# Discussion

Where to put low sample numbers??

## Overview

My analysis of XXXX self-reported surveys demonstrates complex heterogeneity of the influence of an innovative ESD intervention on changes of sustainability competencies. Contrary to my predictions, I revealed that one year after the end of the intervention, sustainability attitude and behaviour did not increase (Figure XX), suggesting a rejection of my alternative hypothesis of a positive relationship. This highlights the importance of long-term empirical data collection when analysing the effects of ESD interventions. Simultaneously, in line with my predictions, I demonstrated that the involvement of the students (n= 7) led to overall higher SA and SB, for SB (??) even one year after the intervention (Figure XX), highlighting the positive effect of innovative ESD interventions on changes of sustainability competencies. Careful considerations in terms of the generality of the results should be made, due to the very low sample size of involved students. I found a strong positive relationship between the sustainability attitude and sustainability behaviour with the underlying construct of the theory of planned behaviour and the sustainability competences based on the underlying construct of (individual) self-efficacy beliefs (Figure XX), pointing towards the reciprocal validation of both scales to capture the same latent constructs of sustainability competencies and their usefulness. I uncovered no differences between individual and collective self-efficacy beliefs within and between the involved and the control group (Figure XX), HIGHLIGHTING?. In line with my predictions, I found that the involved students reported higher aim focussed self-efficacy beliefs (Figure XX), potentially indicating the stabilisation of the formation of intentions and at the same time highlighting the importance of also considering outside barriers. *The lack of sufficient data prevented me from to answer my original questions of comparing the outcomes to a participative group as well, which highlights the challenges of collecting comprehensive data in a school context.* Measuring the outcome of ESD interventions requires many considerations and trade-offs - by using a quantitative, long-term, behavioural-focussed/ outcome-focussed approach, I uncovered heterogenous responses in sustainability competencies changes, challenging the assumption that innovative ESD interventions have real behavioural impacts or the assumption of their measurability.

**Summary of most relevant critiques and what they mean related to results**

Sustainability competencies measurement have been criticised for various reasons with important implications for the interpretation of the results.

Paragraph about downsides measurement method, reflecting back to introduction

* Goals of ESD/ measurement of ESD
  + *The presented method and instrument for operationalization of sustainability competencies picks up core competencies for students to enable them to shape a sustainable future. However, when dealing with competency models, this concurrently raises general questions about the possibilities of evaluation, definition and the seemingly antithetical need of openness of the ESD concept in order to stay adaptable to sustainability related challenges in the future. As Wals et al. conclude, “[t]he main point is that there is no single model of education and learning for environmental sustainability, nor should there be” [*[***112***](https://www.mdpi.com/2071-1050/11/6/1717#B112-sustainability-11-01717)*]. The conception of an adaptive and flexible concept of ESD, nevertheless, should not hinder our duty in the field of empirical research to create evidence via research programs, to verify if the undertaken programs of ESD show (the wanted) outcomes. We still argue that a focus on the ESD effects and learning outcomes is highly necessary to evaluate and improve the measures taken to enable learners to shape a sustainable future. Only if these further steps are taken can the compatibility of ESD with empirical research programs be guaranteed, and hence, its success be assessed.*
  + ESD 1 vs ESD 2
  + Can and should behavioral change be outcome of study?
  + Process vs outcome
  + In this case: also democracy education
  + Still need for measurement to go beyond normative statements
  + 🡪 Self-efficacy as relevant indicator?
* Mismatches observed SC and actual impact (also goes along with goal dimensions)
  + Validation measurement tool and actual real world impact
  + In this regard, Kagawa states that “[*t*]here are multiple factors which influence the process of behavioral change and further investigation of dissonance between students’ perception of sustainability and their individual actions needs to be explored” [[**106**](https://www.mdpi.com/2071-1050/11/6/1717#B106-sustainability-11-01717)]. See, for example, research on the attitude–behavior gap [[**103**](https://www.mdpi.com/2071-1050/11/6/1717#B103-sustainability-11-01717),[**107**](https://www.mdpi.com/2071-1050/11/6/1717#B107-sustainability-11-01717),[**108**](https://www.mdpi.com/2071-1050/11/6/1717#B108-sustainability-11-01717)] or cognitive dissonance [[**109**](https://www.mdpi.com/2071-1050/11/6/1717#B109-sustainability-11-01717),[**110**](https://www.mdpi.com/2071-1050/11/6/1717#B110-sustainability-11-01717)].
  + Tried to accommodate with new framework and measuring relevant indicators such as self-efficacy generally and collective self-efficacy especially
  + Fittingness of TPB for students (social desirability, influence of media) 🡪 better alternatives exists (ProBiKlima)
  + Checking for real impact and shift of powers 🡪 impact-focussed research (Nielsen et al 21)// Interesting, whether real lief outcomes for individuals and society (REF Kurz und Kubeck , 2021)
* Mention context-specificity
  + data limitations (both tests and sample size), but also only one school
  + western context
  + trade-off global scope and regional/ context specificity
  + 🡪 Therefore, there is a need for more cooperation amongst the different research fields (e.g., environmental psychology, environmental sociology, science teaching, and empirical educational sciences) and projects, as well as quantitative and qualitative methods of ESD research.
  + 🡪 scalability of results

