediators. Investigating different motivators for pro-environmental behavior might help stabilizing and strengthening it during childhood, resulting in higher levels during adolescence.

Participants were between 9 and 16 years old, and filled out a questionnaire on pro-environmental behavior, nature connectedness and their moralization of situations harmful to nature. The results will help to design new education programs that are specifically tailored for Austrian children and adolescents, that might help to prevent a potential adolescent dip and strengthen pro-environmental behavior.

Methods

Sample

A power analysis using G*Power 3.1.9.4 (Faul et al., 2009) with $\alpha = .05$ and $\beta = .95$ resulted in a required sample size of 89 participants, sufficient to detect a moderate effect of age (effect size = 0.15). All data sets with missing age were excluded from the study. The excluded data sets were all missing up to one-third of the questionnaire responses. Out of the initial 102 questionnaires, the final sample included 95 Austrian students between the age of 9 and 16.

The medium age was approximately 11 years ($M = 11.06$, $SD = 2.06$). 50.5% were female ($N = 48$), 48.4% were male ($N = 46$), and one person identified as "Other" ("Andere"). 96.8% ($N = 92$) reported being Austrian citizens, one person was from Slovakia, and two did not answer this question. 33.7% ($N = 32$) of the participants lived in Vorarlberg at the time of the study, 64.2% ($N = 61$) in Lower Austria, and two did not answer this question. 42.1% of the participants attended a primary school, 26.3% were in a "Mittelschule," and the remaining 29.5% attended a gymnasium.

The study procedure was approved by the Ethics Committee of the University of Vienna.

Procedure

All participants were contacted through their schools. The schools were responsible for distributing consent forms to the participants' parents. The schools received these consent forms either directly from the researcher or, in the case of schools from Lower Austria, from the Department of Education ("Bildungsdirektion"). After returning completed and signed consent forms, parents received a link to a questionnaire with a brief explanation of how their children should complete it. On the first page of the questionnaire, participants were given instructions that they could stop any time without facing any negative consequences. It was also explained that by starting the questionnaire, they were giving their consent. Participants filled out the questionnaires at home.

Although schools all over Austria were contacted, only children from Lower Austria and Vorarlberg participated in the study. This was either because the departments of education from other federal states declined to participate or because no school in those states expressed interest in joining.

Measures

Connection to Nature

To measure children's subjective feeling of being connected to nature, the Connection to Nature Index (CNI) was employed (Cheng & Monroe, 2012). It is a trait measure with the four subscales 'enjoyment of nature', 'empathy for creatures', 'sense of oneness', and 'sense of responsibility'. The CNI consists of 16 items rated on a 5-point Likert scale (from *strongly disagree* to *strongly agree*). For this study, the questionnaire was translated into German. A score was calculated by computing the mean of all 16 items. A score above 4.56 indicates a strong connection to nature, while a score below 4.06 is considered weak. A mild connection lies between 4.06 and 4.56. These boundaries were benchmarked based on their connection to pro-environmental and conservation behavior (Hughes et al., 2018). The CNI showed moderate internal reliability (Cronbach's $\alpha = .75$).

Pro-environmental Behavior

Researchers commonly agree that measuring children's pro-environmental actions poses a challenge, as not many nature-friendly actions can be conducted by children themselves (Evans et al., 2007; Larson et al., 2011). Therefore, five simple items used in previous studies with children were included (Collado et al., 2013; Collado & Corraliza, 2015; Leeming et al., 1995). Examples to increase comprehensibility were put after each item. The items were translated into German. The items were: (a) I carry out activities to protect the environment (Ich führe Handlungen durch, um die Umwelt zu beschützen [Bsp. Müll trennen, weniger Auto fahren,...]) (b) to save water, I use less water when I take a shower or a bath (Ich verwende weniger Wasser beim Duschen und Baden [Um Wasser zu sparen]); (c) in school, I talk to my teachers and peers about the importance of doing things to protect the environment (e.g., recycling) (Ich rede mit LehrerInnen und MitschülerInnen darüber, wie wichtig es ist, die Natur zu beschützen [Bsp.: recyceln]); (d) at home, I help to separate and to recycle (Ich helfe zu Hause den Müll zu trennen und zu recyceln); and (e) to save energy, I switch off the electrical appliances when I am not using them (Ich schalte elektrische Geräte und Licht aus, wenn ich sie nicht brauche).

