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Claire Grauer, Daniel Fischer & Pascal Frank

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Time and sustainability: A missing link in formal education curricula

Claire Grauer^a (D), Daniel Fischer^b (D) and Pascal Frank^a (D)

^aInstitute for Environmental and Sustainability Communication, Leuphana University, Lüneburg, Germany; ^bStrategic Communication Group, Wageningen Research & University, Wageningen, The Netherlands

ABSTRACT

Time is an essential dimension of sustainability and its premise of intra- and intergenerational justice. Moreover, prevailing sociocultural practices of time use are drivers of unsustainability. Educational institutions convey social norms on time and are thus places where time is "learned." It is therefore of relevance for Education for Sustainable Development (ESD) to understand how exactly time is addressed in education. This study from Germany introduces the concept of time as a resource for sustainability before presenting an analysis of how time in this sense is addressed in 2,149 German curricula, covering all grades and school forms. Our study shows that, overall, an engagement with time as a resource for sustainability is rare in formal education. Time is mostly addressed in ethical reflections on lifetime or in teaching time management skills. We discuss implications of our findings and sketch avenues for future research on time as a resource for sustainability.

KEYWORDS

time; consumption; sustainability; curriculum; school

Introduction

In recent years, the relation between time and sustainability has received increased attention within sustainability research (Held, 2001; Jalas, 2004; Reisch, 2015; Seghezzo, 2009; Southerton, 2020). There is a growing body of research such as sociologist Hartmut Rosa's theory of social acceleration (Rosa, 2011a), problematizing the negative consequences of an accelerated lifestyle. Not only does social acceleration seem to contribute to reinforcing gender inequality (Adam, 2002) and negatively affect public health (Strazdins et al., 2011), but it has also been identified as a driver of unsustainable consumption practices and thereby environmental degradation and the climate crisis (Rau, 2015; Rinderspacher, 2019). Schor's (2008) seminal research on work-time reduction as one possible leverage point for reducing consumption levels ties in with discussions on time wealth as an important factor contributing toward more sustainable lifestyles (Reisch, 2001). There is, thus, evidence that a time use perspective is relevant for understanding sustainability-related challenges (Rau & Edmondson, 2013) and that changing practices of time use may be an important lever to advance broader sustainability transformations (Druckman & Gatersleben, 2019; Wiedenhofer et al., 2018).

Education for Sustainable Development (ESD) is considered a "key enabler" (UNESCO, 2017, p. 7) for achieving Sustainable Development Goals. ESD is rooted in traditions of environmental education and global citizenship education (Michelsen & Fischer, 2017). It has been established internationally as an ambitious education concept to enable all learners to address the multiple socio-ecological challenges

CONTACT Claire Grauer Strate Grauer (Section 2) Institute for Environmental and Sustainability Communication, Leuphana University, Lüneburg, Germany

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of our times, develop solutions, and take collective action (UNESCO, 2020). Given the direct and indirect consequences of our use of time for sustainability, the ability to use the resource "time" in sustainable ways should be a central focus of ESD. Indeed, there are some conceptual works (Görtler, 2016a; Reheis, 2007) as well as few pedagogical practice materials (Butler et al., 2012; Niedersächsisches Kultusministerium, 2015) exploring the link between ESD and time. However, there is so far no systematic investigation of how far and in which way "time" as a resource with relevance for sustainability is addressed in curricula. Using the case of Germany as a leading country in implementing of ESD in education policies (UNESCO, 2014), we conducted an analysis of 2,149 German state school curricula, guided by the following research questions:

RQ1: To what extent is time as a resource for sustainability addressed in German state school curricula in different school types and subjects?

RQ2: With which meanings is time as a resource for sustainability addressed in German state school curricula, and what connections are made between time and consumption?

Given the relevance of time for sustainability, we were interested in empirical evidence on whether and how formal school curricula address this nexus with an emphasis on consumption as a domain of everyday life where sustainability materializes in concrete practices and choices.

In the following sections, we will introduce our concept of "time as a resource for sustainability" and provide a brief overview of research regarding time and sustainability, followed by the presentation of our data and a discussion of our findings and their implications regarding to ESD research and practice.

Time as a resource for sustainability

Even though we all have the same amount of time at our disposal, both our individual perception of time and how we use it vary considerably. This notion of a subjective time is relevant with regard to sustainability because our individual use of time is linked to the fulfillment of our personal needs. This is why, in the following, rather than reflecting on time from a philosophical perspective, we are going to establish our perspective on time as a resource for sustainability and then proceed to inquire into the implications this has for ESD. This conception of time as a resource for sustainability goes beyond a purely economic notion of time as a (scarce) resource that can be commodified and therefore needs to be "managed" (Southerton, 2020, p. 3) and that is considered a driver of environmental degradation and climate change (Adam, 1995).

Rather than focusing on getting things done, conceiving of time as a resource points toward doing things in ways that allow to account for one's own needs as well as those of others.

Time and sustainability: A brief overview

Research on the interrelations between time and sustainability is becoming increasingly differentiated. For the purpose of this paper, we will briefly look at three strands of research from sociology, economics, as well as education and ESD, which proved particularly insightful for providing theoretical context to our own analysis presented below.

Sociologists have long been interested in possible connections between the present environmental crisis and our (Western) social norms on time. Our "time culture," that is, how we perceive and how we are using time, they argue, is characterized by short-term, linear thinking and a commodification of time (Nowotny, 2017; Rau & Edmondson, 2013). As a result, modern societies operate with an artificial idea of time, considered independent from the environment and its natural rhythms and cycles (Adam, 1995, 2006). Even though "there is no single story about what is happening to the tempo of people's lives" (Wajcman, 2015, p. 5), many researchers agree that capitalist principles of productivity gains in combination with technological innovations have caused an ever-increasing acceleration in Western societies, resulting in unfavorable consequences with regard to sustainability. These include the perpetuation of

unsustainable consumption practices, including commuting and long-distance travel by plane or car (Rau, 2015) or "compensatory consumption" (Rosa, 2011b) such as coping with stress by indulging in shopping.

One solution for alleviating these potentially unsustainable consequences of time scarcity has been the concept of time wealth (Reisch, 2001; Rinderspacher, 2012). There is evidence that a reduction of (paid) work hours may indeed contribute to individuals experiencing increased levels of subjective well-being (Kasser & Sheldon, 2009) as well as reducing the extent of individual consumption (Schor, 2008). Although there is evidence suggesting that more free time might lead individuals to engage in more energy-intensive activities such as travel (Buhl & Acosta, 2016), Lindsay et al. (2020) point out that individuals' time use is determined by their particular mindset, meaning that more free time will not automatically cause certain more or less sustainable outcomes.