*My research adds to a growing understanding of SCs, their development, and the sustainability and educational governance through policymaking. On this basis, appropriate evidence based recommendations for the further development of ESD research and the implementation of ESD in school practice can be formulated. Through the possibilities of measurement presented and the data already generated, further insights into the successful implementation of ESD in schools and the associated conditions for success can be gained.*

Therefore my results can be interpreted as . While changes of sustainability competencies and their attribution to innovative ESD interventions is somewhat limited with my method, I still observed an impression on the long-term effects captured across levels of involvement of the students.

## Sustainability attitude and sustainability behaviour (TPB-based) over time and level of involvement (Research Question 1a/b)

Contrary to my prediction, I found that sustainability attitude and sustainability behaviour did not increase one year after the ESD intervention (Figure XX). I did find a peak at the second point of measurement (straight after the ESD intervention) for the involved group, being significantly higher for both SA and SB (Figure XX). These difference of SB with significant higher scores for the involved group was constant even one year after the ESD intervention (Figure XX). At the same time SB was reported even significantly higher at the first point of measurement (before the start of the ESD intervention), raising the question of attribution of changes of SC to the ESD intervention (Figure XX). The observed findings could be due to various reasons. Firstly,

* Operationalisation and measurement tool
  + fittingness of TPB for students 🡪 better alternatives exists (ProBiKlima)
  + Already previous interest from self-chosen group 🡪 what would be goal of ESD intervention – quantity vs quality?
  + („Mismatch“/ Difference in) GOALS! Aim of study: also democratic aspects, weren’t considered here 🡪 difficult to make statements about effect of project
* Other factors that could play bigger role in SA and SB than ESD intervention
  + Social desirability (also at various time points?)
  + influence of media, FFF
    - Die Teilnahme an Fridays for Future war ein positiver Prädiktor sowohl für das Nachhaltigkeitswissen als auch für die Einstellungen und das Verhalten der Schüler\*innen. Außerschulische Lernumwelten (z. B. Freundeskreise, Familie, soziale Medien) haben im Jugendalter einen starken Einfluss, so dass die Wirksamkeit schulischer BNE beschränkt sein könnte.
  + BUGEN Attitude
    - Attitude: According to previous research, younger children also tend to have a higher environmental attitude than older children (Krettenauer, 2017; Leeming et  al., 1995; Liefländer et  al., 2013).
    - BUGEN: attitude went down
      * Die durchschnittliche Schulnote, die nachhaltigkeitsbezogenen Einstellungen zu Beginn des Schuljahres, die Teilnahme an Fridays for Future, die Kenntnis des Begriffs Nachhaltigkeit und die Jahrgangsstufe stellten jedoch weiter signifikante Prädikatoren auch der nachhaltigkeitsbezogenen Einstellungen dar. Die Schulformen standen dagegen in keinem statistisch bedeutsamen Zusammenhang mit der Entwicklung der nachhaltigkeitsbezogenen Einstellungen innerhalb eines Schuljahres.
      * Auf Lehrkräfteebene konnten das berichtete Umwelt- und Nachhaltigkeitsbewusstsein der Lehrkraft und die BNE-Fortbildungen – jedoch beide erwartungswidrig in negativer Richtung – als signifikante Prädiktoren für die nachhaltigkeitsbezogenen Einstellungen ermittelt warden