Participants answered on a 5-point Likert scale from *Never* to *Always*. Cronbach's alpha was .55, indicating low internal reliability.

Moralization of pro-environmental behavior

The third part of the questionnaire investigated whether children perceive an act of environmental pollution, specifically water pollution, as a moral issue. A scenario describing a random person throwing trash into a river was presented (Kahn & Lourenço, 2002). Participants answered three questions to establish whether they conceptualize this act as wrong or right and therefore as a moral issue (Kahn & Lourenço, 2002). The first question investigated whether participants see this act as *permissible* (Ist es ok oder nicht ok, dass die Personen ihren Müll in den Fluss wirft?), the second question examined whether *conventional* practices override children's judgment (Sagen wir, jeder wirft seinen Müll in einen Fluss in Österreich. Wäre das ok oder nicht ok?), and the third question examined whether it makes a difference in participant's judgment when it comes to a different *culture* and its varying conventional practices, using Germany as example (Sagen wir, in Deutschland werfen alle ihren Müll in Flüsse, weil das ein Weg ist, wie sie ihren Müll entsorgen. Ist das ok oder nicht ok von ihnen?). These questions correspond to the main factors of Social Domain Theory, widely used in research to assess whether an action belongs to the moral scope (Smetana et al., 2014). Two of the three factors are prescriptiveness of behavior and rule-generalizability. The third main indicator of Social Domain Theory, rule-contingency, was not included in the study. To investigate rule-contingency, participants are typically asked if a rule violation would be acceptable even if explicitly forbidden by an authority. Water pollution is commonly not accepted but not explicitly permitted in Austria. Therefore, this criterion was excluded from the present study (Krettenauer, 2017). Participants answered on a 5-point Likert scale (from *not ok at all* to *very ok*). The internal consistency of this section was sufficient (Cronbach's $\alpha = .74$).

Results

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 29.0 (IBM Corp., Armonk, NY, USA). Although participants had the option to skip questions of the questionnaire, there were no missing values from any participant.

Descriptive analysis

The average score of pro-environmental behavior was 3.72 ($SD = 0.54$), indicating a tendency towards "Sometimes" with an upward trend. The highest scores were observed for recycling and separating waste ($M = 4.31$) and turning off lights and appliances ($M = 4.16$).

33.7% ($N = 32$) of the participants showed a low connectedness to nature, 47.4% ($N = 45$) a mild connectedness, and 18.9% ($N = 18$) a high connectedness. The mean score for nature connectedness was 4.17 ($SD = 0.38$), revealing a mild nature connectedness on average (Hughes et al., 2018).

96.2% saw the act of throwing trash into the river as "not OK at all" (Überhaupt nicht okay). Almost all participants maintained this view even if everyone in Austria (97.9%) or in Germany (93.7%) threw trash into the river. The majority (98.95%) perceived this act of environmental harm as a moral issue, consistent with Social Domain Theory.

Correlation analysis

To address the effects of age, gender, moralization and nature connectedness on pro-environmental behavior, a linear regression analysis was conducted. Table one displays a correlation matrix. The results of the linear regression analysis are presented in Table 2. The regression analysis reveals the overall significance of the model, $F(4,90) = 5,304$, $p < .001$ (two-tailed), $R^2 = .19$. As displayed in table two, the constant and nature connectedness are significant predictors for pro-environmental behavior, while moralization, age and gender show no significant effect.

Table 1

Pearson correlations of gender, age, connectedness to nature and moralization with pro-environmental behavior as dependent variable.