Elaborating on the relation between time use competence-related outcomes, Frank et al. (2020) suggest the promotion of a "time use competence" as an alternative to the established concept of time management. Time management skills are considered essential in modern professional and educational contexts (Dornbach, 2014; Rappleye & Komatsu, 2016) since they follow the above-mentioned approach to saving time as a scarce (economic) resource (Hatzelmann & Held, 2015). In contrast, the concept of time use competence proposes that we can learn to use time in a way that contributes to fulfilling our personal needs while simultaneously allowing us to reflect on the potential impacts of our time use on our surroundings, especially with regard to sustainability (Butler et al., 2012; Frank et al., 2020). Combining this perspective with our notion of time as a resource for sustainability, time use competence allows us to reflect on these practices and their consequences regarding ourselves, other individuals, as well as the environment. This is not to suggest that a "time-competent" person would necessarily always act sustainably. Time use is always embedded within complex social settings, and individuals will always have to make choices, which may not always reflect their values or desires (Lindsay et al., 2020; Southerton, 2020). Nevertheless, time use competence aims at empowering individuals to deal with these social settings. It thus aims at enabling individuals to use their time in a way to shape the present in order to contribute to a sustainable future and thereby participate in reshaping existing social settings (cf. the concept of "shaping competence," de Haan, 2006).

Time, education, and sustainability

A perspective on time in school exposes several layers. First, time is a structural element by which school as an institution shapes students' lives in certain ways, for instance, through timetables or the pattern of holidays and school days. Schools thus are places of a particular kind of "temporal socialization" (Franch & Souza, 2015, p. 421), conveying social norms on time (Bunn et al., 2019; Duncheon & Tierney, 2013). In this paper, we are not going to focus on this institutional aspect of time, even though we are aware of its significance in the context of time and education.

Second, "time" is also part of the content of curricula: From grade 1 onward, students are learning what time is from the perspective of various subjects including physics, mathematics, philosophy, or languages. So far, it remains unclear how exactly learners are introduced to curricular content on time, especially considered from our perspective on time as a resource for sustainability. Studies focusing on curricula from an ESD perspective either focus on analyzing the extent of ESD-related content in national curricula (Jóhannesson et al., 2011), the comparison of the interrelation between sustainability policies and ESD (Aikens & Mckenzie, 2021) or cross-national comparisons of subject-specific curricula (e.g. geography; Bagoly-Simó, 2014). Regarding Germany, there are studies on the inclusion of the sustainable development goals into German education (Müller-Christ et al., 2017), ESD in primary education (Arnold et al., 2017), or the extent of implementation of ESD in Germany in general (Holst & Brock, 2020).

With regard to ESD, time mostly seems to be dealt with in relation to the future, implying "the hope of actually *making* a sustainable future" (Holfelder, 2019, p. 945). Accordingly, there is a variety of ped-agogical approaches seeking to engage learners with concrete visions of the future while developing pathways to put these visions into practice. This includes first sustainability assessment methods, such as life-cycle assessment (Mälkki & Alanne, 2017), which is a tool used for assessing environmental impacts

of products and services. It has been suggested a useful research-based teaching method in energy education because it focuses on all steps of the value chain, including potential future environmental impacts of products, and thus emphasizing aspects such as recycling or longevity.

A second group of approaches focuses on possible development paths, one example being scenario analysis (Burandt & Barth, 2010). Originating in entrepreneurial planning, scenario analysis has been introduced to sustainability teaching because it combines a variety of methods aimed at increasing learners' understanding of complex systemic interrelations with a focus on long-term uncertain outcomes, the global environmental crisis being a prime example for this kind of complex problem.

Finally, there are approaches encouraging learners to develop their ideas for desirable futures, such as visioning workshops (Pereira et al., 2018). This is a format aiming at creating shared social spaces allowing learners to engage with their values and foster mutual understanding in order to develop shared visions of a common future.

What these approaches have in common is that they conceive of the future as potentially open and malleable and to be shaped through actions which are taking place in the now. There is, however, not yet any systematic inquiry into how exactly time as a resource for sustainability is conceived of within formal education, despite the existence of methods like those mentioned above. While some scholars have pointed out existing gaps focusing on considering time an essential dimension of sustainability in German political education (Görtler, 2016b; Reheis, 2007), we are not aware of a systematic analysis of school curricula focusing on time and sustainability or sustainable consumption.

This study contributes to filling this gap. It is the first analysis of German school curricula on how time is addressed within public education with a focus on sustainable consumption.

Methods

We retrieved official state curricula¹ for all school forms and levels from the respective authorities' websites (see Appendix 2 for an overview over respective sources), resulting in a total of 2,149 documents (see Appendix 1). The large number stems from the fact that each of the 16 German federal states issues its own curricula and, in some cases, has introduced its own types of schools. The documents were processed using qualitative data analysis software MAXQDA and made subject to a two-step analysis. The first step aimed at identifying all sections relevant with regard to our interest in time as a resource for sustainability. We therefore ran a lexical search for the term "time" in order to identify any reference to the use of "time." Next we assessed each finding through content analysis (Mayring, 2015) in order to verify that it fit the research focus on time as a resource for sustainability. This included ruling out any term etymologically unrelated to time ("Zeit"), such as "Zeitung" (newspaper), as well as references to "Zeit" (time) in terms of time as "period, time segment of life or history" (Duden, 2018). We also did not consider passages containing semantically generic or compound terms such as "Jahreszeit" (season) and "Mahlzeit" (meal) as well as adjectives such as "gleichzeitig" (simultaneously) and "zeitlich" (timely). Finally, we ruled out passages where time appeared as measurement or quantity, such as in mathematics or physics, as a grammatical category in language teaching or as a reference to historical periods in subjects like history or politics. As a result, we identified 239 documents (out of 2,149 curricula) containing 468 references to time matching our search focus.

In a second step, we coded the material twice. First, we conducted an inductive coding procedure in order to distill a set of themes capturing the specific ways in which time as a resource for sustainability was addressed in the curricula (Spichal, 2018). This was accompanied by continuous discussions within the research team, consisting of two research associates and one research assistant, in order to ensure that we were applying the same standards and understandings to our data, especially in case of disagreements (Gläser & Laudel, 2010). When no further themes emerged, all identified sections were coded again by two independent coders using the agreed-upon set of seven themes as codes (see also Table 2). Intercoder reliability checks using Recal2 (Freelon, 2010) revealed an acceptable rate of 95.2% agreement (Scott's pi $[\pi] = 0.717$, Cohen's kappa $[\kappa] = 0.719$, Krippendorff's $[\alpha] = 0.717$). Please note Appendix 4 in which we provide an overview of the methods and procedures in greater detail.

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Results

In the following, we are going to present our findings by separately answering RQ1 and RQ2.

RQ1: To what extent is time as a resource for sustainability addressed in German curricula in different school types and subjects?

Given the fragmentation of the German educational landscape, we decided to present our findings according to primary, secondary, upper secondary, and vocational education level, despite occasional overlapping (Table 1).

Most references to time were found in secondary school curricula, as were the majority of documents analyzed. This can be explained by the fact that since secondary level usually encompasses five or six years, it covers more school years compared to primary (mostly four years), upper secondary (two to three years), and vocational schools (one to five years) (Figure 1).

