# Discussion

## Overview

Summary of most relevant findings and what it reveals, first explanations, first limitations?

Limitations

* Data very limited (n=7!)
* Test only non-parametric ones (can only show order)
* 🡪 Scalability

## Sustainability competences over time and level of involvement (Research Question 1a/b)

check Discussion Pauli

* Summary findings this question
* Other factors to look in, in research
  + SC change over time
  + Change over involvement (Pauli 🡪 importance long-term)
  + Method of intervention?
  + Change in different dimensions (Behaviour, Attitude) 🡪 BUGEN
  + Relevance indicators used (TPB)
* Reasons
  + Already previous interest from self-chosen group
  + Soziale Erwünschtheit (am Anfang zum MZP1)
  + Auseinandersetzung ohne SW-Erfahrung führt zu Abfall (Klima-Emotionen!) oder positive Verstärkung
  + ihrer Metastudie fanden O’Flaherty und Liddy nur einen kleinen Anteil Studien, die keinen signifikanten Effekt von Bildung für nachhaltige Entwicklung auf nachhaltigkeits-relevante Aspekte feststellen konnten (2018, S. 1038).
  + BUGEN bzw Waltner article methods
    - Age of students (older students higher knowledge, linked to other dimensions?)
  + 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: no change in attitudes and behaviour through year
    - Attitude went down
    - ESD not about to form attitudes and behaviour
    - 🡪 more about critical, independent decision making
  + 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.
* Other determining factors of the study
  + („Mismatch“/ Difference in) GOALS! Aim of study: also democratic aspects, weren’t considered here 🡪 difficult to make statements about effect of project
  + Can and should behavioral change be outcome of study?
  + Age, Gender, school marks when coming to knowledge
  + 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)].
  + Schulform? In der wissenschaftli-chen Literatur wird diese Verbindung zwischen BNE und Montessori bereits untersucht (vgl. Howaida Sayed, 2017; Lewis, 2012).
  + Influence of teachers (REF WALTNER) 🡪 high environmental consciousness( importance BNE 🡪 less succesful (Reaktanz der SuS?)
  + Importance media, other factors like FFF
  + Stellenwert BNE an Schule (Whole School Approach!)
  + 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).
  + are the tools employed for measurement adequate?
  + are measurement tools assessing what is distinctive to DE/ESD/GCED education?
* My findings highlight that
  + ESD research can benefit Using empirical, long-term data?
  + Relevance of asking the right questions? TPB limited, because ?? (also debate about whether behavioral change should be outcome!)
  + As important contribution to normative debate, through empirical insights
    - Same weighing or different, depending on societal relevance?
    - Based on def in educational plans: need to shift more to behavioural aspects (away from cognitive components?) 🡪 more impact focused research (Nielsen et al 21)
  + Interesting, whether real lief outcomes for individuals and society (REF Kurz und Kubeck , 2021)

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.

## Sustainability competences and self-efficacy beliefs (Research Question 2a/b)

### Self-efficacy as validation for TPB and comparision (in one?)

* 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 15 Application-Oriented Development of Outcome Indicators for Measuring Students’ Sustainability 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 as intervention outcome

At timepoint 3: comparing individual self-efficacy vs collective self-efficacy between groups

* Summary findings
* Reasons
  + 🡪 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.

At timepoint 3: comparing different categories of self-efficacy (aim vs action) between groups

* Summary findings
* Reasons
  + 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

## Study limitations

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

* Applicability in other contexts (Cultural etc)

## 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.