	Pro-environmental behavior
1. Gender	-0.22*
2. Age	-0.10
3. Connectedness to nature	0.37***
4. Moralization	-0.30**

Note. Correlations based on means of Moralization and Connectedness to nature; * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 2

Regression coefficients for the influence of age, gender, nature connectedness and moralization on pro-environmental behavior.

<i>Independent variable: pro-environmental behavior</i>			
	B [95%-CI]	β	SE
(constant)	2.62 [0.39, 4.45]**		0.94
Gender	-0.15 [-0.33, 0.04]	-0.15	0.09
Age	0.01[-0.05, 0.06]	0.03	0.03
Connectedness to nature	0.42 [0.12, 0.73]**	0.30	0.15
Moralization	-0.53 [-1.08, 0.09]	-0.17	0.31

Note. N = 95. * $p < .05$, ** $p < .01$, *** $p < .001$.

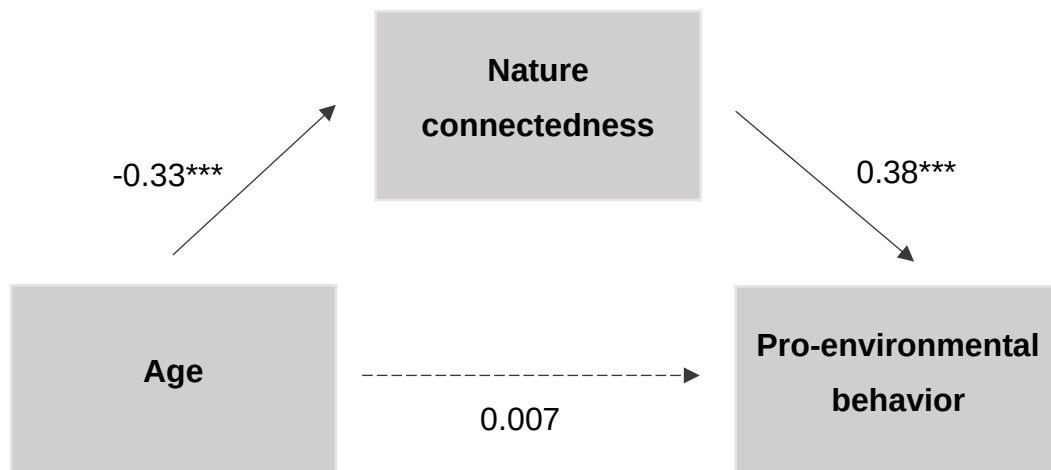
Nature connectedness as mediator

A mediation analysis using the PROCESS macro (Version 4.2; Hayes, 2018) tested nature connectedness as a mediator between age and pro-environmental behavior. The direct effect of age on pro-environmental behavior was not significant ($\beta = .007$, $p = .81$). However, a significant indirect effect mediated through nature connection was found (standardized $\beta = -.13$). Standardized bootstrap confidence intervals of 5000 bootstrap samples confirmed the significance of this indirect effect, 95% CI [-0.23, -0.04]. A significant negative effect of age on the mediator nature

connectedness was found (standardized $\beta = -.33, p < .001$) suggesting lower levels in nature connectedness with higher age. The effect of the mediator nature connectedness on the dependent variable pro-environmental behavior was significant and positive (standardized $\beta = .38, p < .001$). These results suggest a complete mediation.

Figure 1

Nature connectedness as mediator between age and pro-environmental behavior



Note. N = 95, * $p < .05$, ** $p < .01$, *** $p < .001$. Dashed line demonstrating no significant direct effect.

Moral Judgment as Mediator

92.6% of participants saw the environmental pollution as a moral issue. No significant negative correlation was found between self-reported pro-environmental behavior and its moralization in the linear regression analysis. No significant correlation was found between age and moral judgment, which rendered a mediation analysis unnecessary.

