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**Analyzing (and Comparing) Policy Mobilities in Federal
Education Systems: Potentials of a Topological Lens¹**

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Abstract: This contribution takes up and discusses *topology* as a relational approach to better understand and empirically trace policy mobilities in federal education systems. While topology echoes other relational approaches in its simultaneous focus on ongoing change and the “making” of stabilized forms (e.g., policy *scales*), it also brings attention to facets of policy mobility research that other approaches have, at least so far, considered to a much lesser extent.

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Such facets include the systematic integration of a *temporal dimension* (e.g., rhythms of scale- or policy-making) as well as the consideration of *digital/data space-times*. Equally, topology reminds us that policy itself is increasingly *becoming topological*—that is to say, policy-making is increasingly ruled by movement spaces, logics of connectedness, and capacities for change, instead of formal authority, position, or transmission. Integrating these different dimensions into a heuristic framework, we illuminate what we see differently when applying a topological lens to policy mobility analysis in federal education systems, using the example of German education policies since the 2000s, particularly transformations induced by the ongoing pandemic, as a case study.

Keywords: topology; policy analysis; digitization; federal systems; Germany; COVID-19

Análisis (y comparación) de movibilidades de políticas en los sistemas educativos federales: Potencialidades de una lente topológica

Resumen: Esta contribución analiza la topología como un enfoque relacional para comprender mejor y rastrear empíricamente las movibilidades de las políticas en los sistemas educativos federales. Si bien la topología se hace eco de otros enfoques relacionales en su enfoque simultáneo en el cambio continuo y la ‘creación’ de formas estabilizadas (por ejemplo, ‘escalas’ de políticas), también llama la atención sobre facetas de la investigación de movilidad de políticas que otros enfoques han, al menos hasta ahora, considerado en mucha menor medida. Tales facetas incluyen la integración sistemática de una dimensión temporal (p. ej., ritmos de escala o formulación de políticas), así como la consideración de espacios-tiempos digitales/datos. Igualmente, la topología nos recuerda que la política en sí misma se está volviendo cada vez más topológica, es decir, la elaboración de políticas está regida cada vez más por “espacios de movimiento”, lógicas de conexión y capacidades para el cambio, en lugar de autoridad formal, posición o transmisión. Al integrar estas diferentes dimensiones en un marco heurístico, iluminamos lo que vemos de manera diferente cuando aplicamos una lente topológica al análisis de movilidad de políticas en los sistemas educativos federales, usando el ejemplo de las políticas educativas alemanas desde la década de 2000, particularmente las transformaciones inducidas por la pandemia en curso, como un caso de estudio.

Palabras-clave: topología; análisis de políticas; digitalización; sistemas federales; Alemania; COVID-19

Analisando (e comparando) mobilidades de políticas em sistemas federais de ensino: Potencialidades de uma lente topológica

Resumo: Esta contribuição discute a topologia como uma abordagem relacional para melhor compreender e rastrear empiricamente as mobilidades políticas nos sistemas federais de ensino. Embora a topologia ecoe outras abordagens relacionais em seu foco simultâneo na mudança contínua e na ‘criação’ de formas estabilizadas (por exemplo, ‘escalas’ de políticas), ela também chama a atenção para facetas da pesquisa de mobilidade de políticas que outras abordagens têm, pelo menos até agora, considerado em muito menor grau. Tais facetas incluem a integração sistemática de uma dimensão temporal (por exemplo, ritmos de escala ou formulação de políticas), bem como a consideração de espaços-tempos digitais/dados. Da mesma forma, a topologia nos lembra que a própria política está se tornando cada vez mais topológica, ou seja, a formulação de políticas é cada vez mais governada por “espaços de movimento”, lógicas de conexão e capacidades de mudança, em vez de autoridade formal, posição ou transmissão. Integrando essas diferentes dimensões em uma estrutura heurística, iluminamos o que vemos de diferente ao aplicar uma lente topológica à análise de política de mobilidade nos sistemas federais de educação, usando o exemplo das políticas educacionais alemãs desde os anos 2000, particularmente as transformações induzidas pela pandemia em curso, como um estudo de caso.

Palavras-chave: topologia; análise de políticas; digitalização; sistemas federais; Alemanha; COVID-19

Analyzing (and Comparing) Policy Mobilities in Federal Education Systems: Potentials of a Topological Lens

This paper contributes to a growing body of policy mobility research that analytically addresses the specificities of federal systems in their response to global education policy dynamics (e.g., Engel & Frizzell, 2015; Hartong, 2018; Savage & Lewis, 2018; Wallner, 2017). In recent years, such research has, for instance, called for closer scrutiny of how *the subnational* substantially affects and is affected by global policy dynamics. In doing so, this research has critically responded to past studies that have often investigated manifestations of global policy trends—such as the proliferation of educational testing, standardization, accountability, and datafication—mainly through the lens of comparing “national reactions” (Wallner et al., 2020).

At the same time, such federal policy mobility research has substantially contributed to broader debates in the field, which had already been arguing for quite some time for a denaturalization of policy spaces or scales (e.g., national, global, local) as given or nested within each other, or policies being nested within these spaces or scales (e.g., global policies). Instead, such debates have called for understanding both—spaces/scales *and* policies—as being continuously (re)enacted and as transforming *conjointly*. While policies are, in such a view, always restricted by existing spatial/scalar configurations, they equally always present struggles over space/scale—for example, through creating powerful narrations or imaginaries (Papanastasiou, 2019). Additionally, since spaces/scales are always interrelated within wider assemblages, transformations should always be approached in this multidynamic way, recognizing that there is an “agential enfolding” of spaces or scales *through* one another (Barad, 2005, p. 245, cited in Decuyper & Lewis, 2021). Taking up such an understanding, scholars in federal policy mobility research have, for instance, shown how federal education systems may actually differ significantly in how *the subnational*, *the national*, and *the federal* are being co-enacted and how they then transform in conjunction with particular (global) policies (Hartong & Piattoeva, 2021; Savage & Lewis, 2018; Wallner et al., 2020).