Most references to time come from curricula for ethics, philosophy, religious education, and social sciences.² For instance, "me and my time"³ is a characteristic example of an ethics curriculum approach to reflecting on time. The learning goal is described as follows:

"Being responsible for shaping one's own time in school as well as in leisure, own wishes and goals can be expressed. ... Life time is characterized by a continuous change: "Everything has got its time". This includes questions about the end of life as well as coping with grief." (EthHE1, p. 18)

| Table 1. Overview | w of number of docume | ents analyzed and co | orresponding refere | nces to time found in |
|--------------------|-------------------------|----------------------|---------------------|-----------------------|
| relation to the nu | mber of students per so | chool level. | | |
| | No. of | No. of | No. of | Student |

| | No. of | No. of | No. of | Student | |
|-----------------|-----------------------|---|--------------------|---------------------------------------|--|
| | documents analyzed | documents containing references to time | references to time | to population in German in 2018/19 | |
| Primary | 160 | 35 | 79 | 3 m | |
| Secondary | 1,222 | 143 | 285 | 4.4 m | |
| Upper secondary | 398 | 34 | 67 | 0.9 m | |
| Vocational | 335 | 27 | 37 | 2.4 m | |
| Others | 22* | | | | |
| Total | 2,149 | 239 | 486 | 10.7 m | |

*Note that 22 documents could not clearly be attributed to a particular school level; for instance, some special needs education curricula are covering primary and lower secondary level within the same document, only specifying the targeted grade in relation to specific contents.



Figure 1. Number of references to time as a resource for sustainability per subject.

Social science curricula are the only subject group in which the majority of references to time come from primary instead of secondary curricula. This is because most references to time are from general science and social studies curricula ("Sachunterricht"), a subject taught in primary schools only. Examples for relevant unit titles are "reflecting the experience of time" (SuB1, p. 27) or "subjective experience of time" (SuBW1, p. 30), showing how a reflexive approach to time is also taught at primary level. An example from a secondary level social science curriculum is a unit on "When life is more than work: e.g. the invention of leisure in the 19th century" (GewBRB1, p. 37).

Furthermore there are several vocational education curricula containing references to time as a resource for sustainability. These are not limited to vocational education schools but mostly from curricula covering vocational education subjects taught at general education schools such as home economics or social pedagogy. An example for the latter would be: "[L]earning about the necessity of a conscious approach to time" (SozpädRLP2, p. 49). A second example comes from an economic education curriculum: Students "describe the influence of [full and part-time employment] on individual ways of life and name consequences for identity formation" (AlNRW1, p. 57).

The final analytic category of "other" includes a variety of subjects from both secondary and vocational education level, which often are specific to one German federal state and include various special needs education curricula. This includes findings as this one from a curriculum on consumer education: "[Students] reflect the opportunities of time- and self-management" (VerSH1, p. 8). Another example stems from a special needs curriculum, containing "reasonably and responsibly using their [students] own time" (GeiEntNi1, p. 66) as a learning goal.

RQ2: With which meanings is time as a resource for sustainability addressed in German curricula, and what kinds of connections are made between time and consumption?

In this section, we are going to present a general overview of the themes we identified within the data, followed by an in-depth look at the findings related to time and consumption.

Main themes identified and their context

In the course of our analysis, we identified seven distinct themes, which reflect different kinds of framings with which time is addressed as a resource for sustainability in German state curricula.

Table 2 provides an overview of all themes identified and their appearance with relation to subjects and school types. "Reflecting individual time use" is the theme most frequently identified within curricula. It refers to portrayals of time use aiming at instigating students' reflections on qualitative aspects of spending their time, such as the passing of time felt during one's own life course. It is found most often in ethics and philosophy curricula.

"Managing time" is the theme represented second most often. Sections coded in this way suggest that not only are time management techniques introduced, but students are also given space for a general reflection on their individual time use. For example, students "experience, ... observe, ... describe and know about the organization of their own time" (GeiEntNi1, p. 97) or "recognizing and making use of favorable learning conditions, organizing individual learning and structuring time" (EngHH1, p. 26).

"Spending time on consumption" is the third most frequently found theme, which we are going to discuss in detail below. Next, "experiencing leisure" is another theme we identified. We mostly found it in ethics and philosophy curricula, where most references to time focus on motivating students to reflect on how they are spending their leisure time. "Experiencing time in everyday life" differs from "experiencing leisure" in that references to time coded with the former refer to how students are experiencing the passing of time, regardless of a particular sphere such as leisure, work, or home. There are, for example, a number of references to time that point to religious holidays as means of structuring the week ("Sunday is gifting us with time" [KathRelSH2, p. 42]) or "raising awareness on the difference between measured and felt time" (PhiloMV1, p. 23).

"Reflecting on time in general" is most often found in arts education curricula. Theater curricula often seem to combine discussing time as a means of structuring time on stage with reflections of individual experiences, for example, "reflection on acted time, timing and rhythm in theater culture and

| INDLE 2. INCLUS | בא ומבוונווובמ ווו רמו ורמוס | allalys. | | | | | |
|---|---|---|--|---|---|--|---|
| Theme | Reflecting individual time use | Managing time | Spending time on consumption | Experiencing leisure | Experiencing time in everyday life | Reflecting on time in general | Experiencing time in society |
| Coding category (German) | Persönliche Zeitreflexion | Zeitmanagement | Zeit und Konsum | Freizeit | Zeiterleben | Allgemeine Zeitreflexion | Zeit und Gesellschaft |
| Analytical definition | Findings refer to qualitative aspects of spending time, allowing for the conclusion that students are encouraged to reflect on their individual time use. | Findings contain teaching-specific methods for a "purposeful organization of time" (Hatzelmann & Held, 2015), while going beyond a "ticking-a- box" approach, and may allow for reflection on time use. | Findings establish direct relations between time and consumption, including leisure and consumption and media consumption. | Findings refer to students' experience of "free" or "leisure" time. | Findings contain references to how individuals may perceive certain time-related phenomena, e.g., calendars, and holidays, or by referring to acceleration or slowing down. | Here, time is presented as a means of structuring life, collectively as well as individually. This includes various phases in life or rhythms such as natural cycles or clock-time rhythms. | Findings refer to time as experienced in modern Western societies, where time is attributed to mutually exclusive spheres (e.g., "school" or "work" time as opposed to "leisure"). |
| Example* | "[R]eflecting on the meaning of becoming and passing by () conceiving of time as a symbol of transitoriness?" (EthSA1, p.17) | Students "reflect on opportunities of time and self management" (VerMV2, p.18) | "Assessing the interrelation between consumption habits and one's individual lifestyle" (EthGymS2, p.20) | <i>"What does leisure mean?"</i> (PhiloMP1, p.19) | "Students describe individual time experience and how time is structured" (GesNi3, p.13) | "Time and rhythm, e.g seasonal change, life time, past, present, and future" (FhwRLP1, p.22) | "Seeking a balance— work time and leisure time" (EvRelBay1, p.4) |
| No. of sections coded | 122 | 87 | 67 | 65 | 60 | 45 | 22 |
| % of total sections coded (n = 468) | 26% | 19% | 14% | 14% | 13% | 10% | 5% |
| Sections coded per level | P: 32 S: 65 US: 22 V: 3 | P: 5 S: 44 US: 9 V: 29 | P: 3 5:58 US: 5 V: 1 | P: 11 5: 49 US: 2 V: 3 | P: 20 S: 32 U5: 8 V: 0 | P: 6 S: 18 US: 20 V: 1 | P: 2 5: 19 US: 1 V: 0 |
| Subjects with most sections coded | Ethics/philosophy (40 references to time as a resource) | Vocational Education (39) | Ethics/philosophy (14) | Ethics/philosophy (20) | Religious Education (16) | Theater, arts, music (1 7) | Ethics, philosophy (7) |
| <i>Note</i> . P = primary; 5 *Examples given on section. This is om | s = secondary; US = upper ser Ily refer to headlines of units itted here due to limited sp: | condary; V = vocational. s or subsections within curricu ace. | ıla. In most cases, sections | coded include more i | nformation on specific qu | uestions addressed or conte | ints to be covered by the |