Discussion

The main interest of the study was to investigate the development of pro-environmental behavior in an Austrian sample of children and adolescents between the age of 9 and 16. The study focused on the investigation of nature connectedness and the moralization of pro-environmental action as potential mediators between age and pro-environmental behavior. To investigate these connections, children had to fill out a questionnaire on pro-environmental behavior, nature connectedness and their moralization of actions that are harmful to nature.

Previous research revealed that nature connectedness significantly functions as a motivator for pro-environmental behavior throughout life (Liu et al., 2022; Whitburn et al., 2020; Zelenski et al., 2015). A linear regression analysis showed that this correlation also exists in the present sample. The results of the present study revealed no significant direct correlation between age and pro-environmental behavior, but a significant indirect correlation mediated by nature connectedness. Age correlated negatively with the mediator nature connectedness, indicating that adolescents feel less connected to nature than their younger peers. This aligns with several studies that previously found a drop in nature connectedness and pro-environmental behavior when transitioning from childhood into adolescence (Keith et al., 2021; Krettenauer, 2017; Krettenauer et al., 2020; Olsson & Gericke, 2016).

While a study of Krettenauer (2017) found the prescriptiveness of moral judgments to mediate the negative relationship between age and pro-environmental behavior, we found no significant correlation between age and the moralization of pro-environmental behavior, therefore excluding it as a possible mediator. This might be due to deviating survey methods. There was also no significant correlation between the moralization and pro-environmental behavior in the linear regression model. However, the study revealed that Austrian children and adolescents perceive nature protection as a moral issue. They consider nature pollution to be morally wrong, regardless of whether it is a common practice in Austria. This perspective remains consistent even when applied to different social contexts – in this case Germany. A limitation of the present study is Germany's strong societal similarity to Austria. Future studies implementing the same items should investigate if participants generalize their view, using countries that have less similar social practices and conventions than Austria and Germany. Furthermore, future research needs to focus on the development of not only the feeling of moral obligation in connection to pro-

environmental behavior but also on the development of moral emotions and other normative aspects in the field of environmental psychology.

To investigate Austrian children's and adolescents' pro-environmental behavior, it is crucial to understand not only the impact of age on their pro-environmental behavior but also the influence of gender. Several studies investigated this effect of gender on pro-environmental behavior (Hughes et al., 2018; Keith et al., 2021). These studies found that girls generally exhibit higher levels of pro-environmental behavior, a finding that could not be detected in the linear regression analysis. This might be due to the inclusion of additional control variables in the linear regression model, which could have mitigated a direct effect of gender on pro-environmental behavior. Another reason could be the sample size that is too small to find effects of gender on pro-environmental behavior in the conducted linear regression analysis.

A U-shaped pattern in the development of nature connectedness and pro-environmental behavior suggests that the decreased levels observed in adolescence will rise again after puberty (Pol & Castrechini, 2014). These findings suggest that by preserving children's pro-environmental behavior into adolescence, an even higher increase of pro-environmental behavior in adulthood may be achieved. Based on the current findings showing that the negative relationship between age and pro-environmental behavior is mediated by nature connectedness, one potential strategy to accomplish higher levels of pro-environmental behavior is to enhance children's connectedness to nature to. This should be an aim in the development of educational programs (Frantz & Mayer, 2014). Nature-based, outdoor education programs play an essential role in reinforcing children's nature connectedness (Braun & Dierkes, 2017). The results of the present study highlight the need for outdoor education programs in Austrian schools, preventing a decrease in pro-environmental behavior in adolescence.

A major limitation of the present study lies in the small sample, that is not representative for all Austrian children and adolescents. Future Austrian studies should focus on this. Furthermore, it should be investigated whether children's and adolescent's nature connectedness is generally mild in an Austrian sample as shown in this study, or if it differs based on living in an urban versus rural area. Another considerable limitation presents itself in the scale examining self-reported pro-environmental behavior, which revealed low internal reliability (Cronbach's $\alpha = .55$) in this sample. A study by Collado and Corraliza (2015) exhibited an alpha of .74 using

