# 5. Findings and Analysis

The following chapters present my study's empirical findings. The three chapters are structured along the three research questions of my study (see chapter 4). At the end of each chapter, a brief summary and discussion of key findings is provided. As many common themes between the three empirical perspectives were identified, each findings chapter includes only a brief discussion of key arguments, and chapter six then provides more detailed discussion, in which the findings of all three chapters are interwoven and discussed in relation to the academic literature.

## 5.1 Online Critical Data Literacy Resources

This chapter presents the findings of my study's first empirical perspective, addressing the research question: What is the range, shape and focus of online critical data literacy resources? The content analysis demonstrated that many online educational resources about datafication already exist. The 75 analysed resources applied diverse design formats and came from diverse and international creation backgrounds. The analysis further revealed that *some* aspects of this study's preliminary theoretical framework for critical datafication literacy are already addressed by the majority of analysed resources, whereas others, such as the importance of not shifting responsibility to individuals, are only considered by a minority. Altogether, the analysis provided new knowledge on the under-researched field of online critical data literacy resources, led to new insights for the further conceptualisation of critical datafication literacy throughout this study, and allowed for an informed selection of the ten most suitable resource creators for the expert interviews.

### 5.1.1 Identifying Online Critical Data Literacy Resources

In a first step, 250 potential critical data literacy resources were identified and examined. Of these, 75 resources met the study's qualifying criteria and were fully coded

and analysed in a quantitative content analysis.[1] The qualifying criteria for this sampling described critical data literacy resources in the broadest possible definition: resources that 1) educate about datafication; 2) foster critical reflection of the implications of datafication; and 3) do not require any prior knowledge. The most common reason for exclusion was that resources did not *educate about datafication*, for example because they only covered specific aspects such as data protection or the use of data systems in particular areas (e.g., in the education sector or by the police). Only 97 resources met this qualifying criterion.

The two other criteria were met considerably more often: 142 of the 250 resources fostered critical reflection of data technologies and 156 required no prior knowledge. Resources that did not meet these criteria and were therefore excluded from further analysis would, for example, highlight only the benefits of data technologies; foster an instrumental data literacy (data usage skills only) without addressing more critical questions; or cover specific and complex issues such as the implications of data technologies in political advertising, or bills on facial recognition without providing any introductory knowledge. Already this first selection prior to conducting the content analysis thus provided insights on the landscape of online educational resources about data, highlighting that many existing resources focus on specific aspects or perspectives on data technologies, and that a broader critical consideration of datafication is less common in the examined resources.

### 5.1.2 Characteristics and Origins of Critical Data Literacy Resources

#### International and Multilingual Resources

The goal of the content analysis was to examine the range, shape and focus of online critical data literacy resources – including to what extent they are in line with the preliminary framework for critical datafication literacy. First, the analysis of the resources' countries of origin revealed that over half of the resources originated in Germany (41 of 75), whereas only 15 were created in the US, 8 in the UK, 5 in Switzerland, 4 in the Netherlands and 3 in Canada. Apart from that, one resource originated in each Brazil, France, Austria and Italy. Finally, one resource was coded as European: a series of short explanatory videos by the "Project Sherpa", a decidedly European research project with stakeholders and team members from several European countries (R67, see appendix II). This distinct dominance of resources with a German origin is likely not representative but can be explained by the study's sample and its sources (see chapter 4.2.2).

The resources' languages showed a similar German predominance. In total, 45 of the 75 resources were available in German and only 36 in English. The sample included any resource that would fit the qualifying criteria and was available in at least

1 For a full list of the 75 resources, see appendix II.

English or German. Yet, the analysed resources were offered not only in these two languages, but 17 different languages in total were identified in the sample. This included not just widespread languages such as English, Spanish, French or German but also less widespread languages such as Persian, Burmese, Amharic or Welsh (see table 4). Moreover, several languages from the Global South were included although most countries of origin were located in the Global North. However, a closer look revealed that only a small group of 18 of the 75 resources was multilingual, whereas the rest were provided in only one language. The high number of languages thus resulted from very few resources that were offered in many different languages. For example, the "Surveillance Self-Defense" resource, a website offering "Tips, tools and how-tos for safer online communications" by the NGO "Electronic Frontier Foundation" was available in 12 different languages (R12).

*Table 4: All languages identified in the resources and how often they appeared in the sample.*

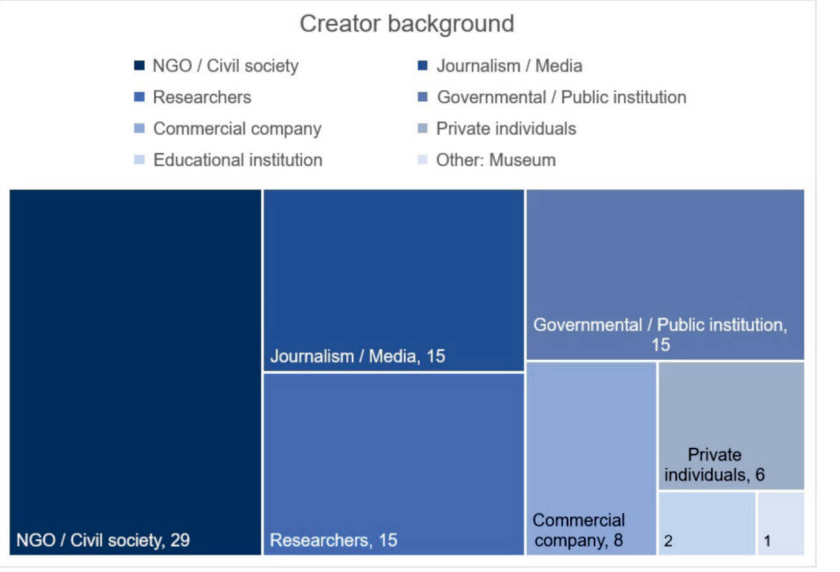
| | | | |
|---|---|---|---|
| German | 45 | Turkish | 2 |
| English | 36 | Amharic | 1 |
| Spanish | 7 | Burmese | 1 |
| French | 6 | Dutch | 1 |
| Arabic | 4 | Persian | 1 |
| Portuguese | 3 | Thai | 1 |
| Russian | 3 | Vietnamese | 1 |
| Italian | 2 | Welsh | 1 |
| Rumanian | 2 | | |

## Diverse Creator Backgrounds

To get a clearer picture of the societal sectors and actors that create online educational resources about datafication, I further examined the background of the resource creators. As suggested by the literature, civil society emerged as a strong actor in this context (see below). In total, 29 resource creators were coded as civil society actors, 15 as journalists or media producers (such as television producers), 15 resources were created by researchers, and 15 by governmental or public institutions. As with all other figures in this chapter, these numbers include duplicates, since several resources were produced by more than one creator. While civil society and journalism and media constitute creation contexts that were also identified in previous studies on critical data literacy resources (Sander 2020c; Young and Pridmore Forthcoming), identifying researchers and public institutions as resource cre-

ators constitutes a novel finding. In line with previous studies, the content analysis further identified eight commercial companies, six private individuals and two educational institutions (a publishing house, R48, and an online competence centre for teachers, R52). Moreover, one museum was identified as a creation context: the museum for communication in Bern, Switzerland, developed an entire package with teaching material about big data, including animated videos, lesson plans and assignments (R39, see also chapter 5.2).

*Figure 4: Creator backgrounds with number of resources identified in each field.*



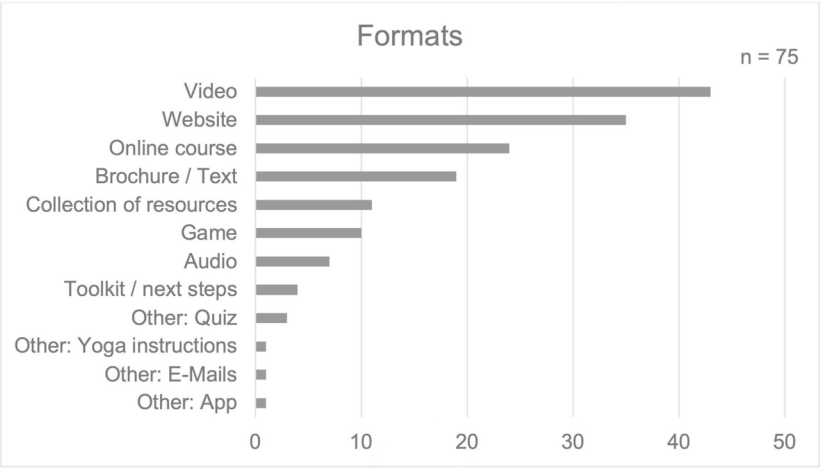

## Various and Unusual Formats

The analysis of the resources' formats identified short videos (43) and websites (35) as most common formats (see fig. 5). Apart from this, 24 resources were coded as "online courses". This included short tutorials and MOOCs (Massive Open Online Courses) that learners can work through individually. However, the majority of resources in this category consisted of teaching material, such as lesson plans for teachers or work assignments for pupils. Several examples are outlined in more detail in chapter 5.2. This relatively large amount of existing critical teaching material on topics around big data and datafication represents a contrast to the focus on instrumental data literacy approaches and calls for more teaching material (see chapter 2.2; Pangrazio and Sefton-Green 2020, p. 211). Yet, later findings of my

study suggest that at least some educators seem to be aware of this "abundance" of material (see chapter 5.3.4).