TABLE 2. Themes identified in curricula analysis.

individual projects" (PhiloHH1, p. 15). Finally, references to time grouped under "experiencing time in society" refer to time as being structured along the areas of "school," "work," and contrasting these with time spent in "private/home" and "leisure" contexts and thereby depict established social norms on time use or the allocation of time across various spheres of social life. These coded segments often refer to how "work" and "leisure" seemingly have become essential elements defining contemporary lives: "[D] istinguishing between work time and leisure" (EthGrTh2, p. 6) or "Which is more important? Work time or leisure?" (PhiloHH1, p. 21).

The interrelation between time and sustainable consumption

Given our interest in the interrelation between time and sustainable consumption, we are going to take a more detailed look at this theme in the following section. We found 67 segments within 25 documents establishing such a relation. For analytic purposes, we further subdivided our findings into two subthemes: "time and consumption" and "leisure and consumption" (see Table 3). We are aware that this may appear confusing, since we already established the theme "experiencing leisure" above. Yet, as sections coded with "time and consumption" frequently represent leisure as being of importance with regard to individual consumption, we decided to take a closer look at possible differences between these two subthemes.

Time and consumption

Within coded sections focusing on "time and consumption" (20 findings), the use of one's time is directly related to consumptive purposes, such as "thought experiment': a day without electrical energy" (EthFöS1, p. 38) or "capitalism as system of acceleration" pointing to "24-hour-consumption" (WNNi2, p. 43). In these sections, interrelations between time use and patterns of consumption appear to be starting points for discussion. Many of these contain suggestions for assignments in which students are supposed to consider possible solutions to time scarcity as one possible cause of unsustainable consumption. These sections might serve as starting point for igniting reflections on the relationship between time and sustainable consumption when taught in class.

A second example is an optional unit entitled "time is money" (FhwRLP1, p. 75) contained in various curricula from Rhineland-Palatinate, focusing on unsustainable outcomes as possible results of the notion of "time is money," including fast food, fast fashion, or single-use items. This shows that the findings on "time and consumption" appear to be influenced by sociological analyses of acceleration such as those

| | Time and consumption | |
|-----------------------------|---|---|
| | Time and consumption | Leisure and consumption |
| Analytical definition | Sections coded suggest that a relation between time and consumption is established through putting time into context with consumption-related topics. | Sections coded establish a relation between leisure and consumption, seemingly suggesting leisure as an important realm of consumption. |
| Example | "Time is money (Fast food, single-use items, fashion)" (FhwRLP1, p. 75) "Assessing consumptive behavior and personal lifestyle" (EthFöS1, p. 20) | "Leisure and consumption" (KathRelNRW1, p. 21) "questioning the meaning and variety of media for spending leisure way" (EthGrTh2, p. 8) |
| No. of findings | 20 | 47 |
| Findings per level | P: 0 | P: 3 |
| | S: 17 | S: 41 |
| | US: 3 V: 0 | US: 2 V: 1 |
| Subjects with most findings | Ethics/philosophy (10) findings) | Languages (13) |

Table 3. Overview of references to time and consumption.

Note. P = primary; S = secondary; U.S. = upper secondary; V = vocational.

of Rosa (2011a). Even though the overall number of findings in this context is small compared to the total number of documents analyzed, they illustrate that there are indeed a few curriculum sections pointing out the interrelation between time and sustainable consumption.

Leisure and consumption

There is a small number of curricula (46) in which an explicit connection between "leisure and consumption" (KathRelNRW1, p. 21) is established, thereby presenting consumption as an activity mainly carried out during leisure. While many acts of consumption do indeed happen during leisure, our findings do not contain any corresponding sections referring to consumption also happening while spending time at school or the workplace. Instead, our findings suggest that curricula are containing normative suggestions on how there are positive as opposed to negative ways of spending one's leisure, as illustrated, for instance, in a section entitled "active shaping of leisure vs. passive consumptive behavior" (FhwRLP1, p. 53).

Only 16 out of the 46 curricula containing findings on "leisure and consumption" explicitly refer to potential negative consequences of time use for the environment. This includes, for instance, a geography unit on the "[i]mpact of leisure behavior on recreation areas and their natural geographic structure" (EkNRW1, p. 26) or a home economics curriculum addressing "leisure behavior and environmental impact" (FhwRLP1, p. 52). Overall, there are only a few findings establishing a relation between time use and possible negative outcomes on the environment.

Over one-third of the coded segments on "leisure and consumption" are focusing on media consumption as a way of spending leisure. For the purpose of our analysis, we defined media consumption very narrowly, ruling out units focusing on media competence (*Medienkompetenz* in German) or those focusing on technical aspects of media use such as how to code or ten-finger typing and so on. Rather, we were interested in passages suggesting a relation between media consumption and time use, for example, "responsible media use in leisure and school" (EngTh1, p. 52) or "questioning the variety of media for shaping leisure" (PhiloMV1, p. 24). Once more, it seems that curricula are containing distinct normative ideas on the quality of time spent on certain activities during leisure. This is further illustrated by several references to "time and consumption" suggesting that students "find alternatives to watching TV and computer games during leisure" (WeS3, p. 29).

Discussion

Within the next paragraphs, we will focus on three main observations regarding the relation between time and sustainability in German curricula, before attempting a more general outlook on the implications we consider important in the context of ESD.

The limited extent of dealing with time as a resource for sustainability in German curricula

Regarding RQ1, *To what extent is time as a resource for sustainability addressed in German state school curricula in different school types and subjects?* our findings illustrate that a perspective on time as a resource for sustainability is rarely found within German curricula. We pointed out how time as a resource for sustainability is mostly dealt with in subjects like philosophy, social sciences, and religious education. This is not surprising, as these are traditionally the kinds of subjects where social phenomena are approached from a reflexive perspective. Moreover, this kind of reflexive approach to time is mostly taught at the secondary level, which may at least partly be explained by the fact that with advanced age, it is possible to ignite more complex discussions and processes of reflection among students (Dornheim & Weinert, 2019). Yet, there is a comparatively smaller number of references to time as a resource for

sustainability at upper secondary or vocational education level curricula, which may be explained by both education levels covering comparatively fewer years than secondary level. Moreover, education at upper secondary and vocational levels focuses more on students' final exams (i.e., university entrance qualification or final exams required for the completion of vocational training), thus giving greater weight to main subjects such as mathematics or languages than to other subjects.