almost the exact same items. Using another scale investigating pro-environmental behavior in an Austrian sample that shows higher internal reliability might change the outcome of the study. This needs to be further investigated. Additionally, the fact that the questionnaire is solely based on self-reports should be kept in mind when reading and interpreting the results, due to social desirability response biases (Camerini & Schulz, 2018; van de Mortel, 2008). Although measures for pro-environmental behavior, nature connectedness and moralization were taken from previously validated questionnaires, they were translated and adapted. It is necessary to cross-validate these modified procedures with an independent sample in future research. Finally, it should be noted that a limitation lies in the age range of the sample. The medium age of the sample was at 11.06 years, revealing that participants were very young. Participants' age was unequally distributed, rendering it unnecessary to investigate the approximate age of a drop in pro-environmental behavior. The highest age in the study was 16, leaving it unclear whether this mediation through nature connectedness is maintained through adulthood in an Austrian sample. This demands further research. Furthermore, the results may be based on cohort differences rather than developmental effects.

Although there are several limitations to the present study, the finding of nature connectedness as mediator between age and pro-environmental behavior in an Austrian sample of children and adolescents reveals the importance of developing specific outdoor education programs that help to maintain and strengthen children's nature connectedness. Although no connection between moralization and pro-environmental behavior could be detected, Austrian children and adolescents see harming the environment as morally wrong. Future studies should focus on the role of moralization in pro-environmental action and further investigate its development. This study provides a starting point for understanding how nature connectedness and moral reasoning develop and influence pro-environmental behavior in Austrian youth.

Acknowledgment

I would like to acknowledge the use of ChatGPT, an open AI language model by Open AI, for this master's thesis. It was solely used to refine the language of this thesis and to phrase its content in a more academic style. The content generated by ChatGPT was carefully reviewed, edited, and verified to ensure its accuracy and

relevance to the research topic. The use of this tool aimed to enhance the clarity and coherence of the thesis while maintaining academic integrity.

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Abstract Deutsch

Aktuelle Forschung zeigt, dass Naturverbundenheit über das gesamte Leben hinweg als Motivator für umweltfreundliches Verhalten wirkt. Mehrere Studien im Bereich der Entwicklungspsychologie haben herausgefunden, dass sowohl Naturverbundenheit als auch umweltfreundliches Verhalten beim Übergang von der Kindheit in die Adoleszenz sinken. Dies zeigt eine sich verändernde Beziehung zur natürlichen Umwelt während der Pubertät. Ein anderer Forschungsstrang untersucht die Rolle der Moralisierung des umweltfreundlichen Verhaltens als Motivator, sich für die natürliche Umwelt zu engagieren. Es liegen jedoch nur wenige Studien vor, die diese Entwicklung der Moralisierung des umweltfreundlichen Verhaltens untersuchen. Die vorliegende Studie erforscht die Entwicklung des umweltfreundlichen Verhaltens bei österreichischen Kindern und Jugendlichen im Alter von 9 bis 16 Jahren, die in Vorarlberg oder Niederösterreich wohnen. Insbesondere wird untersucht, ob Naturverbundenheit und Moralisierung als Mediatoren zwischen Alter und umweltfreundlichem Verhalten fungieren. Die Ergebnisse zeigen eine signifikante indirekte negative Korrelation zwischen Alter und umweltfreundlichem Verhalten, die vollständig durch Naturverbundenheit mediiert wird. Obwohl keine signifikante Korrelation zwischen Moralisierung und umweltfreundlichem Verhalten gefunden werden konnte, wurde beobachtet, dass österreichische Kinder und Jugendliche die Umweltverschmutzung als moralisches Problem betrachten. Diese Erkenntnisse können dazu beitragen, speziell für österreichische Schüler*innen entwickelte Bildungsprogramme zu gestalten. Darüber hinaus legen die Ergebnisse nahe, Bildungsprogramme einzusetzen, die die Naturverbundenheit von Kindern stärken, um einen möglichen Rückgang des umweltfreundlichen Verhaltens während der Adoleszenz zu verhindern.