Moreover, a high number of games was identified (10). Five of these were analogue games such as simulation games or card games, for example the "Fairdata" game as part of the "Dataselfie" resource (R20), and five were online games. These included short games that could be played within a few minutes, such as the browser game "Data Clash" as part of the "Your Data Your Rights" website (R19), as well as more extensive so-called "serious games", such as the "Datak" game that is outlined in more detail in chapter 5.2 (R41). Since the development of games is time-consuming and expensive (especially when it comes to digital games), ten games in a sample of 75 resources can be seen as a high number. Particularly serious games constitute an increasingly popular approach to learning as they offer "motivating and engaging experiences" for learners (Anastasiadis et al. 2018, p. 139).

*Figure 5: Identified resource formats with number of resources applying each format.*



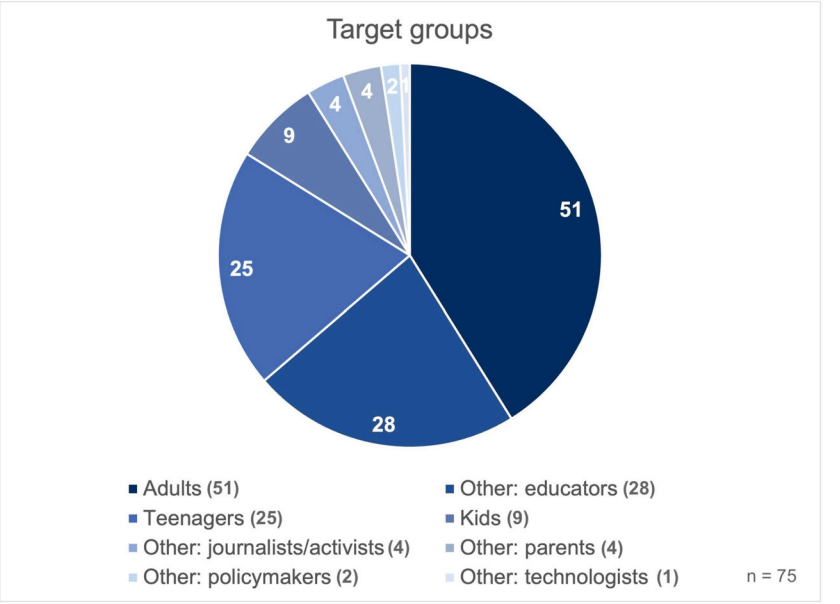

Finally, the analysis of the resources' formats revealed new formats that were not included in the coding sheet. Apart from three quizzes, the research identified one app that educates about datafication. The "Stadt Land DatenFluss" app, a gamified course on a large variety of topics around data was created by the Volkshochschule in Germany (Adult Education Association) (R54). Moreover, one resource used an email newsletter format in combination with a podcast series: The "Privacy Paradox" Newsletter provided subscribers with daily insights on data and privacy and a daily "challenge" on how to protect one's data, sent on five subsequent days alongside its five-part podcast series (R4). Even yoga instructions were used to educate

about datafication: the "Coveillance: Watching the watchers" website offered "Countersurveillance Yoga" (R74).

## The (No) One-Size-Fits-All Approach

The content analysis further investigated if the resources recognise the need for different approaches for different audiences or if they follow a "one-size-fits-all" approach (see Carmi et al. 2020, p. 11). This is a key aspect of this study's preliminary critical datafication literacy framework (see chapter 3.4). The content analysis examined this in two ways: a) the target group(s) of the resources were coded and b) a second question tested whether the resources recognised the need for different approaches for different audiences (see codebook, variable 13 and 15, appendix III). As outlined in the methods chapter, both variables were difficult to code and, to some extent, a matter of interpretation.

*Figure 6: Identified target groups of the resources.*




The first variable was coded based on the overall content and style of the resource as well as, if available, information on the resources' intended use. This was the case when a website included specific sections, for example for "youth, parents and educators", "policymakers" and "technologists" (R62); or specifically stated its target audience, such as the "Digital Defense Playbook" by "Our Data Bodies" (R31, p. 12). Fur-

ther examples for resources that were very clear about their audience included the infographic "Dein Tag in Daten" (your day in data) by "Watch Your Web" that clearly addresses kids and teenagers, as the data that is portrayed includes "arriving at my school" and "checking how long I need to wear my braces" (R29); the "curriculum materials" by Mijente for educators (R61); and the video courses on privacy by Privacy International on the "Advocacy Assembly" website for activists who want to gain better skills in advocacy (R5). If no target group could be identified at all, the variable was omitted.

The overall distribution of identified target groups within the sample is shown in figure 6. Apart from many resources addressing adults and teenagers more generally, the large number of 28 resources targeting educators stands out. This corresponds with the large amount of teaching material in the sample that was outlined above. Apart from that, some resources seemed to address specific groups such as journalists or activists (4), parents (4) and the already mentioned policymakers (2) and technologists (1). With the exception of the target group "educators", however, the number of resources addressing specific groups was very small in contrast to the large majority of resources addressing broader groups such as "adults".

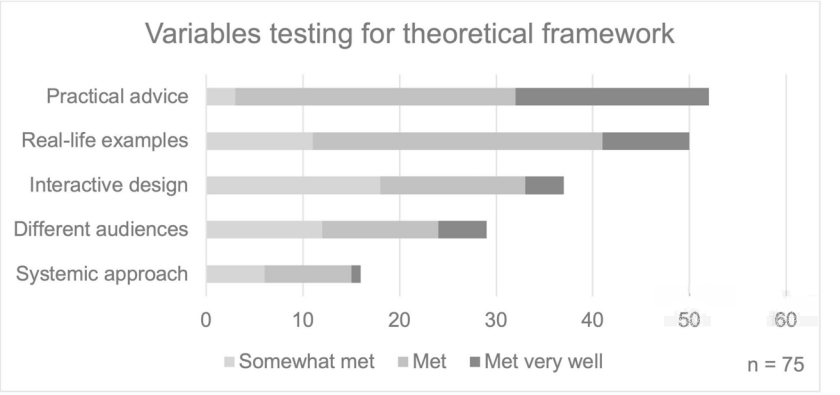
This is in line with the findings for variable 15 that tested for "different audiences". This variable examined if resources recognise the need for providing different approaches for different audiences, for example by addressing a specific target group or by offering adaption possibilities for different needs of their audiences. All examples outlined above met this variable. Further examples include the "Watching You" website with material for pre-school children (R58) or websites with sections for different target groups, such as "Klicksafe" (R28) or the "My data and privacy online" toolkit (R2). Overall, five resources were coded as meeting the criterion "different audiences" very well, 12 as meeting it, and 12 as somewhat meeting it (see fig. 7). Thus, 29 resources in total considered different audiences at least in some way. However, this also means that the majority of resources did not specifically cater to the needs of different audiences but rather seemed to take a 'one-size-fits-all' approach. This represents a contrast to the strong emphasis on the importance of catering for the needs of different learners in critical data literacy research and general education literature (e.g., Brüggen 2015, p. 16; Aßmann et al. 2016, p. 15; Carmi et al. 2020, p. 43). However, it is possible that some of these resources were indeed designed for specific audiences and their needs, without making this transparent in the resource itself.

### 5.1.3 How Do the Resources Implement Critical Data Literacy?

The content analysis further examined if – apart from the different audiences – other key aspects of the preliminary theoretical framework for critical datafication literacy developed in this study could be found in the resources. Figure seven shows

all five variables in this section, with the different shades of blue representing how well each variable was met by how many resources. Again, this differentiation into three stages is to some extent a matter of interpretation. However, given the diversity of the analysed resources and the size of some of the websites, the goal here was to give at least some idea *to what degree* a resource was, for example, interactive, and to differentiate between resources using one interactive element, such as the "Daten, Daten, Daten" website that includes a short online game (R16), and others that are profoundly interactive in their entire design, such as the "How normal am I?" online video experiment (R66). A resource was also coded as "somewhat interactive" if the resource itself was not interactive, but it was intended for an interactive use, such as simulation games or work assignments for students, as for example the case in the "Unbias Fairness Toolkit" (R32).

*Figure 7: Variables testing for resources' alignment with the preliminary theoretical framework.*




## Many Popular Characteristics Identified

Of the five variables that tested for different aspects of my preliminary literacy framework, the variable that was met by most resources was *practical advice* (52 of the 75 resources), which in figure seven summarises any kind of advice provided (detailed analysis below). *Real-life examples* were nearly as common and were found in 50 resources. The third most common characteristic that was tested – *interactive design elements* – was met by 37 of the 75 resources. This is high considering the additional effort and time and financial resources required to develop interactive online tools. Both of these approaches – using real-life examples and interactive formats to educate about datafication – correlate with calls from participants of my previous study (Sander 2020c), with other critical data literacy scholars (e.g.,

D'Ignazio and Bhargava 2015; Iliadis and Russo 2016), and with critical pedagogy's approach of entering into dialogue with learners and presenting them with real-world problems (see chapter 3.3).

### Practical Advice for Data Protection – (Too much) Individual Responsibility?

The variable "practical advice" tested not only if a resource provided practical or constructive advice for users, but also *what kind of advice* it suggested. As figure eight shows, the different types of advice tested for showed a very different distribution within the sample. *Data protection advice* was by far the most common form of practical advice. In total, 36 of the 75 resources included suggestions on how to better protect one's data online, for example by installing ad and tracking blockers, turning off location tracking, using a VPN, changing social media settings or using secure passwords. Related to this, 21 resources recommended using *alternative services*, such as privacy-sensitive independent or non-commercial messaging apps, search engines or email providers.

While steps towards more data protection online and using alternative services are easy to suggest and often also to implement, these are not final solutions for the problems surrounding datafication. There are many controversial issues, such as risks of discrimination related to data systems, the use of automated decision-making systems in increasing societal areas, or risks of surveillance through smart technologies (for more details, see chapter 2.1), that cannot be addressed by individuals changing their behaviour online. For this reason, many scholars argue that critical data literacy approaches should not shift responsibility to the individuals by conveying the impression that it is up to the individuals to solve these issues through an altered internet usage (e.g., Pangrazio and Selwyn 2019; Carmi et al. 2020).