There has been growing scholarly enthusiasm about investigating such dynamics and complexities of space/scale-making. However, substantial challenges arise, particularly for comparative research, when we systematically call into question frameworks that are still commonly used to locate, describe, or distinguish policy actors from one another or to trace political power shifts with reference to a particular context (Bartlett & Vavrus, 2019; Piattoeva et al., 2018; Sobe, 2018). Over recent years, scholars have accordingly developed alternative, more *relationally* oriented concepts to name, trace, and compare policy mobilities and space/scale-making as the ongoing (un/re)building or unfolding of relations. Examples include Carney’s (2009) notion of “policyscapes,” Robertson and Dale’s (2015) concept of “education ensembles” or different “policy assemblage” approaches (e.g., Peck & Theodore, 2015; Savage, 2020). In addition, new space-sensitive methodologies for empirical analysis have been developed, which claim to be more open or inventive (Gulson et al., 2017) regarding the tracing of relations. Such approaches do not usually abandon, for example, policy scales but instead seek methodological ways to problematize the idea of, for instance, the national level when disentangling particular policy assemblages (e.g., Savage & Lewis, 2018).

Despite such undoubtedly important achievements, the emergent field of space/scale-sensitive policy mobility studies is far from being saturated. Instead, there remains considerable work to be done to *empirically* show (1) what we do *not* see when investigating policies as nested in

scales or spaces and (2) what we *instead* see (differently), for example regarding the recontextualization of global reform, when applying alternative approaches. A rising number of studies have taken up this work already (e.g., Carney, 2009; Hartong, 2018; Lewis, 2021; Savage & Lewis, 2018; Takayama & Lingard, 2021).

In line with this argumentation, this article takes up and discusses topology as a relational approach, which in recent years has increasingly been adopted in the field of policy mobility analysis, including in the education sector (for a recent overview, see Decuyper et al., 2022; see also Gulson et al., 2017; Hartong & Piattoeva, 2021; Martin & Secor, 2014). While topology echoes other relational approaches in its simultaneous focus on ongoing change and the making of stabilized forms, it equally brings attention to facets of policy mobility research that other approaches have, at least so far, considered to a much lesser extent. As we describe in more detail in the next section, such facets include the systematic integration of a *temporal* dimension (e.g., rhythms of scale- or policy-making), as well as a strong consideration of *digital/ data space-times*. Equally, topology emphasizes that policy itself is increasingly *becoming topological* (Lury et al., 2012); that is to say, policy-making is increasingly ruled by movement spaces, logics of connectedness, and capacities for change, instead of formal authority, position, or transmission. Hence, in our view, the topological lens offers significant potential to also further develop federal and comparative policy studies.

Topology has undoubtedly increased in popularity among policy scholars, including attempts to integrate a topological lens into, for instance, assemblage research (Thompson & Cook, 2015; Savage & Lewis, 2018; Hartong, 2018; Takayama & Lingard, 2021). However, topology is still in the initial stages of being made (more easily) accessible, conceptually sharp(er), and methodologically applicable to analyses in the education field (Decuyper et al., 2022). With our paper, we seek to contribute to that agenda by developing a topologically-informed analytical heuristic applicable (not only) to federal policy analysis. We then use that heuristic to investigate German education policy transformations since the 2000s, with a specific emphasis on transformations induced by the ongoing COVID-19 pandemic. Germany adheres to an integrated model of federalism based on joint decision-making, in which state school policy is primarily aligned through efforts of the Standing Conference of the Ministers of Cultural Affairs of the German *Länder* (*Kultusministerkonferenz* or KMK) but equally affected by objectives and tasks in the responsibility of the Federal Ministry of Education and Research (*Bundesministerium für Bildung und Forschung*, or BMBF). (We will empirically discuss what this actor constellation *means* from a topological perspective.) Germany's state school policy is also affected by intermediary actors that substantially increased in power since the 2000s. Past periods of intensive policy mobility (e.g., wide-ranging reforms around school performance improvement as well as the gradual emergence of a *digital agenda*) continuously challenged, but has thus far not eroded, this complex policy constellation.

The interest of the study, which will be further framed later in the paper, was to better understand how the recent COVID-19 crisis corresponds to and diverges from these former policy mobilities. Using a topological lens, we particularly investigate the rising nationalization of crisis-related policy (Weber & Wille, 2020). In education, such attempts have been most clearly visible in policies directed at (1) school closure/reopening and (2) the digitization of schooling to enable remote education. As our analysis shows, the topological lens brings our attention to tracing and comparing the evolution of both policies under the influence of the pandemic, which, in the end, enacted different topological forms within the federal architecture. In the case of school closure/reopening, we observed a deformation but, ultimately, a continuing stabilization of the traditional, topographically-oriented form. In contrast, in the case of digitization, new forms of policy-making were created that not only systematically relied on digital space-times but also ultimately eroded large parts of traditional policy authority and scale-making rationales/strategies. At the same time, specifically in the field of digitization, the pandemic gave rise to a substantial

becoming topological of policy-making, installing change through mobilization as a new rationale for education policy-making. Based on our analytical findings, in the final part of the paper, we discuss the potential of a topological lens to inspire future policy mobility analyses, comparative policy research, and research on federalism.

Disentangling Federal Policy Mobilities through a Topological Lens

Like other relational approaches,² the topological lens understands space-making as dynamic and continuously unfolding and yet, at the same time, as manifesting in sustainable and powerful *forms*. Put differently, the topological lens seeks to understand how continuous change and enduring relations can be thought of together (Martin & Secor, 2014), examining which relations endure or what stays *typical* even though changes occur (Decuyper & Simons, 2016).

At the same time, and differently from other relational approaches, the topological lens strongly emphasizes that forms are not only related to spaces (or scales) but equally to *time*-making and the stabilization (or change) of particular temporal relations, as visible in the rhythmization of policies/policy-making (Decuyper & Vanden Broeck, 2020; Landahl, 2020). Even though scholarly work on the interlinkage of spaces and times (also in the education field) is nothing new (see, for instance, Ritella et al., 2016; Alhadeff-Jones, 2019), in policy mobility research there has remained a tendency to focus on space- (or scale-) mobilities nested within a mainly chronological processing of time. As the topological lens suggests, however, it is the ongoing enactment, change, and stabilization of multiple *space-times* that enact policy mobilities and that should, consequently, become more systematically embraced together.