      * , lässt sich auch nur vermuten, dass es bei den Schüler/-innen bei zu pointierten Äußerungen bezüglich des eigenen Umwelt- und Nachhaltigkeitsbewusstsein seitens der Lehrkraft möglicherweise zu einer Reaktanz (d.h. einer Art innerer Widerstand) in der eigenen Einstellung kommen könnte.
  + BUGEN behaviour
    - Die durchschnittliche Schulnote, das von den Schüler/- innen zu Beginn des Schuljahres berichtete Nachhaltigkeitsverhalten und die Teilnahme an Fridays for Future stellten signifikante Prädiktoren dar.
    - Auf Lehrkräfteebene wurden der persönliche Stellenwert der BNE und die Anzahl von besuchten BNE-Fortbildungen als negative(!) signifikante Prädiktoren, die Selbstwirksamkeitseinstellungen in Bezug auf BNE jedoch als positiver signifikanter Prädikator für das selbstberichte nachhaltigkeitsbezogene Verhalten der Schüler/-innen ermittelt.
* Actual reasons for going down
  + Effectiveness of innovative method? 🡪 evaluation of method of intervention (innovative) difficult
  + Auseinandersetzung ohne SW-Erfahrung führt zu Abfall (Klima-Emotionen 🡪 importance whole-institution approach; Stellenwert BNE an Schule (Whole School Approach!)
  + Influence of teachers (REF WALTNER) 🡪 high environmental consciousness( importance BNE 🡪 less succesful (Reaktanz der SuS?)// Bereits in anderen Studien wurde nachgewiesen, dass ein pluralistischer Zugang, also die Diskussion vielfältiger Sichtweisen anstatt der Präsentation einer „richtigen“ Meinung im Kontext nachhaltiger Entwicklung, einen positiven Effekt auf das Verhalten der Lernenden hat (Boeve-de Pauw et al., 2015).
* Other determining factors of the study
  + Schulform? In der wissenschaftli-chen Literatur wird diese Verbindung zwischen BNE und Montessori bereits untersucht (vgl. Howaida Sayed, 2017; Lewis, 2012).
* My findings highlight that
  + ESD research can benefit Using empirical, long-term data?

## Sustainability competencies as sustainability attitude and sustainability behaviour (based on TPB) and self-efficacy beliefs (Research Question 2a/b)

### Self-efficacy as validation for SA and SB (based on TPB)

* Summary findings
  + Confirmation validation
  + this shows that the two scales measure the same latent construct, namely, environmental attitude.
* Reasons findings
  + First scale already validated through participation FFF and impact-relevant behaviour
  + Campbell: Within the Campbell paradigm, a person’s attitude becomes transparent in the amount of behavioral cost said person is willing to overcome in order to pursue their goal (Byrka et al., 2017).
  + On the other hand, our findings also provide support for the Campbell paradigm (see Kaiser et al., 2010) – in this paradigm, personal attitudes can be derived from verbal acts, such as expressions of appreciation for the environment and self-reports of past engagement in environmentally friendly behaviors (Kaiser et al., 2018). Our findings also show that it is not relevant with which specific items a latent attitude is assessed but that any number of reasonably well-phrased behavioral or verbal selfreports which are aimed at the attitude object in question can be used to infer the underlying. This supports the call for a higher priority of specific objectivity within the validation criteria for measurements in general (for a detailed account, see Kaiser et al., 2018).
* Other potential explanations
* My findings highlight that
  + As a consequence, the competency differences which were assessed with this measurement instrument could point toward meaningful differences between the students which may have an actual impact on their future behavior.