In order to examine whether existing online critical data literacy resources recognised this shift of responsibility to individuals as problematic and suggested broader, more systemic approaches instead of, or alongside, individual solutions, the content analysis further tested for a *systemic approach*. One resource that met this variable very well was the "Lernparcours Big Data" by the youth media centre "jfc Medienzentrum" (R18). In its section "Becoming active" (original: "Aktiv werden"), the website writes:

> Learning about this topic [big data] can often lead to feelings of helplessness and powerlessness. This is understandable, as we are experiencing a profound technological and societal transformation through digitisation. Big commercial and governmental interests are fuelling this development. It is characterised by global entanglements and high technological dynamics. Individuals and the civil society are initially in a weak position. (jfc Medienzentrum [no date], own translation)

Following this statement, the website takes different options of "becoming active" into consideration. For example, it argues that abstinence is not an option as this restricts social participation. Some tips for "digital self-defence" are offered, but the website highlights that these steps require certain knowledge along with self-discipline, and that they can still be subverted by the companies behind the internet services. Thus, the website concludes, what is needed is *awareness-raising*, as this helps users become aware of data collection and its risks, such as discrimination, as well as *becoming politically active*. The website clearly calls for political action and asks readers to become active in political parties, via consumer advice centres and in civil society.

However, this elaborate and sophisticated practical advice is unusual in the sample. In total, only 16 resources met the variable "systemic approach": one resource met it very well, nine met it and six somewhat met it (see fig. 7). Further examples include the "Klicksafe" website's section "What can we do" that calls for privacy-by-design and for becoming politically active (R28), and the "Mathwashing" website that urges users to think critically and to "demand to know how 'what is good' [in an automated decision-making system] is decided upon. In a democracy we decide this together. You should have a say" (R68). The "Digital Defense Playbook" further includes a "community defense toolkit" and activities to move "from paranoia to power" and for people to "recognize their collective strength in identifying and practicing alternatives to oppressive, unjust data collection and data-driven systems" (R31, p. 70).

### Other Types of Practical Advice

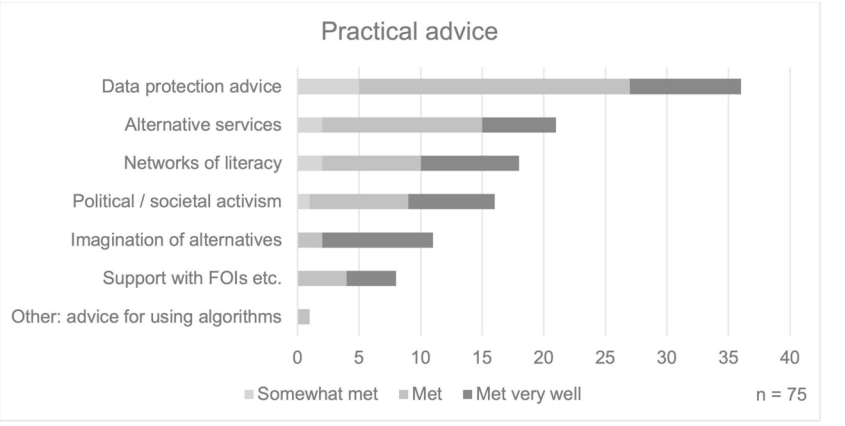
These examples not only clearly met the variable testing for a systemic approach, but they also constitute ideal examples for *political / societal activism* as a form of practical advice (see fig. 8). This form of advice was comparatively rare and was only identified in 16 of the 75 resources. It was often provided in combination with other forms of advice.

The third most common form of advice in the sample – after advice on data protection and alternative services – was coded as *networks of literacy* (18 resources in total, see fig. 8). Resources in this category actively asked users to share their new knowledge and awareness with others, thus establishing "networks of literacy" (Carmi et al. 2020, p. 12), or starting a "chain reaction" of critical thought (Markham 2019, p. 756) as discussed in the academic literature. In practice, this could mean asking users to share their knowledge with their friends and family, such as the "Dataselfie" website that asks users to "share your knowledge!" on the bottom of each page (R20), or providing material that can be used to inform others about datafication.

One less common type of advice in the sample consisted in fostering the *imagination of alternatives*. Again, this is discussed and recommended in the academic literature (see chapter 2.2; 3.4) but was identified in only eleven resources. Two resources that met this category very well were the "Do Not Track" video series (R9) and the simulation game "Future Influencer" (R46). In the game, secondary pupils

act out a fictional future, in which they decide how much and what data is collected by a smart bracelet that is mandatory for all pupils. In the Do Not Track series, the last episode "To Change The Future, Click Here" brings together different arguments made throughout the series and finally offers three possible imaginations of the future: "Big Brother", "Big Business" or "Big Win" (Gaylor et al. 2015). All three future scenarios are detailed in short stories that start from the present (at the time the resource was developed in 2015) and detail key developments around datafication until 2021–2024.[2] The reader is thus shown different imaginations of the future: one full of surveillance, where liberty is sacrificed for security; one of the "glory days of big data" and the companies behind it; and one in which the internet is governed internationally and with the interest of citizens in mind and where "a balance is struck between privacy and the rule of law" (ibid.). These detailed imaginations are very much in line with calls to foster people's "critical imagination" (Milan 2017, no page number) or "infrastructural imagination" in relation to data systems (Gray et al. 2018, p. 3).

*Figure 8: Different types of practical advice identified in the resources.*




Another rare form of advice was *support with Freedom of Information requests (FOIs)*, which was identified in eight resources. While most combined this with other forms of advice, one resource focussed entirely on this type of advice: a short documentary on how to access one's data through Freedom of Information requests (R21). Finally, one resource provided practical advice that was not included in the coding sheet and was thus coded as "other". The "Mathwashing" website offers three steps of practical

2 However, this example also highlights how quickly these resources can become outdated, as today's users are likely confused by "future" scenarios that take place between 2021–2024.

advice (two are already outlined above), of which one addresses people who apply data systems: "If you're deploying algorithmic systems, learn about their limitations. Hire an ethics expert to do an algorithmic audit" (R68). This direct call to action is unusual and was not found in any other resource in the sample.

## Appealing Visualisations

As explained in chapter four, the coding sheet included a "special category" variable which was intended to highlight resources that take an unusual approach (content or format); fit the project focus extremely well; or came especially recommended by established practitioners. Most of these aspects predominantly aimed to support a selection of diverse expert interviewees. Yet, some novel findings were identified: only 17 of 75 resources used *appealing visualisations*. This appears to be a small number considering that using visualisations of data systems is an approach that is often suggested in the literature as one way of materialising complex topics around data technologies (D'Ignazio and Bhargava 2015; Windeyer 2019; Pangrazio and Selwyn 2020). However, it should be noted that this variable is difficult to code and, to some extent, a matter of interpretation. More details on the reasoning behind using visualisations emerged in the interview findings and will be discussed in chapters 5.2 and 6. A small selection of data visualisations from the sample are displayed below (figure 9–11).

*Figure 9: Visualisation of the "Datenkraken" (data octopuses) by the teaching material "Lehrmittel Big Data", R39.*


Illustration: Nina Christen, Team Tumult, © Museum für Kommunikation, Bern.

*Figure 10: Visualisation of the "Chupadados, the Datasucker" monster (Felizi and Varon [no date]), R6.*

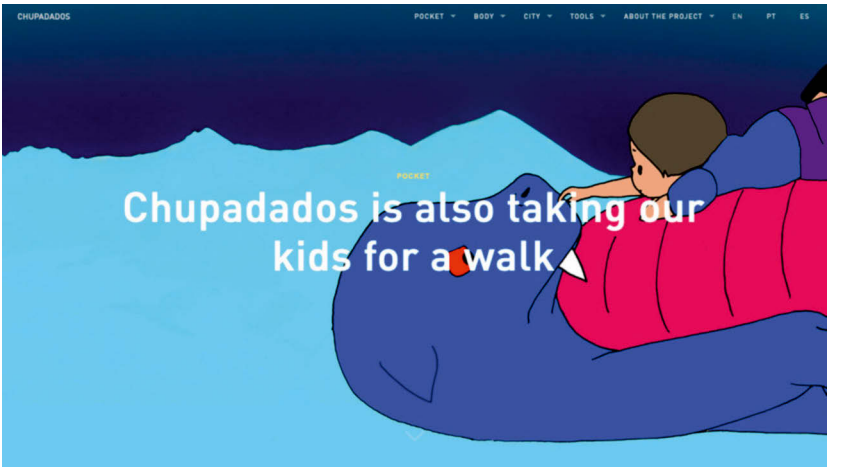
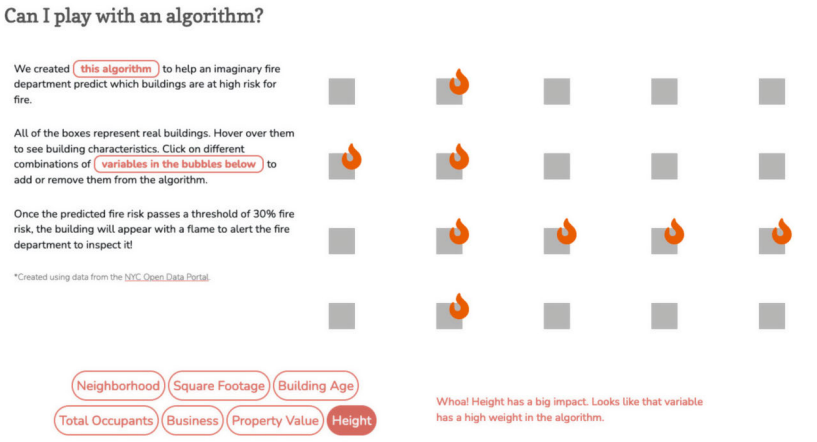



*Figure 11: "Toy algorithm" that visualises how different variables affect the outcome of an algorithmic calculation included in the website "Automating NYC", R33.*




### 5.1.4 Conclusion and Discussion

#### Introducing the Topic of Datafication

The first question the content analysis aimed to address asked about the range of online critical data literacy resources that could be identified. 75 different and diverse

resources might seem like a large number that could be identified and analysed. However, since 250 resources were examined in total, this also means that 175 did not meet my study's qualifying criteria. This seems high considering the broad nature of the criteria for inclusion – the resources should educate about datafication, foster critical reflection and require no prior knowledge. A common reason for exclusion was that resources lacked a general introduction to datafication and jumped directly to specific topics such as data protection, digital rights or police surveillance. These resources could be very valuable for people who already understand the basics of datafication and want to learn more about specific aspects. However, considering citizen's fragmented and incomplete knowledge about datafication (see chapter 2.1), a general introduction to datafication should be a key part of critical data literacy resources.