Given the overall small number of findings on time as a resource for sustainability, it is not surprising that we found few curricula containing sections that relate time and sustainability or, more specifically, time and sustainable consumption to each other. This corresponds with our observation whereby the perspective on time as an important dimension of sustainability is not yet prominently included in either education policy or practice and thus unsurprisingly is not yet prominently included in curricula either.

Perpetuation of social norms on time

When time in German curricula is dealt with from a reflexive perspective, this is mostly found in subjects like philosophy, ethics, or religious education and most often in general education curricula at secondary level. Time in vocational education curricula by contrast is almost exclusively approached from a technical-managerial perspective. As pointed out above, findings from vocational school curricula, while representing only 7.9% of overall findings, contain roughly 45% of all 87 findings on the theme of "time management." Reflexive perspectives on time are therefore likely most often taught at general education schools, considerably less at upper secondary level, and only rarely in vocational schools.

This observation provides evidence that schools are contributing to reinforcing existing social norms of time in the context of societal acceleration (Buddeberg & Hornberg, 2017). Various studies on young people's time use in Western societies point out that time required for school and learning is considered as the main cause for stress and pressure among students (Brannen & Nilsen, 2002; Darmon, 2018; Thing et al., 2015). Time in education is generally experienced as scarce and therefore in need to be "managed" and used "efficiently" (Dornbach, 2014, pp. 44–45). Modern pedagogy, Gravesen and Ringskou (2017) suggest, has become a "timeagogy," where "time and time pressure [constitute] an accelerated pedagogy that deeply affects the everyday practices of pedagogs and their relationships with the children" (ibid., p. 174). Modern schooling thus seems to contribute to teaching young people the ability of "squeezing time" (Southerton, 2003), thereby resulting in the perpetuation of those kinds of individual time use which we identified among the causes of unsustainable practices.

Presentation of consumption as part of individual leisure sphere

We found that the connection between time and sustainable consumption is very rarely addressed by German curricula. Where it does occur, it is striking that consumption is mostly described as being part of students' leisure sphere. While the connection between leisure and consumption is obvious and well evidenced (Druckman & Gatersleben, 2019; Røpke & Godsesken, 2007), we see three shortcomings with this approach: First, it omits relevant consumptive practices associated with any kind of school-related activity including transportation, acquiring school supplies, or options for school lunch. Second, it falls short of providing students with the bigger picture: Rather than just focusing on their individual behavior, it might for instance be possible to enable students to better understand the underlying systemic causes of unsustainable consumption practices (see, e.g., Grunwald, 2010; Sutoris, 2019). Third, the focus on leisure and consumption might contribute to obscure the fact that all other areas of our time use also have potentially negative impacts on the environment.

With regard to time use and sustainable consumption, this would have to include a stronger focus on the school as a "setting" where students are spending considerable amounts of time, which in turn has implications on their everyday consumptive behavior (Fischer, 2011) and which can, at least partly, be influenced by individual time use decisions. This includes, for instance, transportation to school and back home or food practices including bringing snacks or buying meals provided by the school cafeteria. Considering the ongoing expansion of all-day schools in Germany,⁴ young people are experiencing an

increasing overlap between school and leisure, for example, through sports or music practice taking place at schools during afternoons (Blumentritt et al., 2014; Soremski & Lange, 2010). These blurring boundaries between "school" and "leisure" might then serve to provide a variety of tangible entry points into discussions of consumption as a crosscutting element characterizing and being related to the various spheres of spending one's time, instead of focusing on isolated spheres like leisure.

Implications for ESD

So far, we have shown that the perspective on time in German curricula is mostly one that understands time as a scarce economic resource. Moreover, curricula predominantly present consumption as something that takes place outside of school instead of pointing out how consumption is linked to all areas of life. With regard to ESD, this leaves room for a more sophisticated engagement with time as an essential dimension of sustainability. We would like to conclude our discussion by suggesting four implications for further research and practice within ESD.

First, we consider the time perspective useful for school development from an ESD perspective. While there are a number of practitioners and researchers emphasizing the need for rethinking time in education (Drews, 2008; Lingard & Thompson, 2017; Reheis, 2007), it remains contested how such a shift might look. Considering time as an essential dimension of sustainability, we suggest that it readily connects to the long-standing discussion of whole school approaches for ESD (e.g., Mathar, 2015; Mogren, 2019) (where, ironically, teachers and school administrators often mention lack of time as a main hurdle to implementation; Hargreaves, 2008). In this context, school development dedicated to sustainability-related outcomes would need to focus on institutional aspects of time as well as on individual time use, for example, through promoting time use competence both within curricula and in everyday learning and teaching practices.

A second implication is that we consider our findings of potential value for curriculum development. At present, ESD is mainstreamed into German curricula at an increasing rate (von Seggern, 2019). We thus consider our findings important for policymakers interested in extending ESD-related content in curricula related to individual subjects but also as a crosscutting issue, since time and time use are cross-cutting topics as well. With regard to the German-speaking education context, time use competence as suggested by Frank et al. (2020) readily connects to the core concept of "shaping competence" for ESD ("Gestaltungskompetenz") (de Haan, 2006). It includes the ability of thinking and acting anticipatorily with regard to sustainable development and thus already provides a framework for including the perspective on time and sustainability more prominently within ESD discourse and practice.

Third, our findings might serve to spark future research inquiring into the complex relations between time and sustainability in physical school settings as well as into the various ways contents of curricula are taught in class. Since curricula come with a certain freedom for interpretation, research about individual teachers' approaches to time and sustainability in the classroom might certainly serve to enhance the understanding of how to establish the topic of time as a dimension of sustainability within formal education.

Finally, our findings might provide a starting point for developing teaching materials on time and sustainability similar to Butler et al. (2012) or Grauer et al. (2021). Formal education experts as well as other actors including nongovernmental organizations working in ESD contexts could engage with and thus contribute to promoting the concept of time as a resource for sustainability independent from the more formalized and lengthy process of mainstreaming it into formal education curricula.

Limitations

We acknowledge some limitations related to our research. First, we limited our search to the actual term "time" (**zeit**). We may therefore have missed sections dealing with time-related issues that do not contain the term **zeit**, such as "acceleration" ("*Beschleunigung*"). This decision was made for two reasons; pragmatically, to keep the body of data within feasible dimensions. Conceptually, we were interested in how time is framed as a concept, which we were only able to elicit by searching for explicit usages of the

term. Future research could expand this study by using more extensive search strings that also include more implicit references to time use.

Second, it is possible that we have overlooked sections that do not meet our criteria but that nonetheless serve as starting points for teaching about time as a resource. For example, time as a unit of measurement in mathematics did not fit our selection criteria, yet teachers could also motivate their students to reflect on individual time use in this context.

Conclusions

Our analysis of German curricula aimed at providing empirical evidence on whether and how curricula contain references to time as a resource for sustainability. We found that the interrelation between time and sustainable consumption is rarely discussed—neither, it seems, in most subjects overall nor within sections focusing on ESD-related content. Based on these findings, we suggest two possible starting points for future inquiry.