Also in the field of education policy, we can accordingly observe a limitless array of topological space-times, of which *the national*, *the subnational*, and *the federal* are very powerful ones, each of them linked to particular policy rhythmization. While all of these space-times connect in more or less sustained ways, they enact different policies³ through “ensemble effects” (Thompson & Cook, 2015, pp. 737, 743). Put differently, when applying a topological lens, policies appear as the result of dynamic topological co-constitution, while simultaneously contributing to the stabilization of particular topologies (e.g., scale narrations). Elements (such as particular actors, policy documents, etc.) in turn always relate to different topologies. It is this simultaneity of “invariance and intrinsic change (understood as deformation)” (Lury et al., 2012, p. 8)—or in other words, the “continuity of transformation” (Massumi, 2002)—that scholars are interested in deconstructing.

Adopting such a lens on global/local policy mobilities, we consequently see an ongoing interaction of topological space-times, in which there is not one that dominates the others. However, as Thompson and Cook (2015, p. 736) argue, “This is not to say that one topology cannot take primacy in directing forces, at least for a time. It does so, however, because of its relation to all of the principles *working through* all of the enfolded topologies and not because it is ‘on top’” (emphasis and italics added). Consequently, when investigating policy mobilities within federations, it is actually this *power of working through enfolded topologies* that is drawn attention to. We use the term *surface* here to describe this power of working through, that is, a space-time that embraces and affects existent topologies in an inclusive manner⁴ (see also van de Oudeweetering & Decuyper, 2021). As will be shown in our case study, the pandemic can be regarded as one of the most powerful topological surfaces that has been affecting education policy in recent years. It has worked through

² For instance, *assemblage* approaches (Hartong, 2018; Savage, 2020).

³ As well as imagined configurations such as the state (Lury et al., 2012).

⁴ Surface is, thus, not meant in a flat manner, as the term might equally suggest.

and substantially disentangled and reformed existing topologies, which, in turn, has gained power to work through other topologies (as in the case of digitization).

A similar unique feature of the topological lens lies in its aforementioned *ontological* dimension—that is to say, its diagnosis of society (and, consequently, policy-making) as *becoming topological*, in which ongoing change becomes the default state (Lury et al., 2012, p. 5; see also Decuyper & Lewis, 2021):

In a topological society, we no longer live in or experience ‘movement’ or transformation as the transmission of fixed forms in space and time but rather movement – as the ordering of continuity – composes the forms of social and cultural life themselves. (Lury et al., 2012, p. 6)

Lury and colleagues name computers or commensurable registers as examples of such movement spaces, which not only continuously multiply relations of equivalence and difference, but also radically expand the “possibilities of establishing comparisons” (= relations; Lury et al., 2012, pp. 3, 8), including how space-times such as *the national* or *the local* become related and relatable (p. 13). Following this line of argumentation, the topological lens draws attention to space-times that not only establish such new types of connectedness but also equally seek to maximize change capacities as the *modi operandi* of policy-making. As we will show in our analysis, both the COVID-19 and digital education policy mobilities can be regarded as prime examples of this becoming topological of education policy, driven either by permanent reactivity to an ever-changing pandemic or by ongoing reactivity to continuously accelerating digital innovation. This *becoming topological* is empowering, and in turn empowered by, new forms of policy actors and new (digital) space-times of policy-making (e.g., platforms or mobile policy surfaces; see Lewis, 2021; Lewis & Lingard, 2015; Thompson & Cook, 2015) that are accelerating the connection of various policy contexts. These connections occur between the education technology (EdTech) sector, politics, administration, and educational practitioners, but equally between the global and the local. As Lewis and Hartong (2022) argue, digital technologies and the “shadow professionals” behind them hereby play a central facilitative role in not only creating but equally in continuously expanding relations through which policy ideas “can diffuse within and across these emergent topological spaces.”

As this short overview shows, the topological lens offers a number of fruitful contributions to policy mobility analysis in an increasingly digitized and globalized environment, including mobilities within and across federal systems. Nonetheless, despite its rising popularity and also adoption, the topological lens has not yet arrived at the stage of wide acknowledgment. One reason may lie in its deliberate scrutinization of what many scholars, for well-grounded reasons, still use as foundations of their research (e.g., a comparison of nations). In contrast, analyzing policy mobilities from a topological lens means taking a more fluid approach, which comes with new challenges of operationalization (which is, again, something topology undoubtedly shares with other relational approaches). However, as Decuyper et al. (2022) state, “Letting go of the seeming objectivity of such categories does not mean that they cannot be used; it rather means that their topological embeddedness urges a systematic account too.” Still, the *how-to* of topological analysis—beyond bringing conceptual attention to the non-topographical making of space-times—has remained a substantial lacuna.

But also in conceptual terms, the application of the topological lens in education policy research still lacks sharpness. For example, past research has often used the notion of topological relations to emphasize relations that are not topographically bound, such as policy mobilities that stretch across nations. Digital or data spaces (such as educational assessment infrastructures) have often been used to illuminate this distinction (e.g., Lewis & Lingard, 2015). However, more recent

research has emphasized that such a conceptual distinction actually falls short of acknowledging that there is no topographical space without topologies behind it—and, in many cases, vice versa (e.g., Hartong & Piattoeva, 2021). Put differently, topographical constructions such as national territories can be regarded as powerful topologies as well, which means that interest lies less in the dominance of either the topographical or the topological, and more in the *interplay* between topological relation-(un)making on the one hand and topographical (de)stabilization or digital space-making on the other (Hartong & Piattoeva, 2021; see also Harvey, 2012).