### Novel Findings regarding the Resources' Origins and Formats

The content analysis further examined the creation backgrounds and defining features of online critical data literacy resources. The analysis revealed *international* and *multilingual* resources in *diverse formats* and from *diverse creators*. The 75 analysed resources originated from ten different countries and were available in 17 languages. However, both of these characteristics were distributed unequally throughout the sample and were likely affected by the sample's sources. The majority of resources originated in Germany or English-speaking countries (US, UK or Canada), and only 18 were available in more than one language. Overall, a higher proportion of multilingual resources would be desirable in order to reach different audiences and offer them resources in their preferred language. However, the sample of my study is by no means representative or comprehensive, and it is possible that many resources in other languages exist. Moreover, if the sample's resources' target groups were primarily native German and English speakers, the predominance of these languages would be appropriate.

In line with previous research, the most common *formats* were websites and short videos, and the most common *creators* came from civil society and journalism and media production (Sander 2020c; Young and Pridmore Forthcoming). However, many resources were also developed by researchers and public institutions. Thus, it seems that Iliadis and Russo's call for critical data literacy scholars to contribute to data literacy efforts and provide individuals "with the necessary tools for becoming more informed and the ability to organize efforts around data justice issues" is being implemented (2016, p. 5). Moreover, the analysis identified a large number (nearly a third of the analysed resources) of online courses or teaching and training material. This might be explained by a growing general awareness of topics around data technologies or by changing curricula. For example, one of the Swiss resources was created as a reaction to the new Swiss school subject "media and informatics" (interview with Siegenthaler, see chapter 5.2). The amount of educational material

on datafication identified in this analysis further reinforces scholarly calls for supporting "networks of literacy" and a "chain reaction" of critical thought as it enables individuals to easily spread their knowledge and educate others about datafication (Markham 2019; Carmi et al. 2020). Moreover, the great variety of formats that was identified supports the "no one-size-fits-all" argument (Carmi et al. 2020; chapter 2.2), as different formats take different approaches – textual, visual, audio-visual or interactive – which correspond with different learning types, thus helping different learners to approach the topic in a way that works for them.

### Parallels between the Theory and Practice?

Finally, the analysis explored to what extent the identified resources aligned with the preliminary framework for critical datafication literacy. Strong parallels that could be identified included that more than two-thirds of the analysed resources provided (different forms of) practical or constructive advice; that two-thirds incorporated real-life examples and that about half of the resources used interactive elements. Thus, the majority of resources corresponded with scholarly calls for applied and participatory approaches (D'Ignazio and Bhargava 2015; Iliadis and Russo 2016; Markham 2019); for connecting people's real-life experiences with data (Freire 2017; Fontichiaro et al. 2017); and for including "practical strategies and tactics" (Pangrazio and Sefton-Green 2020, p. 218).

However, other characteristics of the preliminary literacy framework were less common. While the sample included many different formats, which help cater to different learner types, only 29 resources seemed to recognise the need to provide different approaches for different audiences, and the large majority seemed to address the general population. Although it is not always possible to recognise the intended target group of a resource without talking to the creators, this nevertheless demonstrates that a "one-size-fits-all approach" seems to be more widespread than recommended by the literature. Moreover, only few resources addressed the difficult balance between empowering individuals through data protection advice but not merely shifting responsibility to individuals but rather promoting a systemic approach. While 16 of the 75 resources openly communicated this intricacy and called for, among other approaches, societal and political action, six others took a contrary position and clearly *urged individuals to take responsibility* for their data. They would, for example, demonstrate to users that their data are "the new gold" and argue: "It is therefore up to each individual to become active and protect their privacy" (R24, p. 2, own translation). Both challenges – addressing different audiences and finding a balance between empowerment and responsibility – will be discussed in more detail in chapter six based on findings from the next two empirical perspectives.

Overall, the answer to the third guiding question of the content analysis can only be: the analysed resources are *somewhat* in line with my preliminary literacy framework. While some characteristics were identified in the majority of the sam-

ple, others were rare in the analysed resources. Yet, the content analysis identified a small number of resources that offered elaborate and sophisticated approaches to critically educate about datafication, cater to different audiences – without requiring any prior knowledge – and provide detailed constructive advice – without shifting responsibility to the individuals. Moreover, a number of novel approaches were identified. These provided valuable new insights for the further development of this study's framework for critical datafication literacy, and informed both the expert interviews with resource creators and the qualitative survey with educators.

## 5.2 Goals, Strategies and Challenges of Critical Data Literacy Resource Creators

The goal of my study was to learn from practitioners of critical data literacy: creators of online educational resources about datafication, and educators who might use these resources to foster critical understanding of data systems through their educational work. In order to learn from the resource creators, ten diverse resources were selected based on the previous content analysis and 12 expert interviews (ten initial and two follow-up interviews) with their creators were conducted and analysed along with additional material (see chapter four). The interviews demonstrated that while the interviewed resource creators may not necessarily use the concept of "literacy", they all had specific educational goals they wanted to achieve with their resource. Key goals included fostering systemic understanding of datafication, promoting critical thought, and empowering learners to become active – both individually and collectively. Moreover, the interviews led to novel findings on how these objectives can be reached through the format of online resources, for example highlighting strategies to create personal involvement and develop engaging and entertaining resources. Finally, challenges around the funding of resources, evaluating them and keeping them up to date were discussed. This chapter presents key findings on these themes, which include strong parallels but also some diverging opinions among the different interviewees. Overall, the expert interviewees provided numerous new insights for the further development of critical datafication literacy in this study.

### 5.2.1 Creation Contexts of Critical Data Literacy Resources

As outlined in more detail in chapter three, the multistage selection process for this analysis led to a final sample of ten diverse resources (see table 5). This sample included a variety of design formats, such as websites, collections of teaching material, interactive video experiences, an online game, short videos, podcasts, data protection toolkits and several brochures. The ten resources were produced in six different

countries (Canada, France, Germany, Switzerland, United Kingdom, United States) by creators from various backgrounds.

*Table 5: The ten selected resources and the creators who were interviewed for the study.*

| **Reference (see appendix II)** | **Resource Name** | **Interviewee(s)** |
|---|---|---|
| R17 | Anna. Das vernetzte Leben | Ludwig Reicherstorfer |
| R33 | Automating NYC | Akina Younge, Deepra Yusuf, Jon Truong |
| R62 | Center for Humane Technology | David Jay |
| R75 | Clear Your Tracks | Ed Parkes |
| R41 | Datak – A game about personal data | Julien Schekter |
| R9 | Do Not Track | Brett Gaylor |
| R39 | Lehrmittel Big Data | Carmen Siegenthaler |
| R18 | Lernparcours Big Data | Esther Lordieck |
| R10 | Me and My Shadow | Fieke Jansen |
| R2 | My Data and Privacy Online | Mariya Stoilova |

This variety in the resources' creation backgrounds and thus the diversity in my expert interviewees' vocational contexts was one of the first findings from the interviews. Three of the interviewees created the resources as part of their work in non-governmental organisations such as the *Tactical Technology Collective* (Jansen);[3] the *iRightsLab*, formerly NGO, now think tank (Reicherstorfer); or the *Center for Humane Tech* (Jay). Two others worked in journalism and media production: Gaylor as a documentary filmmaker and Schekter as a producer journalist for the *Swiss National Radio*. Further roles included working as a media pedagogue at the youth media centre *jfc Medienzentrum* (Lordieck) or as a research fellow at the *Department of Media and Communication* at the London School of Economics (Stoilova). The interview sample further included some more unusual backgrounds for critical data literacy resource creators. Parkes, for example, has a consultancy for "data innovation and data transformation projects in the public sector" (Parkes Interview, 2021), and created "Clear Your Tracks" (R75) together with his colleague Jemma Venables as part of his freelancing work. Equally unusual is the background of "Automating NYC" (R33): It was

3 Jansen was involved in the development of "Me and My Shadow" (R10) and many other resources by the Tactical Technology Collective but did not work at the organisation anymore when the interview was conducted.

created by Akina Younge, Deepra Yusuf, Elyse Voegeli and Jon Truong as part of their Master's Thesis on Public Policy at the *Harvard Kennedy School*. Finally, the "Lehrmittel Big Data" (R39) was created by Carmen Siegenthaler, a museum communicator and former teacher, and her colleagues at the *Museum for Communication* in Bern.