Abgesehen von der Kritik am Instrument ist außerdem anzumerken, dass durch die zu-grundeliegende Theory of Planned Behavior nur eine bedingte Vorhersage des Verhaltens möglich ist (Armitage & Conner, 2001, S. 471; Kaiser et al., 2006, S. 2153). Intention kann demzufolge im Schnitt nur 27 % der Varianz des Verhaltens erklären (Armitage & Conner, 2001, S. 471; Bamberg & Möser, 2007, S. 23; Kaiser et al., 2006, S. 2153), auch wenn einzelne Studien Aufklärungsquoten von bis zu 95 % bescheinigen (Kaiser et al., 2006, S. 2160). Selbst der Modellbegründer Icek Ajzen hat die TPB im Laufe der Zeit weiterentwickelt, da augenscheinlich noch weitere Faktoren neben der Intention das Ver-halten beeinflussen (Bosnjak et al., 2020).

At timepoint 3: comparing individual self-efficacy and TPB between groups

### Self-efficacy beliefs and level of involvement (Research Question 2b)

#### Individual and collective self-efficacy beliefs between and within groups

* Self-efficacy as self-categorised efficacy belief
  + Allows distinction self/ collective, clears
  + Individuals can flexibly shift from categorising themselves as individuals to members of groups (Coking, Fritsche, Tajfel) (different social identity underlying)
* Collective efficacy was better predictor of pro-evironmental behaviour than self-efficacy ((M-F Chen, 2015)
* Summary findings
  + No differences found
  + Individual SW higher than collective involved group
* Reasons
  + Relevance group?
  + Difficulty of task 🡪 changing sth for school as expert group, too difficult or maybe also decreased after nothing happened?
  + And desirability of aim?
  + 🡪 as research shows that collective efficacy highest, when medium task 🡪 maybe too difficult?
  + Link campbell and medium task 🡪 harder task was too difficult?
  + collective efficacy was significantly stronger when task difficulty was moderate rather than easy or difficult; and (b) that through specific collective and self-efficacy perceptions, sustainable intentions were gauged—even when controlling for attitudes and social norms. These findings suggest that collective efficacy beliefs are particularly relevant for attaining environmental goals that are neither too easy nor too difficult, and could thus be valuable for communication and policy strategies. (REESE; JUNGE)
  + this process is explained by the model of group-based control that postulates individuals can derive personal benefits (e.g., self-efficacy beliefs) from social groups because groups can make them feel personally capable and in control [[**31**](https://www.mdpi.com/2071-1050/9/2/200#B31-sustainability-09-00200),[**32**](https://www.mdpi.com/2071-1050/9/2/200#B32-sustainability-09-00200)]). In fact, Jugert et al. [[**12**](https://www.mdpi.com/2071-1050/9/2/200#B12-sustainability-09-00200)] could show that through collective efficacy, individuals came to feel in control of their outcomes: People’s intention to act was enhanced through providing a sense of efficacy transferred from the group to the self. Similarly, using a qualitative research approach, Cocking and Drury [[**11**](https://www.mdpi.com/2071-1050/9/2/200#B11-sustainability-09-00200)] found that collective efficacy led to a feeling of personal empowerment. Thus, with collective and self-efficacy being strong and closely intertwined predictors of pro-environmental action (
  + Supporting this assumption, Van Zomeren et al. [[**37**](https://www.mdpi.com/2071-1050/9/2/200#B37-sustainability-09-00200)] found that social action support significantly predicted collective efficacy. Second, behaviors that are easy usually have a weaker environmental impact per se. It is likely that people believe actions that are too easy (e.g., refraining from plastic bags) to be unlikely to make a big difference in environmental issues, even if they are collectively practiced. In other words, when actions are too easy, the (potential) success may not translate into feeling collectively efficacious. In short, this suggests that efficacy beliefs would be strongest for medium difficulty tasks.
  + However, for research on spillover effects (for a review, see [47]), it is helpful to know that task difficulty of a topic-specific challenge (as in our case, a plastic reduction task) can also increase general collective efficacy beliefs that might in turn enhance pro-environmental behavior in other domains—a finding in line with [26], who show that self-efficacy beliefs mediate between less difficult and more difficult behaviors. Our findings nicely complement this research, suggesting that such spill-over can also be mediated via collective efficacy beliefs.
* Other potential influences
* Implications
  + Integrate self-efficacy research into SC research: linking the aim of BNE to self-efficacy framework (wanting collective action as outcome?)
  + Policy implications. The trade-off between responses to more or less difficult tasks and perceived (collective) efficacy is informative for policy making as it shows that people may more easily engage in behaviors that cost little but feel more efficacious through performing somewhat more difficult behaviors.