To address both challenges when applying the topological lens (i.e., making it operational without falling into oversimplistic categorization), we aimed at developing an analytical framework to disentangle education policy mobilities in federal contexts. We hereby found additional fruitful inspiration—firstly, in Papanastasiou’s (2019) book on *scalecraft*, which offers several approaches to operationalizing scale-making and can equally be adopted in topologically oriented research. The book’s main emphasis lies in the analysis of policy discourse (e.g., policy documents), which is operationalized as the tracing of “scale narrations” (Papanastasiou, 2019, p. 25). Following that operationalization, Papanastasiou (2019) develops a heuristic of different scale-making mechanisms/narrations traceable in documents,⁵ including *fusing/weaving scales together* (here: joining up topologies, creating connections) or *constructing boundaries between scales* (here: establishing discontinuities between topologies; p. 112f). Another example is the mechanism/narration of *naturalization*, for example through *creating scale-dualisms* (p. 57).⁶

Secondly, we saw promising potential in Alhadeff-Jones’ (2019) rhythmanalysis approach which—based on the work of Henri Lefebvre—investigates space-time-making in education through the unpacking of relations between rhythms. More specifically, Alhadeff-Jones (2019) uses three (of originally four) of Lefebvre’s analytical categories: The first, *arrhythmia*, refers to rhythmic dissonance—that is, rhythms which are not synchronized and consequently cause mismatches or conflict (he names jetlag experiences as an example). The second category is *polyrhythmia*, which refers to multiple rhythms coexisting and, through that coexisting, creating a particular space-time (here he uses schooldays as an example). The last category, *eurhythmia*, describes rhythmic resonance and harmonization (exemplified in his text through the idea of self-steered learning). We argue that such a distinction of different rhythms offers a fruitful complementation to the aforementioned policy-making strategies, while simultaneously substantiating the temporal dimension of topologies (e.g., connecting topologies through harmonizing policy-making rhythms; establishing discontinuities between topologies though desynchronizing policy rhythms, such as through intense acceleration).

Thirdly and finally, for the operationalization of topology, it seems important to understand that analytical material (such as documents) should not only be regarded as a *source* for gathering information on policy space-times. Instead, as Lewis and Hartong (2022, p. 51) recently argued, such material itself always manifests the “labour of establishing relations” or positions, which means that it is a “central textual *disposition of activities*” that ensures topological movement/stability. In other words, it is not only the content of documents that matters for tracing policy mobilities using a topological lens but also, for instance, their amount or form (e.g., rhythms of publication, usage of

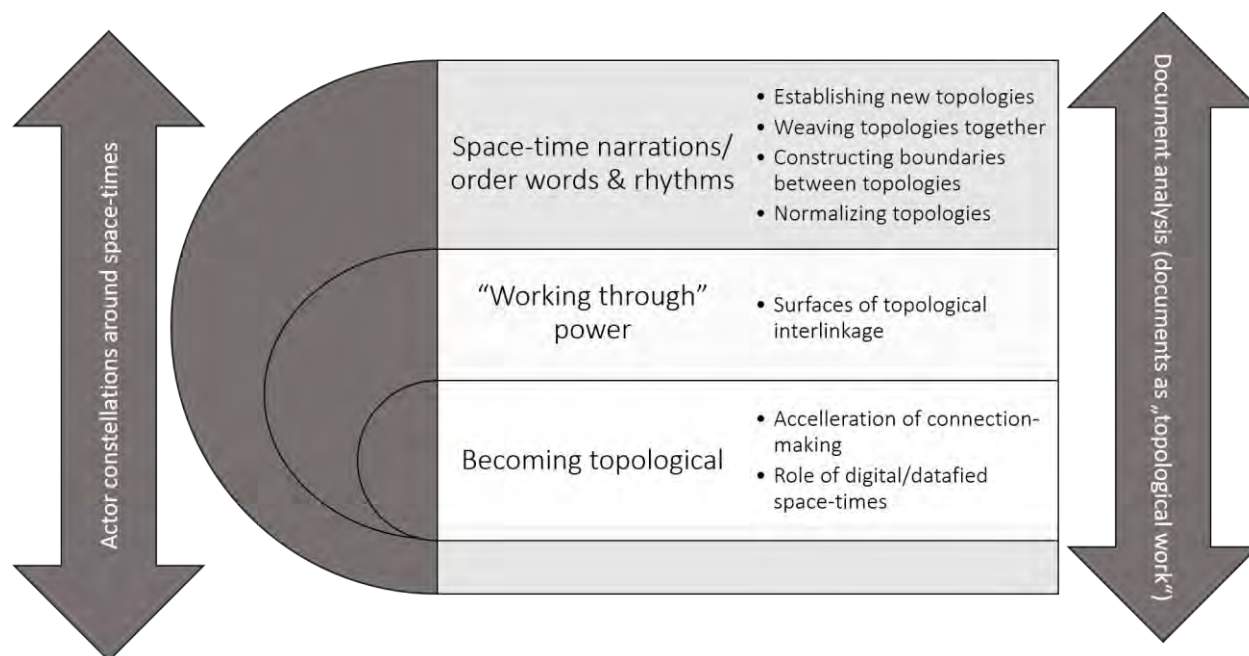
⁵ This equally resonates with Thompson and Cook’s (2015, p. 743) approach to investigate “order-words”—that is, words that discursively locate or position policy within (here) particular space-times.

⁶ Illuminating this mechanism, she shows how the European scale has also been stabilized through actively addressing *the national* as a contrasting unit serving distinguishable purposes. In doing so, she argues, the European scale became naturalized and simultaneously strengthened as being responsible for specific activities that had previously been assigned to the national scale.

digital platforms to store documents). Taken together, different areas of work inspired us to develop the following multidimensional analytical heuristic, which helps to disentangle policy mobilities in federal contexts using a topological lens (see Figure 1).

Figure 1

A multidimensional analytical lens for topological policy mobility analysis



Methodologically, our study⁷ builds on an extensive collection of policy material available online, including press releases, documentation of political working groups and events, descriptions of policy programs and administrative processes (available for example on the *Dokumentations- und Informationssystem für Parlamentsmaterialien*, or DIP), and the frequently updated websites of the BMBF (www.bmbf.de), KMK (www.kmk.org), and different (non-)governing parties. Additionally, we collected newspaper articles from major German newspapers/online news platforms (ZEIT, FAZ, Handelsblatt, Tagesspiegel, Tagesschau, etc.), based on keyword searches related to digitization, schooling, and federalism. Thus, we were able to match announcements of important education policy decisions with the corresponding media responses. In the following section, we first provide an introduction to the German case and draw a topologically framed picture of the policy situation before the pandemic hit in the spring of 2020. Based on that overview, we illuminate key findings of our topological policy disentanglement between 2020 and 2021.⁸

⁷The study presented is related to a larger research project on the transformations of educational federalism in the digital era.