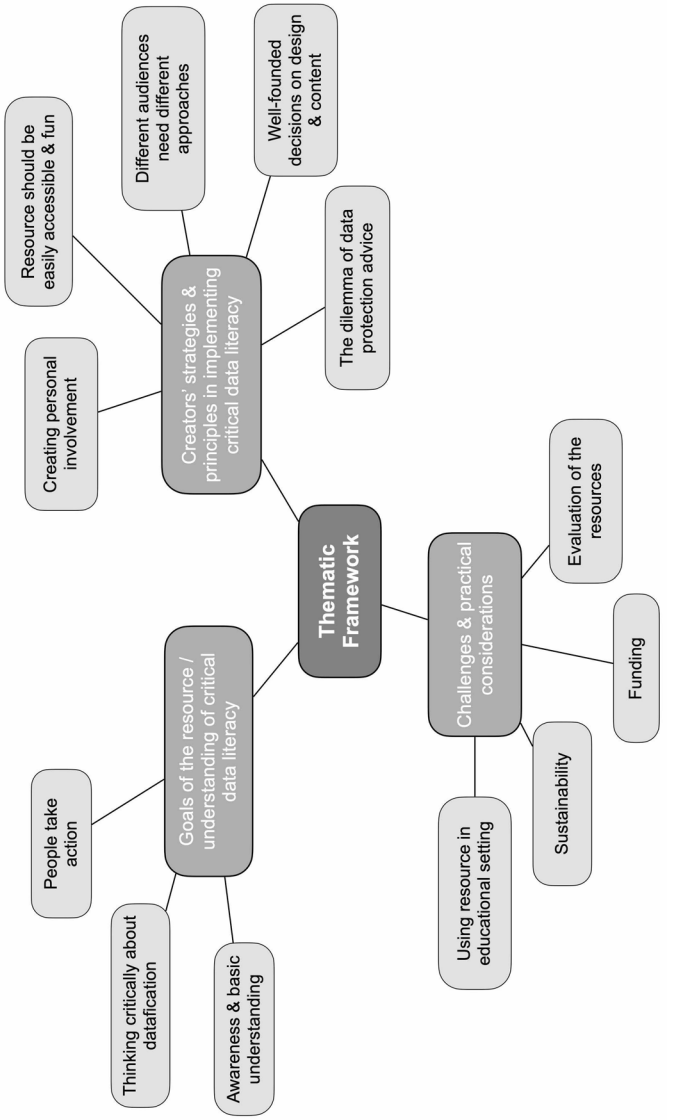
Thus, this short introduction of my interviewees and the contexts in which they developed the different online educational resources on datafication already provides a first valuable finding: critical data literacy resources can be created in a variety of contexts by a variety of actors. As the further analysis throughout this chapter shows, this variety can also be found in the funding and the target audiences of the examined resources. Nevertheless, many common goals and strategies were identified among the interviewees – along with some significant controversies.

### 5.2.2 Critical Data Literacy Resource Creators' Goals

Overall, twelve main themes were identified in the analysis (see fig. 12). These were structured along three categories. The first, *goals of the resource*, describes the resource creators' idea of a 'literate' or empowered citizen, or, in other words, their practical understanding of critical data literacy: What should people know, understand or do after using their resource? The second category, *creators' strategies and principles*, represents the 'how': How did the creators try to reach their goal of a 'literate' citizen? How did they decide on the resources' format, design and content? The third category finally addresses *challenges and practical considerations*. This category summarises key challenges that repeatedly emerged across the different interviews together with the creators' considerations on using their resource in educational settings.

The main themes that are shown in figure 12 constitute the key findings for each category – the key answers to the research question. However, the most interesting findings could often be found in the subthemes of each main theme. These provide the (sometimes controversial) answers to open questions and dilemmas that had emerged in the prior stages of my study, such as: What exactly does a 'critical reflection' of data technologies entail? How can abstract issues around datafication be made tangible? Which actions should people take? Should citizens' digital skills be fostered or does this only shift responsibility to the individuals? Thus, it is these subthemes that show many parallels to key findings from the theory chapters and chapter 5.1, and that highlight diverging opinions between the expert interviewees' perspectives. For this reason, the subthemes identified in the analysis are not only outlined and discussed throughout this chapter but are also visualised for each category (see fig. 13, 14 and 15).

*Figure 12: Categories and main themes identified in the expert interview analysis.*

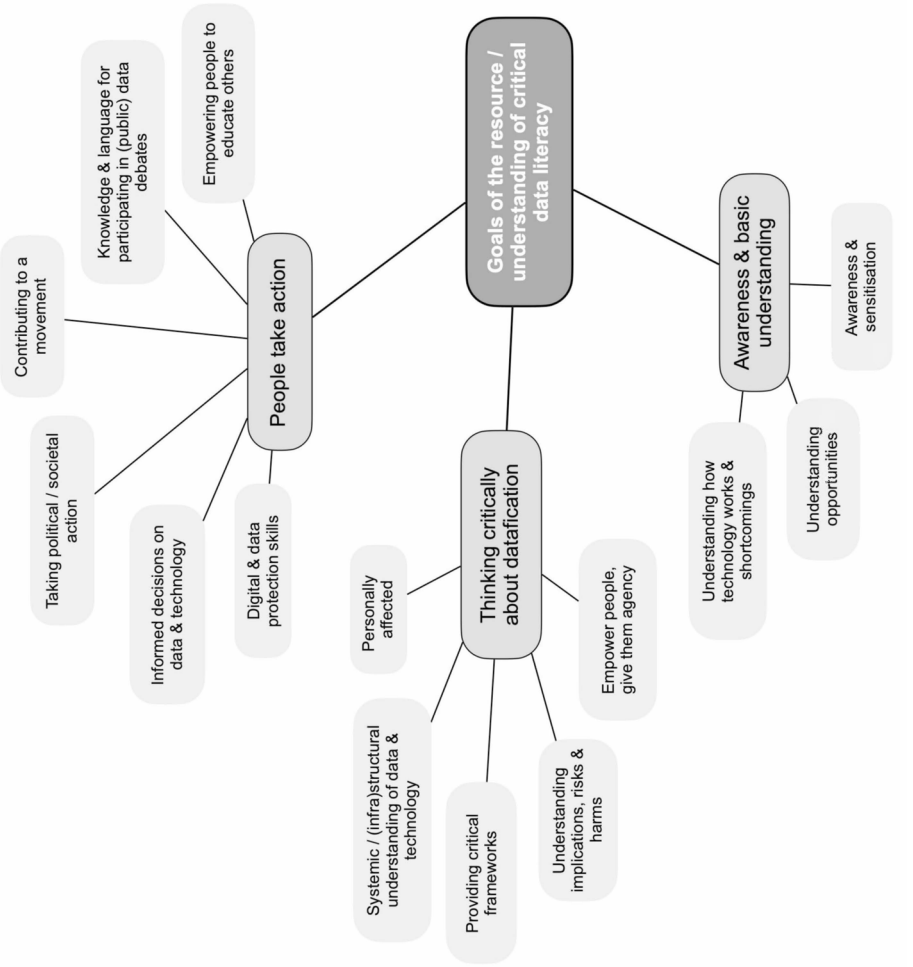


## Awareness and Basic Understanding

The creators' goals for their resources and their practical understanding of critical data literacy could be condensed into three main themes. Figure 13 displays these three main themes and their related subthemes. The first main theme that was identified was awareness and basic understanding. Particularly considering citizen's lacking awareness of the use of algorithms (e.g., Grzymek and Puntschuh 2019; Hitlin and Rainie 2019) and their "major understanding gap" when it comes to the business model of the internet (Doteveryone 2018, p. 5), *raising awareness* about data systems is an expectable goal of critical data literacy resources.

However, the interviewed creators wanted to go beyond awareness: they wanted to demystify technology. Eight of the ten interviewees stated that one goal of their resource was for people to gain an *understanding of how the technology around them functions*, including its *shortcomings* and the "assumptions baked into the product development process" (Jay Interview, 2021). Brett Gaylor even specified such "visceral understanding of the way that their data is used online" as the key goal – or the "big hairy audacious goal, so BHAG" – of his resource Do Not Track (Gaylor Interview, 2020). Apart from technologies' shortcomings, some of the creators also aimed for people to *learn about opportunities* of data and technology. This represented somewhat of a contrast to the overall critical perspective of the examined resources. Yet, including how people can "save the world through big data" (Siegenthaler Interview, 2021) could also help with the issue of fear and resignation, which is further discussed below.

*Figure 13: Main themes and subthemes in the category "goals of the resource" in the expert interview analysis.*



### Thinking Critically about Datafication

The second main theme identified as a key goal of the creators was to encourage users to think critically about datafication. This goal was expected since critical reflection was one of the qualifying criteria for selecting the resources in the prior analysis (see 5.1). However, examining *how* exactly practitioners envision this critical reflection to take place and how they try to foster it led to novel insights. One goal that many interviewed creators highlighted was to provide people with *critical frameworks* to think differently about digital technologies. Some, like the creators of Automating NYC, wanted to "give people a conceptual framework from which to enter" (Truong Interview, 2021). Others aimed for their resource to teach people how to apply "their own social and political frameworks" to technology (Jansen Interview, 2020). Either way, many hoped to change the way people think about technology, to encourage them to critically reflect on technology and to "continuously ask questions" and "think outside what they know so far" (Siegenthaler Interview, 2021).

Related to this, many creators wanted the users of their resources to gain *systemic or (infra)structural understanding of data and technologies*. Such broader understanding – not just of how data technologies function, but also of the process of datafication and its implications on individuals and wider political, societal and economic impacts – is currently still missing from many critical data literacy concepts in academia (see chapter 2.2), but is a key aspect of the critical datafication literacy framework developed throughout my study (see chapter 3.4). The interviewed creators described this perspective as "helping people have a systemic view on how this technology is limiting their agency" and "reveal[ing] the systemic forces underneath [social media]" (Jay Interview, 2021); or as a "sociological, societal understanding" (Younge Interview, 2021).