First, there is a lack of research on how time is taught, learned, and experienced in schools, especially from the perspective of time as a resource for sustainability. This would include a systematic analysis of how time is treated in different subjects and how it is generally handled in classroom settings, for instance, through using ethnographic approaches. It would also mean examining whether and how these various practices and contents related to time are connected to young peoples' sustainability-related consumption practices. Research of this kind might also include a focus on school as a time-shaping institution that is perpetuating norms of social acceleration. This would entail studying the manifold time structures that characterize educational institutions, such as timetables, which organize learning in forms of fixed collective rhythms, or requirements, which extend beyond the actual school day such as homework and thereby extend school time into other spheres of students' lives.

In addition, given the considerably large periods that curriculum development processes usually require, we consider it relevant for ESD practitioners and researchers to work bottom up and try out and experiment with approaches motivating students to reflect on their individual time use and link this to questions of sustainability. This would imply a systematic search for, testing, and evaluation of learning activities enabling learners to build time use competence. The concept of time as a resource for sustainability presented in this paper might serve as one starting point for such a venture.

Notes

- 1. The terms most commonly used in German are "Lehrpläne," "Bildungspläne," or "Kerncurricula."
- Religious education is compulsory in many German states. Students who opt out of participating in religious education often have to attend ethics instead—depending on the respective states' regulations regarding participation in religious education. In some states, philosophy is taught instead of ethics, in others, philosophy is taught as a compulsory subject throughout secondary level.
- 3. Direct quotes from curricula are included in English translation only and all translations are by the authors.
- 4. All-day schools have only been widely introduced in Germany since the year 2003. Per definition, an all-day school needs to offer supervision of students for at least three days per week with at least seven full hours per day. As per 2017, about 70% of German public schools were all-day schools (Kultusministerkonferenz, 2019).

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ORCID

Claire Grauer (b) http://orcid.org/0000-0003-3555-4663 Daniel Fischer (b) http://orcid.org/0000-0001-5691-0087 Pascal Frank (b) http://orcid.org/0000-0001-6130-0099

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Appendices

Appendix 1. Overview of total number of curricula, number of documents identified, and text sections identified per federal state

| Federal state | Total No. of curricula documents | Documents containing sections identified | % of documents containing sections identified | No. of findings in total |
|-------------------------------|-------------------------------------|---|---|-----------------------------|
| Baden-Württemberg | 120 | 22 | 21% | 54 |
| Bavaria | 398 | 18 | 5% | 24 |
| Berlin Brandenburg | 78 | 13 | 16% | 22 |
| Bremen | 104 | 7 | 7% | 12 |
| Hamburg | 103 | 12 | 12% | 20 |
| Hesse | 56 | 7 | 13% | 9 |
| Mecklenburg Western Pomerania | 127 | 9 | 7% | 18 |
| Lower Saxony | 139 | 20 | 14% | 28 |
| Northrine-Westphalia | 101 | 13 | 13% | 21 |
| Rhineland-Palatinate | 116 | 27 | 23% | 86 |
| Saarland | 262 | 14 | 5% | 25 |
| Saxony | 194 | 25 | 13% | 37 |
| Saxony-Anhalt | 75 | 13 | 17% | 30 |
| Schleswig-Holstein | 150 | 22 | 15% | 44 |
| Thuringia | 127 | 17 | 13% | 38 |
| Total | 2,149 | 239 | | 468 |
| Average | | | 1306 | |

Average

Note. <u>Curricula documents</u>: Curricula are, in general, published per subject, school form, and grade, e.g., "Mathematics, Primary School, grade 1," and are available as PDF online via education authorities of each state. Their number per state varies greatly because some states have issued individual curricula per each subject, school type, and grade whereas others are combining curricula for various school types or grades, thus resulting in numbers varying between 56 (Hesse) and 398 (Bavaria).

Documents containing sections identified: Number of documents in which we identified passages relevant to our search on "time as a resource."

Appendix 2. Sources for curricula document downloads per federal state

Baden-Württemberg

Ministerium für Kultus, Jugend und Sport, Baden-Württemberg (2016). *Bildungspläne 2016*. Retrieved November 4, 2018, from http://www.bildungsplaene-bw.de/,Lde/Startseite/Informationen/Impressum

Berlin Brandenburg

Bildungsserver Berlin Brandenburg (n.d.). *Rahmenlehrpläne*. Rahmenlehrpläne und Materialien. Retrieved November 3, 2018, from https://bildungsserver.berlin-brandenburg.de/unterricht/rahmenlehrplaene

Bavaria [Bayern]

Staatsinstitut für Schulqualität und Bildungsforschung München (n.d.). *Lehrplan*. München. Retrieved November 03, 2018, from http://www.isb.bayern.de/schulartspezifisches/lehrplan/

Bremen

Landesinstitut für Schule Bremen (n.d.). *Bildungspläne nach Stufen*. Retrieved October 30, 2018, from https://www.lis. bremen.de/sixcms/detail.php?gsid=bremen56.c.15219.de

Hamburg

Behörde für Schule und Berufsbildung (n.d.). *Bildungspläne*. Retrieved November 03, 2018, from https://www.hamburg. de/bildungsplaene

Hesse [Hessen]

Hessisches Kultusministerium (n.d.). *Kerncurricula*. Retrieved November 04, 2018, from https://kultusministerium.hessen.de/schulsystem/bildungsstandards-kerncurricula-und-lehrplaene/kerncurricula

Mecklenburg Western Pomerania [Mecklenburg-Vorpommern]

Bildungsserver Mecklenburg-Vorpommern (n.d.). *Rahmenpläne an allgemein- bildenden Schulen*. Schwerin. Retrieved November 04, 2018, from https://www.bildung-mv.de/schueler/schule-und-unterricht/faecher-und-rahmenplaene/ rahmenplaene-an-allgemeinbildenden-schulen/

Lower Saxony [Niedersachsen]



Niedersächsisches Kultusministerium (n.d.). Verzeichnis der niedersächsischen Lehrpläne. Hannover. Retrieved November 03, 2018, from https://www.mk.niedersachsen.de/startseite/service/rechts_und_verwaltungsvorschriften/lehrplaene/lehrplaene_allgemein_bildende_schulen/lehrplaene-allgemein-bildende-schulen-6378.html

NRW

Qua-Lis NRW (n.d.). *Lehrplannavigator*. Qualitäts- und Unterstützungsagentur - Landesinstitut für Schule. Soest. Retrieved November 04, 2018, from https://www.schulentwicklung.nrw.de/lehrplaene/

Rheinland-Pfalz

Bildungsserver (n.d.). *Lehrpläne*. Bildungsserver Rheinland-Pfalz. Retrieved November 04, 2018, from https://lehrplaene. bildung-rp.de/

Saarland

Bildungsserver (n.d.). Lehrpläne und Handreichungen. Ministerium für Bildung und Kultur Saarland. Saarbrücken. Retrieved November 04, 2018, from https://www.saarland.de/lehrplaene.htm

Sachsen

sachsen.de (n.d.). *Verzeichnis der Lehrpläne & weiterer Materialien*. Sächsisches Landesamt für Schule und Bildung. Dresden. Retrieved November 04, 2018, from https://www.schule.sachsen.de/lpdb/