⁸ While we consequently illuminate the findings, as is common in policy studies, over time we use this temporal understanding more as a pragmatic framing to identify and discuss, for instance, different policy-making rhythms.

(Changing) Education Policy Topologies in Pre-COVID Germany

Viewed through a topological lens, the federal context of Germany—as federal contexts in general—can be conceived as a complex entanglement of topological relations that strongly reference different types of topographical bordering, but also include other forms of relation-making that operate across such topographically embedded forms. Unsurprisingly, the most strongly embedded topographical forms are *the federal*,⁹ *the national*, and *the subnational scale*.¹⁰ Yet, when looking more closely from a topological perspective, we see that these forms are actually based on heterogeneous, partly overlapping, and quite fragile topologies (see Hartong & Piattoeva, 2021).

To begin with, in 1948, the Kultusministerkonferenz (KMK) was established as the most important education policy arena assigned with supra-state harmonization of education policies, or in other words, monitoring and coordination of education policies within the German territorial borders (Avenarius & Hanschmann, 2010). However, particularly given the dark nationalist past Germany was moving away from when the KMK was founded, it was deliberately not imagined as a centralizing and, thus, *national* body. Rather, it was framed as an arena of state coordination, thus representing *the states* (= the subnational)—in this case, the 16 education ministers from various parties and contexts—symmetrically in their heterogeneity and authority (Hepp, 2011; KMK, 2021). In doing so, the installment of the KMK deliberately left the authority for education policy with the states and their respective topographical state borders. In line with this idea, the KMK assigns a new president/leadership board from among its state members each year, meaning there is no long-term leadership stability but an annual rhythm of policy change. Furthermore, the majority of decisions based on majority voting made by the KMK have the status of non-obligatory recommendations. As we will show later, this absent national (self-) positioning of the KMK and, thus, the high fragility of a national scale enabled substantial topological shifts after 2000.

Given the topological setting of the KMK, the BMBF can be regarded as playing a somewhat antagonistic role. This antagonism has traditionally been reflected in the (external) positioning of the BMBF (mostly by states and the KMK) as representing *the federal scale*, which however, in the view of states, is not authorized in educational decision-making. Within KMK structures, this means that the BMBF is allowed guest status but holds no active member position. Here, we see an ongoing constructing of boundaries between topologies in the documents, accompanied by legal regulations that have from the beginning hindered the BMBF from intervening in school policies. Instead, its authority has been focused on areas such as early childhood learning, lifelong learning, non-school vocational training, and education research, funded through federal budgets. However, while this division of labor was continuously documented in the sense of reproducing two different policy space-times, the dual constellation of the KMK and the BMBF still caused significant topological overlap and, consequently, ongoing struggles around who is responsible for *national* education strategies. While the KMK operationally tried to fill this position, it formally refused to take it but was equally opposed to the BMBF claiming it. However, since the KMK's ambivalent positioning often led to de facto failure regarding cross-state policy harmonization, the political staff of the BMBF (also via public media and interviews) frequently pushed for *nationalization*, including more coordination and cooperation between the KMK and the BMBF. Particularly in the last quarter of the 20th century, different forms of such coordination (e.g., policy groups consisting of KMK and BMBF members) as well as several legal amendments were established to foster such a stronger nationalization of education policy (Hepp, 2011). Nonetheless,

⁹ In German, this is usually described as the *Bundesebene*.

¹⁰ Subnational units are called *Länder*.

in most cases, these were eventually abandoned. The most recent example is a renewed failure to establish a National Education Board (*Nationaler Bildungsrat*) in 2019.

Nevertheless, one can identify a gradual strengthening of the idea of national harmonization, which gained substantial momentum after 2000 and was strongly impacted by global policy mobilities, particularly the emergence of large-scale student assessments (such as the Programme for International Student Assessment [PISA]). As we have shown elsewhere (Hartong, 2018; Niemann et al., 2018), the first decade of the 21st century was consequently marked by system-wide reforms to improve the output quality of the education system and to foster data-based education governance, often referring to high-performing education systems (commonly from Scandinavia) or to the Organization for Economic Cooperation and Development's (OECD) recommendations for legitimation. As a consequence, new educational standardization, monitoring, and assessment infrastructures were implemented around that time, all of them deliberately framed as the rise of a national agenda. On the one hand, the KMK played a key role in the reform agenda and, during that time, gradually transformed its recommendations into more obligatory decision-making with a national range—thus, moving partly away from the former positioning as the states. On the other hand, the resulting (increasingly digitized) governing infrastructures simultaneously shifted significant power towards new topological space-times. These were not only highly regulated by new actor constellations (such as assessment data centers) but equally, as infrastructures of knowledge and educational epistemology themselves, *worked through* and forged new connections in the traditional policy constellation (see Hartong, 2018, for a more detailed exploration). Simultaneously, these new infrastructures introduced new rhythms (that is, data production and usage cycles) to education policy, which, due to the idea of grounding policies in data, pressured other policy rhythms to at least partly adapt. Finally, the new infrastructures also introduced a new becoming topological of education policy, since they were established with the idea of the ongoing expansion of (data) connection as well as ongoing change (e.g., through adaptation and refinement), which altogether led to an ongoing acceleration of datafication. Within this constellation, the BMBF gained influence particularly through strategic, large-scale funding programs for empirical, data-intense education research as well as data management (BMBF, 2021a; see also Aljets, 2014), thus further empowering the aforementioned new knowledge infrastructures.

In sum, we see how already in the 2000s, the (global) policy mobilities of rising datafication and standardization were mediated through multiple topological transformations. These transformations, in turn, substantially affected (in topological terms: *deformed*) the existent, strongly topographically oriented policy topologies (for the topological impact of assessment infrastructures, see also Gulson & Sellar, 2019).