To foster people's critical reflection of data technologies, the majority of creators aimed to educate about the *risks and harms* that come with datafication and to make people realise *how they themselves are affected* by issues around data and technologies. They aimed for people to understand "how data about you can impact your life online and offline" (Gaylor Interview, 2020) and to create "personal involvement" (Reicherstorfer Interview, 2021). Specific strategies on how to reach this involvement are discussed in section 5.2.3 below. Apart from feeling that they are personally affected, the creators further wanted to make people *feel empowered* and to give them "real agency" (Stoilova Interview, 2021). This leads to the third key goal of the interviewed creators: they wanted learners to take action.

## People Take Action

In light of the common criticism that critical data literacy and other awareness-raising efforts do not specify what comes after increased awareness, this third theme was particularly significant. The uncertainty of unclear steps after awareness also came up in the interviews: "the question is then always: What now? Knowledge is the one thing, knowledge transfer is the one thing, but what results from this?" (Reicherstorfer Interview, 2021). Brett Gaylor further pointed out that people ask the question of "what can I do? […] almost every time" they watch a documentary or hear about a societal issue, but, he argues, "that's not the right question to ask about systemic issues. You probably can't do that much" (Gaylor Interview, 2021). Another creator, Carmen Siegenthaler, took a similar stance from another perspective, stating that changing the behaviour of her resource's users is in her view a goal that is too big and unrealistic (Siegenthaler Interview, 2021).

Despite this uncertainty about whether it is possible to get people to take action, and whether this action would lead to any significant changes to the problems around datafication, all resources aimed at people taking action in one way or another. Two common goals were to increase people's *digital and data protection skills* and to enable them to *make informed decisions* about the technologies they want to use in the future. This reiterates findings of the analysis of resources in chapter 5.1, which also found a strong focus on advice on data protection and alternative services. The interviewed creators for example outlined that they wanted to give users "better control" of their data and help them develop healthier habits in their use of digital technologies (Stoilova Interview, 2021); that they hoped to create the "prerequisite for self-responsibility" (Reicherstorfer Interview, 2021); and aimed to empower people to make "enlightened choices. If you give your data, just know what you are doing, that's the main goal" (Schekter Interview, 2021). Enabling people to make informed choices rather than telling them what to do is a strategy several interviewees followed and that will be further discussed below. However, as already touched upon above, practical advice and the idea of "enlightened choices" were also controversial among the interviewees, as some argued that the technology is too sophisticated and the issues are too systemic, which makes actual enlightened choices impossible. This dilemma around data protection advice will be further discussed below.

Beyond taking individual and technical steps to protect one's data, several interviewees hoped the users of their resources would become active on a societal level. For example, four creators outlined that they wanted to enable people to *take part in public debates* about data technologies by providing them with the necessary knowledge and the appropriate language. The aspect of requiring a "data language" in order to participate in public debates was discussed in detail by Akina Younge, Deepra Yusuf and Jon Truong. They criticised the "expectation that everyone needs to have technical expertise" and the "gatekeeping nature" of this expectation (Younge Interview, 2021). Akina Younge further stated:

> I wish it weren't the case, that people didn't need this, I don't think this should be the case, I don't think that's the way the world should work. I believe the political education stuff is way more important and I understand that the contextual reality is that they're going to be dismissed if they don't say some of the right words. (ibid.)

This argument of needing the "right" language in order to be able to participate in public debates about data systems and to be taken seriously represents a crucial aspect of critical data education that does not receive much attention in the literature as yet. Others similarly wanted to "create a shared vocabulary" (Jay Interview, 2021), and give people a language to "articulate … [their concerns about facial recognition] through a lived experience" (Gaylor Interview, 2021). Some interviewees hoped that enabling more people to make their voices heard in personal and public discussions about data, would help "shift the frame around which problems with technology are discussed" (Jay Interview, 2021).

Several interviewed creators articulated even more ambitious goals and wanted to empower people to *take societal or political action* – an approach that was already identified in the content analysis of resources (see chapter 5.1) – or even hoped to *contribute to a movement*. Esther Lordieck very clearly argued that changing one's device settings is not enough, but that political action is needed. She aimed to empower young people to form their own opinion and make it heard, for example by contacting political parties about data issues (Lordieck Interview, 2021). Mariya Stoilova took a similar stance, wanting to make "children more active participants and citizens in a digital environment" (Stoilova Interview, 2021). Although some admitted that "we're not going to turn everyone into activists" (Parkes Interview, 2021), three interviewees outlined that they saw their resources as "someone's first step into a broader movement" and hoped that for some people, the educational resource "will be a journey into more leadership in the movement" (Jay Interview, 2021). Deepra Yusuf further specified that she thinks "we are really just at the cusp of starting that movement", in which the knowledge trickles from academia to creators of critical data literacy resources and "hopefully then following that, you really have the on the ground movement" (Yusuf Interview, 2020).

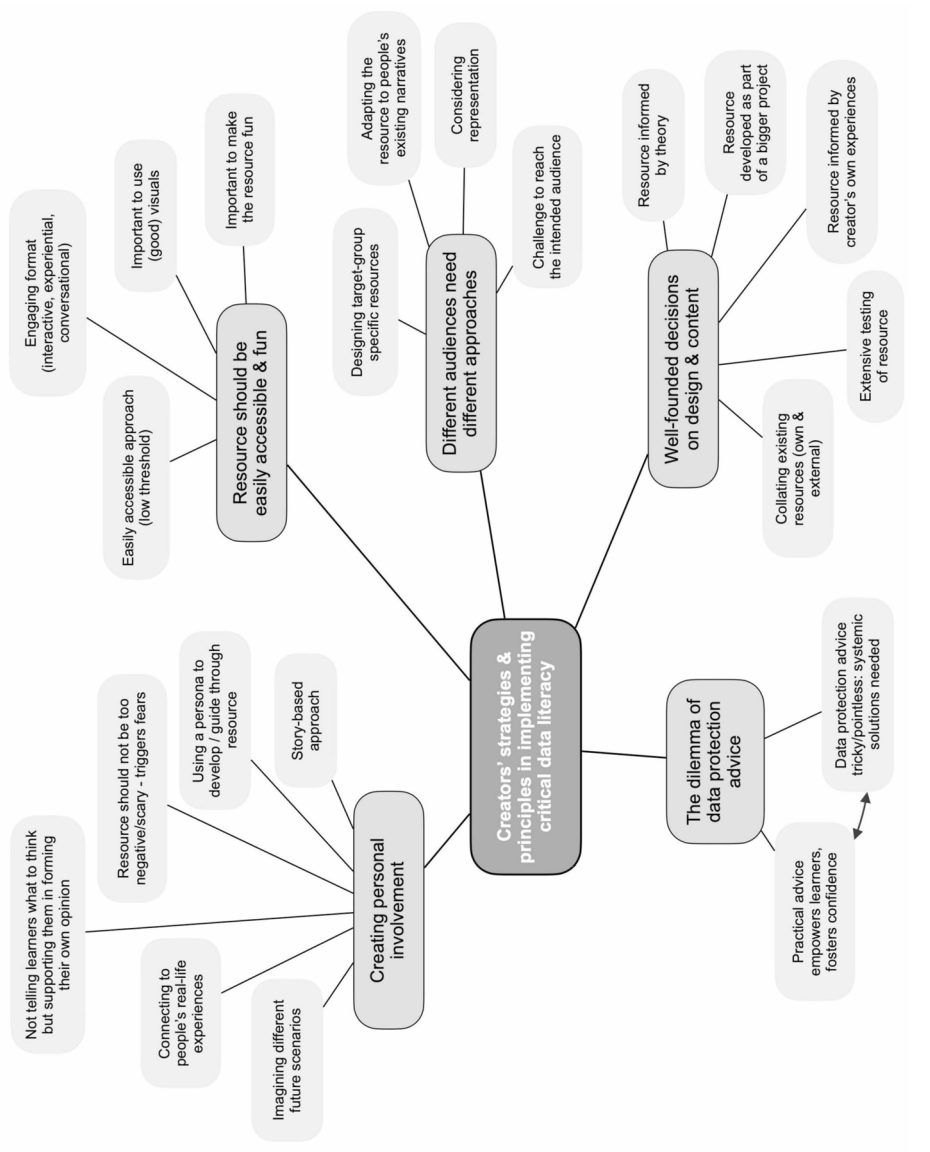
These very ambitious and political goals of the creators are unusual in critical data literacy scholarship but resemble "re-active data activism". This form of activism aims to educate about data technologies and fight against the datafication and its problematic implications (see chapter 2.1). Data activists encourage citizens to carry out "practices of resistance", such as "self-defence, civil disobedience and disruption" (Milan and Gutiérrez 2015, p. 122; Milan and van der Velden 2016, p. 67). Thus, re-active data activism represents a similarly politically activist stance as my interviewees, albeit possibly with a more disruptive focus in contrast to my participants' idea of citizens enacting their democratic rights.

Finally, some interviewees specifically wanted to start a snowball effect of education, hoping to *empower people to educate others* by publishing teaching material, curricula and public speaking material as part of their resource. This correlates with scholarly calls to support learners to foster reflection and literacy for those around them (Markham 2019, p. 756; Carmi et al. 2020, p. 12). Nevertheless, other interviewees also highlighted that comprehensive, systematic data education cannot be provided by small non-governmental organisations and other critical data literacy resource creators but that a literacy strategy should be developed by governments (Jansen Interview, 2020).