Sachsen-Anhalt

Bildungsserver Sachsen-Anhalt (n.d.). *Lehrpläne/ Rahmenrichtlinien*. Landesinstitut für Schulqualität und Lehrerbildung Sachsen-Anhalt. Halle. Retrieved November 04, 2018, from https://www.bildung-lsa.de/lehrplaene___rahmenrichtlinien.html

Schleswig-Holstein

Institut für Qualitätsentwicklung an Schulen Schleswig-Holstein (n.d.). *Lehrpläne des Landes Schleswig-Holstein*. Kiel. Retrieved November 04, 2018, from https://lehrplan.lernnetz.de/

Thüringen

Thüringer Schulportal (Erfurt) (n.d.). *Thüringer Lehrpläne*. Thüringer Ministeriums für Bildung, Jugend und Sport. Retrieved November 04, 2018, from https://www.schulportal-thueringen.de/lehrplaene

Appendix 3. Curricula quoted in results section

- ALNRW1: Ministerium für Schule und Weiterbildung des Landes Nordrhein- Westfalen (2013). Arbeitslehre. Hauswirtschaft, Technik, Wirtschaft. Retrieved November 04, 2018, from https://www.lehrplannavigator.nrw.de
- AnSH1: Ministerium für Bildung, Wissenschaft, Forschung und Kultur des Landes Schleswig-Holstein (n.d.). Anhang. Kommentare zu den vierzehn Leitthemen und Didaktische Landkarten. Ministerium für Bildung, Wissenschaft, Forschung und Kultur des Landes Schleswig-Holstein (Ed.). Retrieved November 04, 2018, https://lehrplan.lernnetz.de/index.php?wahl=4
- EkNRW1: Ministerium für Schule und Weiterbildung des Landes Nordrhein- Westfalen (2011). *Kernlehrplan für die Realschule in Nordrhein-Westfalen*. Retrieved November 04, 2018, from https://www.lehrplannavigator.nrw.de
- EngHH1: Die Senatorin für Bildung und Wissenschaft (2008). Berufliche Bildungsgänge mit Erwerb der Fachhochschulreife. Englisch Sekundarstufe II. Retrieved November 04, 2018, from https://www.lis.bremen.de/schulqualitaet/curriculumentwicklung/bildungsplaene/sekundarbereich_ii_berufsbildend-15316
- EngTh1: Thüringer Ministerium für Bildung, Wissenschaft und Kultur (2011). *Englisch. Lehrplan für den Erwerb des Hauptschul- und des Realschulabschlusses*. Retrieved November 04, 2018, from https://www.schulportal-thueringen. de/lehrplaene
- EthFöS1: Sächsisches Bildungsinstitut (2017). Lehrplan der Schule mit dem Förderschwerpunkt geistige Entwicklung. Ethik. Retrieved November 04, 2018, from https://www.bildung.sachsen.de/apps/lehrplandb/
- EthGrTh2: Thüringer Ministerium für Bildung, Wissenschaft und Kultur (2010). *Lehrplan für die Grundschule und für die Förderschule mit dem Bildungsgang der Grundschule. Ethik.* Retrieved November 04, 2018, from https://www.schul-portal-thueringen.de/web/guest/lehrplaene/grundschule
- EthGymS2: Sächsisches Staatsministerium für Kultus und Sport (2004/2009/2011). Lehrplan Gymnasium: Ethik. Retrieved November 04, 2018, from https://schule.sachsen.de/lpdb/
- EthHE1: Hessisches Kultusministerium (2011). Ethik. Primarstufe. In: *Bildungsstandards und Inhaltsfelder Das neue Kerncurriculum für Hessen*. Retrieved November 03, 2018, from https://kultusministerium.hessen.de/schulsystem/bildungsstandards-kerncurricula-und-lehrplaene/kerncurricula/primarstufe/ethik
- EthSA1: Kultusministerium Sachsen- Anhalt (n.d.). *Fachlehrplan Grundschule: Ethikunterricht*, Retrieved November 04, 2018, from https://www.bildung-lsa.de/lehrplaene____rahmenrichtlinien.html
- PhiloHH1: Behörde für Schule und Berufsbildung (2011). Bildungsplan Gymnasium Sekundarstufe I. Philosophie. Retrieved November 03, 2018, from https://www.hamburg.de/bildungsplaene/2363352/gym-seki/

- EvRelBay1: Staatsinstitut für Schulqualität und Bildungsforschung München (2018). Fachlehrpläne Mittelschule: Evangelische Religionslehre M8. Retrieved November 03, 2018, from https://www.isb.bayern.de/schulartspezifisches/lehrplan/
- FhwRLP1: Ministerium für Bildung, Wissenschaft und Weiterbildung (1999). Lehrplan Wahlpflichtfach Familienhauswesen. Realschule. Retrieved November 04, 2018, from https://lehrplaene.bildung-rp.de/
- GeiEntNi1: Niedersächsisches Kultusministerium (2007). Kerncurriculum für den Förderschwerpunkt Geistige Entwicklung. Schuljahrgänge 1-9. Retrieved November 03, 2018, from https://db2.nibis.de/1db/cuvo/ausgabe/
- GesNi3: Niedersächsisches Kultusministerium (2015). *Kerncurriculum für das Gymnasium Schuljahrgänge 5-10: Geschichte*, Retrieved November 03, 2018, from https://www.cuvo.nibis.de
- GewBRB1: Landesinstitut für Schule und Medien Berlin-Brandenburg (n.d.). *Teil C Gesellschaftswissenschaften. Jahrgangsstufen 5/6.* Retrieved November 03, 2018, from https://bildungsserver.berlin-brandenburg.de/unterricht/ rahmenlehrplaene
- KathRelNRW1: Ministerium für Schule und Weiterbildung des Landes Nordrhein- Westfalen (2013). Katholische Religionslehre. Kernlehrplan für die Hauptschule in Nordrhein-Westfalen. Retrieved November 04, 2018, from https://www.lehrplannavigator.nrw.de
- KathRelSH2: Ministerium für Bildung, Wissenschaft, Forschung und Kultur des Landes Schleswig-Holstein (n.d.). Lehrplan Grundschule: Katholische Religion. Retrieved November 04, 2018, from https://lehrplan.lernnetz.de/
- PhiloMV1: Minister für Bildung, Wissenschaft und Kultur (n.d.). Rahmenplan Philosophieren mit Kindern. schulartenunabhängige Orientierungsstufe, Klassenstufe 5-6. Retrieved November 04, 2018, from https://www.bildung-mv.de/ schueler/schule-und-unterricht/faecher-und-rahmenplaene/rahmenplaene-an-allgemeinbildenden-schulen/ philosophie/
- SozpädRLP2: Ministerin für Bildung, Frauen und Jugend (1999). Wahlpflichtfach Sozialpädagogik: Sekundarstufe I 9. und 10. Klasse der Realschule. Retrieved November 04, 2018, from https://lehrplaene.bildung-rp.de/
- SuB1: Der Senator für Bildung und Wissenschaft (2007). Sachunterricht. Bildungsplan für die Primarstufe. Retrieved October 30, 2018, from https://www.lis.bremen.de/schulqualitaet/curriculumentwicklung/bildungsplaene/primarstufe-15222
- SuBW1: Ministerium für Kultus, Jugend und Sport, Baden-Württemberg (2016). Sachunterricht. In Bildungsplan der Grundschule, Bd. 12. Retrieved November 04, 2018, from https://www.bildungsplaene-bw.de/,Lde/LS/BP2016BW/ALLG/GS/SU
- VerSH1: Ministerium für Bildung und Frauen des Landes Schleswig-Holstein (2009). Lehrplan für die Sekundarstufe I der weiterführenden allgemeinbildenden Schulen Regionalschulen, Gemeinschaftsschulen, Förderzentren: Fachliche Konkretionen Verbraucherbildung. Retrieved November 04, 2018, from https://lehrplan.lernnetz.de
- WeS3: Sächsisches Staatsministerium für Kultus und Sport (2005/2010). Lehrplan Schule zur Lernförderung. Werken. Retrieved November 04, 2018, from https://www.schule.sachsen.de/lpdb/
- WNNi2: Niedersächsisches Kultusministerium (2018). Werte und Normen. Kerncurriculum für das Gymnasium gymnasiale Oberstufe die Gesamtschule – gymnasiale Oberstufe das Berufliche Gymnasium das Kolleg. Retrieved November 03, 2018, from https://www.cuvo.nibis.de
- WUETh3: Thüringer Ministerium für Bildung, Wissenschaft und Kultur (2012). Wirtschaft-Umwelt-Europa. Lehrplan für den Erwerb des Hauptschul- und des Realschulabschlusses. Retrieved November 04, 2018, from https://www.schulportal-thueringen.de/lehrplaene