#### Aim and action focussed self-efficacy beliefs between and within groups

* Field of collective social and ecological aims is especially prone to aim-fiocussed understanding of self-efficacy because it fits complex nature of collective crisis (Zomeren,2019)
* For collective aims, the hardest part is not performing an action as such (e.g., going to a protest) but creating social change *with* this action. Individuals only have a very limited amount of control over collective outcomes ([Hornsey et al., 2021](https://journals.sagepub.com/doi/10.1177/10888683231178056#bibr163-10888683231178056); [Jugert et al., 2016](https://journals.sagepub.com/doi/10.1177/10888683231178056#bibr183-10888683231178056)). Moreover, many barriers lie outside of the individual and are informed by the actions of powerful others; feedback is much more difficult to receive as aims are rather distal (e.g., the impact of an awareness campaign on people’s opinions is difficult to detect; [Hornsey et al., 2021](https://journals.sagepub.com/doi/10.1177/10888683231178056#bibr163-10888683231178056)).[3](https://journals.sagepub.com/doi/10.1177/10888683231178056#fn3-10888683231178056)
  + - * + Similarly, the question arises whether these types of efficacy beliefs share the same relation to other constructs (predictors, outcomes, or moderators of relationships). We hypothesize that agent-action self-efficacy might be more connected to actual behavioral costs, socioeconomic circumstances, and impactful behavior, whereas agent-aim self-efficacy might be more closely related to attitudes, goals, visions, and intentional behavior (see [Bain et al., 2013](https://journals.sagepub.com/doi/10.1177/10888683231178056#bibr19-10888683231178056); [Bamberg & Rees, 2015](https://journals.sagepub.com/doi/10.1177/10888683231178056#bibr23-10888683231178056)). As perceived behavioral control in the theory of planned behavior ([Ajzen, 1991](https://journals.sagepub.com/doi/10.1177/10888683231178056#bibr6-10888683231178056)) predicts intention but also moderates intention-outcome relations, we suspect that the same might be true for action-focused self-efficacy. Action-focused self-efficacy is therefore likely to capture actual constraints such as time, money, or social resources that may prevent a person from following through on their intention. However, aim-focused self-efficacy is less related to these constraints and more involved in the formation of an intention. Thus, a key difference between action- and aim-focused self-efficacy may be that the former moderates intention-behavior relations while the latter does not. Connected to this, future research could also explore whether aim-focused self-efficacy is based on less rational thought and more emotional reaction than action-focused self-efficacy, which would explain why analytic interventions have been rather unsuccessful in manipulating it (see [Hornsey et al., 2021](https://journals.sagepub.com/doi/10.1177/10888683231178056#bibr163-10888683231178056)).

🡪Many actions could (or not) lead to one aim

* Actions and aims should be adapted to outcome variables (which is the category of interest?)
* Distinguish action- and aim links
  + Combining actions that are very concrete
  + With very abstract collective aims
  + With ingroup no agent-action
* Summary findings
  + Involved group did score higher in both action and aim, than control group, but only aim significantly different
  + Involved froup slightly higher in aim than action
* Reasons
  + Desirability of aim?!
  + Different results regarding predictive power of the links
  + Reese and Jung suggest that agent-action-aim better predictor for more concrete intentions, whether agent-aim of more general
  + No other empirical data to compare to other than reese and jung
* Other potential influences
* Implications
  + Need to check for desirability of aim in pilot test in future?
  + Barriers from the outside? Aim is more desirable of involved group, but actions do not seem promising?
  + Actions asked not relevant?