During the 2010s, this process of deformation continued with the gradual rise of the so-called “digital agenda” (Hartong & Förschler, 2020)—yet here the situation looked slightly different. At this time, compared to other countries, Germany was still much more hesitant in implementing digital technologies in the education field, each state hereby following its own (quite strict) regulations. This caused particularly globally oriented EdTech vendors and affiliated networks to increase political pressure, not only to generally increase EdTech usage but equally to foster a *national* EdTech market with harmonized regulations. It was particularly the BMBF, which, due to its dual responsibility for vocational education (for an increasingly digitized industry) and education research, turned out to be increasingly receptive to these pressures and started pushing for large-scale reform. Again, many reform-promoting actors hereby frequently referred to *the global*—such as the widespread usage of laptops in schools abroad—for legitimation (see also Förschler, 2018) and claimed *nationalization* to be the only potential answer. One example is the so-called national IT summit in 2016, organized by the Federal Ministry of Economic Affairs and Energy (*Bundesministerium für Wirtschaft und Energie* [BMWi]). Federal stakeholders, including representatives

of the BMBF, came together with mainly EdTech stakeholders, including the Hasso Plattner Institute (HPI; led by SAP chief Hasso Plattner), to i.a. present a concept for a “national education cloud” (*Nationale BildungscLOUD*; HPI, 2016). The HPI actively received BMBF funding to develop such an education cloud, which has since become the so-called “school cloud” (*Schulcloud*; HPI, 2021). Back then, the idea of the cloud was to provide a centralized digital space-time accessible across Germany to organize learning processes, including public and private vendor learning materials, certification, and community-building options. Even though 5 years later the HPI has only been able to develop one additional learning management solution used by *some* states and schools, the vision itself indicates a substantial topological transformation, which was further empowered in the following years (see next section).

In line with its rising engagement, the BMBF published a major digitization statement program in 2016 (*Bildungsoffensive für die digitale Wissensgesellschaft*), followed by a similar program from the KMK (*Bildung in der digitalen Welt*) 2 months later. Even though little is known about the actual production context of both statement papers—which, in general, promote quite similar reform strategies—they indicate an interesting turn in the aforementioned topological struggle for political authority between *the states* (loosely centered around the KMK) and *the federal scale* (strongly centered around the BMBF). While in the BMBF paper, there was a clear statement that no state authorities/responsibilities would be transferred to the federal—thus, clearly reemphasizing topological bordering—the focus was once again put on the implementation of new cross-scalar infrastructures to accelerate digitization, complemented by the expansion of public-private partnerships (BMBF, 2016, p. 4). More specifically, a so-called digital pact (*Digitalpakt*) was suggested (i.e., a digital infrastructure agreement between *the federal* and *the states* to support schools more directly in their digitization, limited to a 5-year duration). While the BMBF hereby positioned itself not only as an active promoter but also as a supplier of (initial) financial¹¹ and infrastructural support (which included hard- and software as well as various learning platforms), it framed the states as being made accountable through the agreement for supervising and financing, for example, the pedagogical framing of digitization, teacher training, and long-term perspectives. In contrast, the KMK paper (KMK, 2016) framed the digitization of education as the sole task of the states yet equally emphasized the growing role of public-private partnerships. Various areas of reform were listed in the documents, for which the KMK should continue to act as the key arena of state coordination. In the KMK paper, the federal was mentioned only as one option of many to support infrastructural investments—indirectly agreeing with the basic ideas of the digital pact. From a topological perspective, this dual moment of order-wording in both statement papers is highly interesting. On the one hand, we see how old topologies were once again formally reproduced (= *the states* being responsible for digitizing schools), while on the other hand, a new space-time (the financing of digital infrastructure through new application rhythms) was introduced, (at first) limited to 5 years. This infrastructure joined together *the federal* and *the states* (again, not the KMK) with various EdTech promoters as new digital experts, while the BMBF positioned itself as the responsible owner of the infrastructure. It is the BMBF’s logo that was put on the digital pact webpage (www.digitalpaktschule.de), which also includes information for EdTech actors interested in partnering with schools/states to use funding from the program.

The announcement of the digital pact was highly debated in the media, not least because it (again) led to several legal amendments to allow for the aforementioned substantial investments in schooling by the BMBF. Interestingly, these options for investment were formally detached from

¹¹ Originally, the agreement planned for €5 billion Euro of BMBF investment, split among the states according to their relative numbers of students. In the end, it was split using a traditional formula of federal funding distribution commonly used in Germany (called *Königstein* formula).

the earlier (abandoned) ideas of expanding joint tasks between the federal and the states. However, when the digital pact was authorized in May 2019, the authorization document still described digital education as a joint task between the federal and the states. This was also reflected in the makeup of the digital pact steering group, in which the vote of a single BMBF representative was weighted as equivalent to the combined votes of the 16 states. Quite surprisingly, despite the high political hopes for the transformative potential of the digital pact, states barely retrieved funding from the grant before the spring of 2020 (when the pandemic hit). One reason for this appears to have been the quite complex administrative process which, still strongly embedded in the traditional distribution of authority, involved various stakeholders from schools, local authorities, states, and the BMBF. Also, linked to that, the failure could be interpreted as an interesting example of a rhythmic mismatch between state policies and the (short-term) application rhythms of the digital pact, which caused states that kept following their traditional rhythms not to retrieve money.

In sum, we see how, with the rise of the digital agenda, additional policy mobility became introduced to the field. While the datafication/data infrastructuralization period of the 2000s claimed to install a *national* agenda (formally led by the KMK but including a significant empowerment of the BMBF and new intermediaries), the digital agenda of the 2010s introduced additional topological transformations around school digitization. On the one hand, the BMBF pushed for new forms of digital nationalization, such as the education cloud approach. On the other hand, the digital pact did not further develop that national frame. Instead, in the narratives surrounding the digital pact, we find a clear re-emphasis of the formal dualism between *the federal* and *the states*, accompanied by a simultaneous joining-up of the two in a new cross-scale, yet temporally limited infrastructure, through which the BMBF was further empowered. At the same time, because the funding scheme was initially hardly made use of, there was rising pressure on the policy constellation when the pandemic reached Germany.