Appendix 4. Technical report

<u>Note to the reader</u>: In this annex, we present the methodological procedure of the curriculum analysis in more detail than in the corresponding section of the paper. Here you will find some excerpts from the paper, enriched with more detailed information on our methodological approach.

Study aim and research questions

In order to systematically investigate how far and in which way time as a resource with relevance for sustainability is addressed in curricula, we undertook a curriculum analysis. Using the case of Germany as a leading country in the implementation of ESD in education policies (UNESCO, 2014), we therefore reviewed 2,149 German state school curricula, guided by the following research questions:

RQ1: To what extent is time as a resource for sustainability addressed in German state school curricula in different school types and subjects?

RQ2: With which meanings is time as a resource for sustainability addressed in German state school curricula, and what connections are made between time and consumption?

Study design

Throughout the process, we worked in a research team consisting of two research associates and one research assistant. We began our analysis by gathering all German curricula operational in school year 2018/2019, the school year our research took place in. We first downloaded the curricula from respective authorities' websites (see Appendices 1 and 2) where they are publicly accessible in PDF format. The large number stems from the fact that each of the 16 German federal states issues its own curricula and, in some cases, has introduced its own types of schools.

Documents were then analyzed using software program MAXQDA by a two-step analysis procedural approach:

- 1. Identification of sections relevant to our research interest in time as a resource for sustainability
- 2. Coding of identified sections in order to arrive at a set of themes describing the content of identified sections

1. Identification of sections relevant to our research interest in time as a resource for sustainability

- We first ran a lexical search for the search term "zeit" ("time") to identify sections containing references to time.
- We only included those sections containing concrete suggestions of teaching content, leaving out all other parts of
 the documents such as introductory chapters, appendices, or general advice regarding competences learned or
 evaluation criteria as we were primarily interested in content that would likely be taught in classroom settings.
- Next, we assessed every section manually through content analysis (Mayring, 2015) in order to decide whether the
 notion of time mentioned was relevant with regard to our interest in time as a resource of sustainability. Therefore
 we defined the following exclusion criteria (meaning the sections containing any of the following meanings of "zeit"
 (time) were not considered for further analysis):
 - o Terms etymologically unrelated to time ("Zeit") such as "Zeitung" (newspaper) or "Zeitzeuge" (witness of a time period)
 - o References to "Zeit" (time) in terms of time as "period, time segment of life or history" (Duden, 2018)
 - o Passages containing semantically generic or compound terms such as "Jahreszeit" (season), "Mahlzeit" (meal), as well as adjectives such as "gleichzeitig" (simultaneously) and "zeitlich" (timely)
 - o Passages where time appeared as a means of measurement or quantity, e.g., in mathematics or physics curricula
 - o References to time as a grammatical category in language curricula
 - o References to time related to specific historical periods in subjects like history or politics
- We thus identified 239 documents containing 468 references matching our notion of time as a resource for sustainability out of 2,149 curricula.

2. Coding of identified sections in order to arrive at a set of themes describing the content of identified sections

- We then began coding the 468 identified sections by an inductive coding procedure in order to distill a set of themes capturing the specific ways in which time as a resource for sustainability was addressed in curricula (Spichal, 2018).
- Coding was accompanied by continuous discussions within the research team in order to ensure that we were applying
 the same standards and understandings to our data, especially in case of disagreements (Gläser & Laudel, 2010).
- When no further themes emerged, we arrived at a definite list of seven themes representing the various approaches to time as a resource within German curricula. (See Table 2 as well as the table below.)

| Theme (English translation) | Theme (German terminology) | Definition |
|---------------------------------------|----------------------------|---|
| Reflecting individual time use | Persönliche Zeitreflexion | Findings refer to qualitative aspects of spending time allowing for the conclusion that students are encouraged to reflect on their individual time use. |
| Managing time | Zeitmanagement | Findings contain teaching specific methods for a "purposeful organization of time" (Hatzelmann & Held, 2015), while going beyond a "ticking-a-box" approach, and may allow for reflection on time use. |
| Spending time on consumption | Zeit und Konsum | Findings establish direct relations between time and consumption, including leisure and consumption and media consumption. |
| Experiencing leisure | Freizeit | Findings refer to students' experience of "free" or "leisure" time. |
| Experiencing time in everyday life | Zeiterleben | Findings contain references to how individuals may perceive certain time-related phenomena, e.g., calendars and holidays, or by referring to acceleration or slowing down. |
| Reflecting on time in general | Allgemeine Zeitreflexion | Here, time is presented as a means of structuring life, collectively as well as individually. This includes various phases in life or rhythms such as natural cycles or clock-time rhythms). |
| Experiencing time in society | Zeit und Gesellschaft | Findings refer to time as experienced in modern Western societies, where time is attributed to mutually exclusive spheres (e.g., "school" or "work" time as opposed to "leisure"). |

- All sections identified in the first step were then recoded a second time by two independent coders (one research associate and one research assistant) using the agreed-upon set of themes as codes.
- Once the coding was finalized, we calculated intercoder reliability as an additional check to appraise the shared understanding and consistent application of the identified themes by use of the web-based tool ReCal for 2 Coders (Freelon, 2010). We arrived at 95.2% agreement (Scott's pi [π] = 0.717, Cohen's kappa [κ] = 0.719, Krippendorff's [α] = 0.717), indicating an acceptable rate of agreement between two independent coders.
- The final step was compiling an Excel file containing all findings and codes, adding separate columns for relevant criteria per each finding such as such as school type, grade, subject, and federal state to each finding. This allowed for further quantitative analysis of data, such as determining the distribution of themes across school levels or subjects (see Table 2 for results).