### 5.2.3 Creators' Strategies and Principles for Implementing Critical Data Literacy into Practice

The analysis of the expert interviews further revealed novel findings regarding the strategies and principles for implementing critical data literacy into practice. Five main themes were identified in total: Creating personal involvement; resource should be easily accessible and fun; different audiences need different approaches; well-founded decisions on design and content; and the dilemma of data protection advice (see fig. 14). Many of these reiterate theoretical findings and academic discussions on critical data literacy (see chapter 2.2), such as the aim for a low threshold, the "no one-size-fits-all" approach or considerations around providing practical advice while not shifting responsibility to individuals. The interviewees further provided many suggestions on how these approaches can be implemented in practice, including some parallels to academic discussions as well as a number of controversial issues among the interviewed creators.

*Figure 14: Main themes and subthemes in the category "creators' strategies and principles in implementing critical data literacy" in the expert interview analysis.*



## Creating Personal Involvement

As already highlighted above, many interviewees aimed to create a sense of personal involvement through their resources, to make people realise that issues around the datafication of our societies affect them personally. According to the interviewed experts, this is necessary because of "issue fatigue" (Yusuf Interview, 2020) in society, with too many problematic issues that citizens could or should be concerned about. Critical data literacy resources should therefore try to move issues around datafication into people's "circle of worry", which includes issues they are concerned about, such as "am I going to have a job; is the earth going to explode; am I going to get Covid-19?" (Gaylor Interview, 2020). All interviewees agreed that a sense of personal involvement should be created to demonstrate to people why they should care about issues around datafication. The creators applied several strategies to reach this personal involvement. Some of these were already identified in the prior analysis of online resources (chapter 5.1), but also some entirely new approaches emerged.

A very common strategy among the interviewed creators was to connect their resources to *people's real-life experiences* with technology. One way to implement this that was also identified in the previous analysis of 75 resources was to include real-life stories in the resource. One example is the story of Porfirio, the owner of a bodega (a small type of grocery store common in New York City), who was nearly put out of business due to a faulty fraud detection algorithm (see R33). The Automating NYC website uses this story as an "entry point" and common thread throughout the resource in order to make the "immaterial and abstract" issues around automated decision-making systems more tangible (Truong Interview, 2021). Other approaches for connecting to people's lives were to demonstrate that data technologies already affect nearly every area of life and "I am confronted with this every day" (Reicherstorfer Interview, 2021); to encourage people to talk "about their own experiences and the experiences of their friends and the harms showing up in their life and in their community" (Jay Interview, 2021); to include real-life dilemmas in the resource (Schekter Interview, 2021); and to make the resource itself experiential (see below). The Datak game (R41) even included a real-life impact: if users entered their real phone number they would receive an automatic call by a masked number one hour later, which first tried to trick the users and then admitted that "it's just a machine, but you have played Datak and maybe you should think twice next time you put your real number wherever on the web" (Schekter Interview, 2021).

A second very common strategy to create personal involvement that was suggested by the majority of creators was *to not tell people what to think*, but to support them in forming their own opinions. Several interviewees emphasised that critical data literacy resources should try "not to be moral" and not tell "that's wrong or that's good" (Schekter Interview, 2021). Instead, they should educate about advantages and risks and empower learners to "form your own opinion and make it heard" (Lordieck Interview, 2021). This could be achieved by including "philosoph-

ical thought experiments", which suggest different data scenarios to learners and encourage them to imagine how they would handle data in each scenario (Siegenthaler Interview, 2021). Another approach is to prompt people with questions rather than imposing answers, which, according to Truong and Younge constitutes "good pedagogy" (Truong Interview, 2021). They deliberately used questions as headers to allow readers to "lean into something that you might disagree with" (Younge Interview, 2021), and often tried to foster people's critical reflection "without telling people the answer, which I think is a really important part of education" (Truong Interview, 2021).

Related to the question of morality highlighted above, the question of how negative or scary a resource should be kept emerging in the interviews. While some interviewees admitted that fear gets people's attention, most agreed that *critical data literacy resources should not be too negative*. Using fear to educate, they argued, means that "right away you'll lose a bunch of people because they'll be like […], I don't want to think about that" (Gaylor Interview, 2020). They further stated that fear "does not help anyone" as it does not offer solutions (Reicherstorfer Interview, 2021), and that it is the "worst way to learn because if you scare people, they stop learning" (Jansen Interview, 2020). Instead, many agreed that educational resources should be "colourful and fun" (Jansen Interview, 2020; see also below). However, others believed that "a certain amount of fear is useful" for particular groups of people (Parkes Interview, 2021), or argued that people can be reached "through a negative emotion" (Jay Interview, 2021). Lordieck tried to find a balance between these positions, arguing that there is a "thin line" as resource creators often feel strongly about datafication, but they still want their resource to not be too negative (Lordieck Interview, 2021). Thus, it can be said that the interviewed creators did not agree on a common stance toward a fear-based approach to critical data literacy but rather expressed divided opinions. This is in line with the student users of critical data literacy resources in my prior study, who had in part stated that they wanted to be "scare[d] into it" and that this is "always necessary", and in part argued that scaring people is "not the right approach" and people should not do "the right thing because they're scared" (Sander 2020c, p. 12).

Besides these discussions, the interviewees provided further concrete suggestions on how to create a sense of personal involvement. For example, many creators placed a great emphasis on the use of stories in their resources. Brett Gaylor explained the *importance of stories* to foster specific narratives in critical data literacy resources:

> The thing is if you want people to move towards a narrative, it's not necessarily that you just tell them that. […] you have to drop all these little breadcrumbs, so you can tell a story that promotes that narrative. Narratives have a protagonist; they have

> an emotion that they generate and they have an ending which is a happy ending or an unhappy ending. (Gaylor Interview, 2020)

Similarly, Carmen Siegenthaler argued that stories help learners to critically reflect on issues and form their own judgement, without a moral perspective of "you have to behave like this, this or this" (Siegenthaler Interview, 2021). Other creators equally found that stories are the best way to reach people and to communicate complex issues (Yusuf Interview, 2020), and that stories are popular, with Ed Parkes' testing audience demanding: "why don't you just tell us what it is, tell us a story about what actually happens" (Parkes Interview, 2021).

Another approach that could easily be connected with a story-based strategy was to foster people's *imagination of different data futures*. Presenting different future scenarios and "articulat[ing] the steps that we need to get there" was seen as a cheap and effective way to motivate people (Gaylor Interview, 2021), and foster people's imagination (Siegenthaler Interview, 2021). Similar calls for different future imaginaries have been made in academic critical data literacy approaches, for example in Gray et al.'s concept of "data infrastructure literacy" that includes the goal of "infrastructural imagination" (referring to Bowker 2014) about how datasets "might be created, used and organised differently (or not at all)" (Gray et al. 2018, p. 3). Yet, this approach was only identified in eleven of the 75 resources analysed in the previous chapter.

Finally, some interviewees suggested to use *personas* in the design of their resource – either visibly, to guide through the resource, or as an invisible personification of their target audience. A visible persona, such as "Anna" in "Anna. Das vernetzte Leben" (R17) functions as an identification figure, that, like the resource's audience, navigates life in a digital society (Reicherstorfer Interview, 2021). However, a persona can also serve as an invisible personification that represents the resource's target audience and guides decisions on design and content along this audience's needs. This was the case in Automating NYC, where Yusuf's mother served as an embodiment of the 'typical' New York citizen (Young and Yusuf Interview, 2020).

### Resources Should Be Accessible and Fun

As a second main theme, nearly all interviewees agreed that resources should be easily accessible and fun. They highlighted the importance of an *easily accessible approach*, for example by using friendly and lay language and avoiding technical or too academic definitions; by not using too much text, modularising it into chapters or making it 'skimmable' through headers; and by considering people's convenience when deciding on a format or design. However, an easily accessible approach should not only affect the resource's format, design, and language, but also its content. One way to implement this is through a 'step by step' approach, that begins with basic information that does not require any prior knowledge, and slowly offers more advanced knowledge for those who are interested, such as extensive dossiers

on each topic (Reicherstorfer Interview, 2021). Nevertheless, several interviewees highlighted that the balance between technological accuracy versus accessibility, for example when it comes to technical terms, remained a challenge.

Moreover, many expert interviewees agreed that it is good to use an *engaging format* for critical data literacy resources. Mariya Stoilova, for example, conducted workshops with children that informed the development of the "My Data and Privacy Online" toolkit (R2). These revealed that the children most enjoyed using engaging and interactive resources, and they also liked to "find the loopholes" and "outsmart" the resources, whereas "if they just have to sit and watch something, they were like I know this, I don't want to be doing that" (Stoilova Interview, 2021). This reiterates findings of my prior study, in which university student users clearly called for interactive resources (2020c), and strengthens scholarly calls for participatory approaches (e.g., D'Ignazio and Bhargava 2015; Iliadis and Russo 2016).

Other interviewed creators called for interactive resources that constitute a "conversation" or let users have a "tiny little experience" of what it means to be affected by data systems (Gaylor Interview, 2021). The outcome of such an experiential approach, which was also the "overarching strategy" of Siegenthaler, is that learners reach "an essence, an insight" (Siegenthaler Interview, 2021). The popularity of an analogue, black-story-style game included in Siegenthaler's resource further shows that this approach does not necessarily have to be implemented digitally. This experiential rather than 'only' interactive approach was not something I had come across in the academic literature before, but it constitutes a significant finding considering the immateriality of issues around datafication, which often make them difficult to grasp for learners.