Pandemic Policies: Policy Mobility Impacts of a New Topological Surface

During February and March 2020, the global COVID-19 pandemic caused dramatically rising infection rates in Germany that affected various policy fields, including education, in profound ways. In topological terms, the pandemic can hence be described as a new topological surface that immediately *worked through* various policies and simultaneously evoked new forms of space-time (e.g., scalar or rhythmic) narration. Since the pandemic caused a new political focus on human mobility, there was an instant re-emphasis on territorialism and territorial bordering, mainly with regard to national borders, but also borders between state territories—a phenomenon that was very worrying for promoters of the European idea. Never before in the history of post-war Germany had state territorial borders so clearly determined where people could be at which point in time. Given this high re-emphasis on territory, particularly during the first period of the pandemic, each state initially developed its own regulations within its territorial borders, resulting in a federal hotchpotch of COVID-19 measures. This hotchpotch put the federal configuration under rising pressure (see Illan, 2020), clearly visible in media reactions at the time. As a result, the federal government (including Chancellor Angela Merkel) initiated new arenas of emergency policy-making, which from the outset included new experts from the health sector (e.g., the federal health minister as well as virologists). Within these arenas, the idea of *national reactions* was soon accompanied by pleas for states to systematically align their strategies. While there were no initial plans to close schools, during the political chaos of March 2020, some states started to do so, soon followed by others. Consequently, while there was no actual supra-state coordination process during that time (e.g., by the KMK), school closures were ultimately implemented in all German states within a short period.

With the literal overnight closure of schools, the pre-existing lack of digitization made it tremendously challenging for many schools to provide remote learning, thus causing even more tension within the already dynamic topological constellation created through (a) the rising *nationalization* of digital education through the BMBF in concert with intermediaries, and (b) the digital pact which had, in a way, reemphasized the joint dualism between *the federal* and *the states*. During the spring of 2020, the digital pact in particular was heavily discussed in the media either as a systematic failure of the BMBF to streamline digital education in Germany or as evidence of the states' ongoing resistance to necessary transformation. Unlike before, however, pandemic-related school closures now provided an indisputable rationale, from the perspective of politicians and the media, for highly accelerated and comprehensive *national* digitization. In other words, a new topological relation between school closure/opening and digitization was created through the pandemic surface, which empowered the national potential of digitization in a way that was not possible in the previous constellation. However, even though both topics were joined up in the spring/summer of 2020, we can also identify a gradual process of topological re/de-coupling, to which we turn next.

By April 2020, the debate on how to organize school reopenings clearly mirrored the intensified call for more supra-state coordination and alignment. As with the school closures 1 month before, the KMK remained largely inactive. Instead and following the initiative of one of the leaders of the Social Democrats Party, Saskia Esken,¹² Chancellor Merkel started to meet with state ministers (*not* education ministers) in rhythms spontaneously adapted to the pandemic development, to discuss strategies for reopening different areas of society, including schools. It was a declaration from one such meeting that *assigned* the KMK the task of developing organizational/administrative regulations for school reopenings, but not deciding if and when schools would reopen. The KMK accepted the assignment and came up with a framework by the end of April. Despite these efforts, as with school closures, states ultimately implemented various strategies for school reopening.

In contrast, the policy mobility (that is, the space-times around digitization) gained much stronger *national* momentum. It was not only the press that increasingly called for a more powerful role for the BMBF in enforcing the digital pact, but also the BMBF itself as well as various intermediaries related to the pact, who were now able to use the pandemic as proof of policy failure by the states. After schools reopened, these actors legitimized the ongoing need for national digitization by not only referring to a required revolution of the education system (as done previously) but also anticipating a continuing pandemic future, to which schools would need to constantly and quickly adapt. Such topological transformations can also be found in the creation of a new education policy arena in August 2020: the school summit (*Schulgipfel*; see Deutscher Bundestag, 2020). Framed as an informal meeting about the challenges of the COVID-19 pandemic, Chancellor Merkel invited the minister of the BMBF, the current president of the KMK, and six state education ministers to meet and develop strategies for the upcoming months. The remaining state education ministers did not participate in the meeting, including two former KMK presidents who had previously strongly protested the increasing engagement of the BMBF in school policy. At the same time, inviting the KMK president created an image of one person nationally representing all 16 states, which, as noted before, stands in contrast to how the KMK actually understands itself. During the summit, the general relevance of the digital pact was not only re-emphasized, but its substantial expansion and acceleration via immediate emergency funding was promoted. In the end, three additional packages of €500 million Euro each got approved, to be provided by the BMBF within very short periods. Here we see a gradual intensification of the topological shift established

¹² The Christian Democratic/Social Parties (CDU/CSU) and the Social Democratic Party (SPD) formed the government during that time.

via the digital pact infrastructure, which simultaneously became more and more determined and defined by the BMBF.

One month later, in September 2020, the school summit met once again, this time including all state education ministers and bringing back together both policy mobilities: the debate surrounding infection prevention regulations for schools in order to keep them open (to be implemented by the states) and the debate around digitization. On the one hand, the summit now approved further modules of the digital pact, including mobile devices for students and teachers, the provision of online materials, and support for the costs of digital administration. On the other hand, the summit went even further in terms of normalizing and even further expanding the topological transformation: the initiation of a *national education space*, including a national platform for providing high quality digital classroom materials to every teacher in Germany. The idea, which clearly built upon the national education cloud of the 2010s, became enacted in the following months as the Digital Education Initiative (*Initiative Digitale Bildung*; BMBF, 2021b; see below). The initiative became staged as a collaboration between the chancellor and the BMBF and incorporated various activities to foster digital capacity in education, including the implementation of digital infrastructures, digital learning tools, training for teachers, digital content and teaching methods, and scientific evidence provision (BMBF, 2021b). The BMBF also established a new network structure – the Digital Education Network (*Netzwerk Bildung Digital*; www.netzwerk-bildung-digital.de) as an intermediary actor to quickly establish wide-ranging networks and platforms for reform coordination between stakeholders from all areas of education.

When looking at promotion documents for the Digital Education Initiative, we can clearly see what Papanastasiou (2019) describes as scale narration driven by a “fantasmatic logic”: *the national* is not imagined here as a specific place or context but rather as an infrastructure of “universality, transferability and depolitisation” (p. 67). Regarding the temporal dimension, the BMBF itself describes the infrastructure as a new “master clock” of reform—that is, as a digitally driven policy-making (supra-) rhythm, oriented towards ongoing technological innovation and, consequently, towards continuous policy adaptation. In other words, here we see another, yet even more powerful example of the becoming topological of digital education policy. At the same time, and unlike the digital pact, the new infrastructure was narratively framed not as a limited funding program but as a permanent structure of change.