GENERAL

* Finally, we believe that distinguishing efficacy is also relevant from a more practical perspective. Distinguishing links between agents, actions, and aims enables better predictions about which characteristics of self-efficacy make it more or less predictive of relevant social and environmental outcome variables. Such detailed knowledge is needed, for example, in campaign design, political decisions, and team building in groups working against social and ecological injustice. Then again, in our own practical work with environmental and social rights activists (e.g., in workshops, lectures, counseling), we noticed that it is not intuitive for practitioners to make the above-mentioned distinctions. Responding to this, researchers could use the triple-A framework to practically integrate self-efficacy links into one overarching framework that simultaneously allows for a more nuanced research overview when it comes to practical counseling and advice.

While self-efficacy theory strongly focuses on the need for efficacy (competence), self-determination theory ascribes equal importance to all basic psychological needs (i.e., competence, autonomy, and relatedness), assumes that meeting these needs is intrinsically satisfying ([Elliot et al., 2001](https://journals.sagepub.com/doi/10.1177/10888683231178056#bibr109-10888683231178056)), and emphasizes the important role of autonomy for human agency ([Chirkov et al., 2011](https://journals.sagepub.com/doi/10.1177/10888683231178056#bibr73-10888683231178056)). Rather than looking at aim strength, self-determination theory distinguishes different qualities of motivation (e.g., [Ryan & Deci, 2017](https://journals.sagepub.com/doi/10.1177/10888683231178056#bibr282-10888683231178056)). Based on this, we define perceived agency as the belief that a self-categorized agent can perform a *self-determined* action toward an *autonomous* aim.

Thereby, it raises the question of where actual agency for collective social and ecological aims is situated ([Louis, La Macchia, et al., 2016](https://journals.sagepub.com/doi/10.1177/10888683231178056#bibr227-10888683231178056)). At this point, our reasoning reaches the boundaries of self-efficacy theory and the triple-A framework and enters the realm of actual (and not only perceived) agency that we believe [Bandura (1997)](https://journals.sagepub.com/doi/10.1177/10888683231178056#bibr28-10888683231178056) also wanted to call attention to. In terms of the triple-A framework, agency thus would not only include agent-action-aim *perceptions* but embrace actual agent-action-outcome *influences*.

## Study limitations

“Analyses of biodiversity change can be limited by insufficient and imbalanced taxonomic, spatial and temporal data.”

* Applicability in other contexts (Cultural etc)
* Limitations (DISCUSSION?)
  + Furthermore, we propose the distinction of three efficacy links (agent-action, agent-aim, agent-action-aim) based on operationalizations and labeling decisions. However, strong empirical evidence for such a distinction and possible moderators of the relation between various efficacy links is still missing. It remains a task for future research to investigate how interdependent these facets of self-efficacy actually are under which circumstances. Therefore, the triple-A framework should be understood as a theoretical proposition that conceptually fleshes out what is already practiced, highlights previously overlooked research questions, and helps researchers make more strategic decisions in the study of efficacy beliefs.
  + Constraints to generality

## Future directions

* the dominant form of assessment of impact from the educational intervention utilised quantitative measures, such as a pre/post survey or questionnaire, essentially reflecting a positivist epistemology.
* are forms of assessment employed relevant and appropriate? (epistemologically)
* A performance measurement approach to project management insists on the inclusion and development of indicators of expected change, assessment of baseline, stated targets and validation tools to provide evidence of change. This results-orientated approach emphasises efficiency and accountability in public spending, with clearly defined outputs, and results demonstrating value for money. (Oflaherty, Liddy, 2018)
* Consequently the development of indicators and outcomes is more complex and relates to the researcher/educators’ definition of development education, as addressed earlier. This product outcome focus misses the distinctiveness of DE/ESD/GCED, where the learning outcomes may be in the form of questioning and activism, rather than immediate or short-term goals.

On a policy level, the development of further indicators (see for example [[**114**](https://www.mdpi.com/2071-1050/11/6/1717#B114-sustainability-11-01717),[**115**](https://www.mdpi.com/2071-1050/11/6/1717#B115-sustainability-11-01717)]), or the evaluation of ESD programs (see for example [[**13**](https://www.mdpi.com/2071-1050/11/6/1717#B13-sustainability-11-01717),[**116**](https://www.mdpi.com/2071-1050/11/6/1717#B116-sustainability-11-01717)]), seem like helpful supplements to foster future steps and crucial insights in the implementation process of programs that aim to promote learner competencies to build a sustainable future.