By the fall and winter of 2020/2021, the BMBF had established various formats to further stabilize this transformation, including a series of digital launches/meetings where the chancellor, the BMBF, the government’s appointee for digitization, some (but not all) state education ministers, and digital leaders (from the EdTech sector but also selected digital visionaries from school practice) came together (for instance, in public webinars to discuss future steps for school digitization). Similar formats—then with the BMBF or the KMK president as some of many participants—were initiated by various other intermediary actors around the same time, including hackathons.¹³ All these formats had in common that their main focus was put on *reach*, establishing as many policy connections as possible—mainly measured in numbers of participants from different backgrounds—within short periods (e.g., 2-hour webinars each week, a 2-day hackathon each year). This marked an even sharper and intended rhythmic conflict to the rather slow political decision-making processes established within the traditional constellations (e.g., KMK meetings), and aimed at the creation of seemingly united voices from a widespread community, to which the KMK would be forced to align with.

It was equally during the fall/winter of 2020/2021 that a new wave of infections hit Germany and caused another, even longer period of school closures. Surprisingly, and despite the

¹³ For a closer investigation of the educational hackathons in Germany, see Förschler & Decuyper (2023).

aforementioned substantial transformations in the field of digitization, the school closure (and reopening) debate to a great extent replicated that of the spring of 2020—namely, back-and-forth attempts for more supra-state harmonization and state strategy fragmentation. At the same time, many states watched with concern as the federal government strove for greater influence, leading to a new wave of resistance and reclaiming of school authority. The development somewhat culminated in a national COVID-19 summit in February 2021, during which Chancellor Merkel clearly reemphasized states' authority over schooling, including school closure/opening. Yet, only 1 week later, the BMBF launched a range of innovative projects as the *modi operandi* of the newly founded “national education space of digitization” (see also BMBF, 2021c).

Summary and Outlook

The aim of this contribution was to not only provide insights into how two of the most powerful global policy imperatives of our times—rising digitization and the recent pandemic—have manifested in the federal education context of Germany, but also to discuss the potential of topological thinking to disentangle federal education policy mobilities. Like other relational approaches, topological thinking understands policy mobility as the ongoing (un/re)building of (topological) relations, which includes the relational (re)making of policy scales. At the same time, we have argued that the topological approach supplements such approaches by emphasizing (1) the temporal dimension (e.g., rhythms) of policy mobility (e.g., rhythmic dissonance or harmonization); (2) the role of digital/data spaces; and (3) the ontological observation that policy itself is becoming increasingly topological. Applying such an approach to policy mobility, the goal is consequently not only to understand and trace which topologies exist or emerge (e.g., if and how *the national* is configured), but also how particular topologies *work through* others—that is to say, how strong their (also rhythmic) potential is to deform or even break up other topologies. In our study, we operationalized the tracing of such topologies via space-time narrations found in policy documents and press articles, as well as via tracing the forms of such documents themselves (seen as topological work; see also Lewis & Hartong, 2022).

As noted in the first part of this article, there is already a growing body of, for instance, policy assemblage research, which has included topological thinking in the analysis of de/re-assemblage processes (e.g., Thompson & Cook, 2015; Savage & Lewis, 2018; Hartong, 2018; Takayama & Lingard, 2021). At the same time, we argue that particularly the three topological dimensions emphasized in this article—policy rhythms, the rising digitality of policies, and the becoming topological—can offer substantially more to further develop relational approaches in general than what has been adopted so far.

At the same time, it is important to note that our study, of course, comes with a range of limitations, which include absences and blind spots resulting from the decision to analyze (a specific selection of) documents/press articles through a particular heuristic within a particular (here chronological) time frame. Equally, we only observed a selected number of topologies from a field (education) that actually consists of an unlimited array of topological forms and relations (Thompson & Cook, 2015), including curriculum, teacher education, and building infrastructures. However, it is to be expected that mobilities such as the pandemic and digitization increasingly *work through* most educational topologies; future research would need to investigate how (far) exactly.

Despite such limitations, we argue that our analysis still shows the potential of the topological lens to contribute to a more nuanced understanding of policy mobility, equally offering an alternative approach to constructing units in comparative analyses. In other words, even though our study might, at first glance, appear as a single case investigation, it can be regarded as a

comparison of different topological transformations nested within, but in turn deeply affecting, the topological configurations of the German federal system. We hereby identified substantial differences between digitization and school closure/opening policies. The former led to far-reaching *nationalization* (ruled to a growing extent by the BMBF), a rise of new intermediary, globally oriented actors (e.g., EdTech), and digital space-times of policy-making. The latter led to a de facto re-formation of the traditional dualism between *the federal* and *the states*, without a strong *national* and also without such a strong global orientation. Nonetheless, both policy mobilities showed a clear becoming topological in the sense of being driven either by permanent reactivity to an ever-changing pandemic or by ongoing reactivity to continuously accelerating digital innovation. Yet the intensity of this becoming topological appeared much stronger in the field of digitization, where we could equally observe a massive expansion of new forms of digital policy-making, which key logic is (platform-based and continuously growing) connection-making across policy spheres and scales. Since such new forms of policy-making popped up quite recently, yet in vast scope, their initiators have caused substantial rhythmic conflicts, not only with more traditional policy space-times such as KMK meetings but also, in a way, with one another. Hence, a task for future research would lie in tracing how these rhythmic conflicts further evolve and if one finds indications for stabilizing rhythmic coexistence (as partly visible in the implementations of assessment data infrastructures in the 2000s, see Hartong, 2018), or even rhythmic harmonization.

Even though with our comparison of different topologies we remained within the German case, we argue that our approach might equally inspire comparisons between different federal systems regarding the (de)formation potential of specific global-local policy mobilities (for an exemplary analysis of datafication mobilities in Russia and Germany see Hartong & Piattoeva, 2021). As noted at the beginning of this paper, adopting a topological lens does hereby not imply abandoning more classical comparative units—such as federations—but rather deliberately co-investigating the (un)making of federalism itself, its temporal and digital dimensions, as well as the ongoing becoming topological of policy-making. With this contribution, we hope to have offered fruitful inspiration for the wider adoption of such a lens.

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