As another way to reach people, many interviewed creators highlighted the *importance of using visuals* to illustrate abstract concepts and to offer another way of understanding (Lordieck Interview, 2021). Some examples of this were already illustrated in the previous chapter. However, as Fieke Jansen emphasised, it is crucial to avoid stereotypical visualisations of data systems and instead use images that people can relate to:

> We wanted to be material because if you type in privacy or digital security on Google, you will get padlocks, you get matrix, you get all of these images, but these are images people don't relate to, like it doesn't stick in their heads. So, we wanted to be material, so tangible and relatable. (Jansen Interview, 2020)

Finally, seven of the ten expert interviewees called for *colourful and fun resources*. The entire resource, they argued, should be approachable, playful and entertaining and this should be represented in its visual style. This is particularly important for resources targeting adults, as they "must want to learn" and thus "interest and conversation" must be sustained throughout a training or educational resource (Tactical

Technology Collective 2018, additional material, p. 1f). Similarly, Gaylor argued that "people should enjoy the experience, [...] you should laugh" (Gaylor Interview, 2020). In Do Not Track, he aimed to include an interactive feature in the first 30 seconds of each episode, and he emphasised that especially these interactive tasks should be entertaining and resource creators should always ask themselves: "the thing that you're asking the person to do, is it fun at all?" (ibid.). Others equally stated that they aimed for fun and interesting (Jansen), entertaining (Schekter) and playful (Siegenthaler) resources.

### Different Audiences Need Different Approaches

Another main theme that emerged in all interviews – that different audiences need different approaches – was already identified in the literature on critical data literacy (e.g., Carmi et al. 2020) and in the previous chapter. The interviews further revealed that several creators had defined very different and often specific audiences, such as educators, children, teenagers, young adults, parents, "Generation X", activists or advocates, journalists, lawyers, technologists, New York City residents, people who often use the internet, or people who are open to taking action. However, also some broader groups were mentioned, such as all Germans (Reicherstorfer Interview, 2021) or "people who watch TV" (Gaylor Interview, 2021, speaking about his resource "Internet of Everything"). Several creators further found it *difficult to reach the intended audience* for their resource, such as audiences beyond Europe and the US (Jansen Interview, 2020), or beyond the "digital rights communities" in order to not just "preach to the converted" (Gaylor Interview, 2020).

Despite these difficulties, the majority of interviewees emphasised the *importance of target-group specific resources*. In practice, this could mean developing a resource specific for a location (e.g., Automating NYC, R33), creating location-specific versions of a resource (Do Not Track, R9); deciding on a format based on your intended target audience (e.g., podcasts for "senior leaders in tech", Jay Interview, 2021); combining different formats and approaches in one resource to cater to different learning types (Reicherstorfer Interview, 2021); or to collaborate with social media influencers to reach a young target audience (Schekter Interview, 2021). Several creators further emphasised that identifying your audience is "the first thing that you do because decisions will cascade from that" (Gaylor Interview, 2020). Targeting a broad audience was seen as "a big challenge" (Reicherstorfer Interview, 2021) and some interviewees highlighted that it is "probably impossible to make one tool that can reach everyone" (Younge) or that a "product for everyone is a product for no one" (Jansen, additional material, 2020). However, they also argued that "public literacy tools could and should reach everyone" (Younge Interview, 2020).

One way to reach different people through critical data literacy resources is to adapt a resource to *people's existing narratives*. Jansen highlights this when she explains that issues around datafication have "so many dimensions", from technical,

social, political to economic, and that there are "different hooks that make people tick and you have to try to find these hooks and build on them" (Jansen Interview, 2020). Gaylor similarly stated that:

> I think what you need to do is you need to understand the narratives that people already have in their head around these issues. […] They might hold in their head a narrative that you as the maker might consider unhealthy, or that you actually want them to hold a different narrative in their head, like that's part of your goal and that kind of thinking and that kind of persuasion and propaganda is pretty explicitly different than enabling literacies for people. […] how receptive are those people to different messages? (Gaylor Interview, 2020)

This quote highlights a crucial point: that enabling literacies is a fundamentally different approach than trying to persuade people to adopt a certain opinion. Instead, enabling literacies should mean empowering people to form their own opinion and act on it. To achieve this, people's different points of departure and their existing narratives should be considered, and the resource adapted accordingly. This is in line with Younge and Truong's argument above, which suggested prompting people with questions rather than providing answers in order to invite them to lean into perspectives they might otherwise disagree with.

A final approach to more target-group specific resources that the interviewed creators suggested was that it is important to *consider representation*. Jansen, for example, stated that she deliberately did not use "representations of people because it's very difficult if you work in a global context, what skin colour do you use, what gender do you use, what sex do you use and it always ends up looking horrible" (Jansen Interview, 2020). Several other creators did use a visual persona in the resource (see also above) but refrained from assigning the main characters in their resource a gender (Schekter), or chose a mixed-race person "of indeterminate gender, a non-binary person" (Parkes Interview, 2021). In contrast, Ludwig Reicherstorfer explained how his main character Anna, although she has a defined age, gender, relationship status and living environment, was intended to create a high degree of identification for users through the different scenarios from her life that are depicted in the resource. He stated:

> No matter how old I am, which gender I have, which profession I may have, which training, which level of education etc. – all scenarios apply to me in one way or another. So I am Anna, we all are Anna. (Reicherstorfer Interview, 2021)

Thus, it can be said that several creators considered questions of representation and highlighted its importance for target-group-specific resources, although they drew very different consequences for their resources.

## Well-Founded Decisions on Design and Content

The next main theme that was identified concerns the background and development processes of critical data literacy resources. The analysis revealed that the interviewed creators made well-founded decisions on the design and content of the resources. Many explained that their *resource was developed out of a bigger context*, such as an academic research project (Stoilova); a Master's Thesis project including a collaboration with a think tank (Younge, Yusuf and Truong); a user research project with a user-centred design focus (Parkes); a radio show with a number of investigative journalism pieces (Schekter); a new permanent exhibition in a museum for communication that is interconnected with the resource (Siegenthaler); or the creator's practical experiences in giving workshops on data-related issues (Lordieck; Jansen). Some resources were also *informed by theory*. This could be academic theory, as with "My Data and Privacy Online" (R2), which was informed by a "typology of privacy" and "three different notions of data" developed throughout the creators' own research as well as additional media literacy frameworks (Stoilova Interview, 2021). However, it could also be adult learning principles (Jansen) or a model of big data that was developed by the resource creators themselves to make sense of the different levels on which data systems affect our society ("Cassata-model", Siegenthaler Interview, 2021).

Apart from this, many resources were informed by the creator's personal interests in the topic or their *personal experiences* with data technologies. Moreover, several creators stated that one intention to develop their resource was to *collate existing resources* in one place. This could be a collection of their own already existing resources – "a place where we could park a lot of the answers and practices that we developed" (Jansen Interview, 2020), as Schekter, Lordieck and Jansen explained. Or it could be "a way to lift up the people around us" (Jay Interview, 2021), and to collect and recommend existing resources by others, as Stoilova, Siegenthaler and Jay pointed out.

Finally, the analysis demonstrated that some of the interviewed creators conducted *extensive testing of the resource*, often with their target audience. Carmen Siegenthaler, for example, reported testing her teaching material with teachers and in two classrooms with different age groups. Similarly, Julien Schekter also tested his game in two classrooms with different ages. Ed Parkes tested a first prototype of his resource with the use of a professional recruitment agency. Akina Younge, who reported testing with friends, family and fellow students, said: "one of the things that we probably wish we had done more is more extensive user testing" (Younge Interview, 2021).

## The Dilemma of Data Protection Advice

A final key finding on the creators' strategies and principles for implementing critical data literacy concerned the dilemma of data protection advice that was already touched on in previous chapters (see chapter 3.4, 5.1). It describes the difficult balance between the importance of providing constructive next steps when educating about datafication to avoid resignation and to encourage learners to become active, while not merely shifting responsibility to individuals (see e.g., Pangrazio and Selwyn 2019, p. 425). Without me actively bringing it up, this dilemma came up in many of the interviews and seemed to be something that many of the interviewed creators faced when developing their resources.

On the one hand, many highlighted that *practical advice on data protection can empower people and foster their confidence*. Ludwig Reicherstorfer argued that it is important to include constructive advice into a resource in order "implement users' understanding into actions" and so that citizens can "feel safe in a digital society" because they can make informed decisions on which services to use. Akina Younge argued further that a certain amount of technical knowledge can "empower people and encourage them and instil the confidence" that they need to articulate their experiences with data, and that it also makes "you seem legitimate to someone else" (Younge Interview, 2021). Esther Lordieck outlined that practical advice on "concrete, tangible things to do" can help to not feel "overrun by a feeling of powerlessness" (Lordieck Interview, 2021). Despite using different terms, these arguments strongly correspond with academic research on resignation and with findings of my previous study, in which participants argued that easy-to-follow practical advice could help against resignation. However, Lordieck also emphasised that it was important to her to not give users the impression that "if you adjust your devices' settings the right way, everything is fine, but I think it is necessary to talk about this on a societal, political level" (ibid.).

This hints at the counterarguments to including practical advice that many interviewees brought up: that *data protection advice is tricky or even pointless because systemic solutions are needed*. The creators brought up different arguments for this perspective. One line of argumentation was that today's technology is "so sophisticated" and there is "so much asymmetric power" that "it's not on us as individuals to use them in a way that's balanced and healthy for us" (Jay Interview, 2021). Suggesting individual solutions thus only "allows them [the big companies] to play on their terms", when what is really needed are "systemic solutions instead of these individual ones, which won't amount to anything" (Gaylor Interview, 2021). This reiterates recent academic research that examined YouTube videos on surveillance resistance. The authors, whose findings will be further discussed in chapter six, argued that while "personal protection can superficially make people feel better", this "small bandage approach to systemic problems feeds into post-privacy mindsets" and "perpetuates a feeling of helplessness beyond individual action" (Young and Pridmore Forthcom-

ing). When calling for systemic solutions to datafication, several interviewed creators further compared challenges of datafication to the issue of climate change, which is a similarly complex and systemic issue that is often approached through individual solutions, such as using reusable bags for shopping or cycling to work instead of driving.

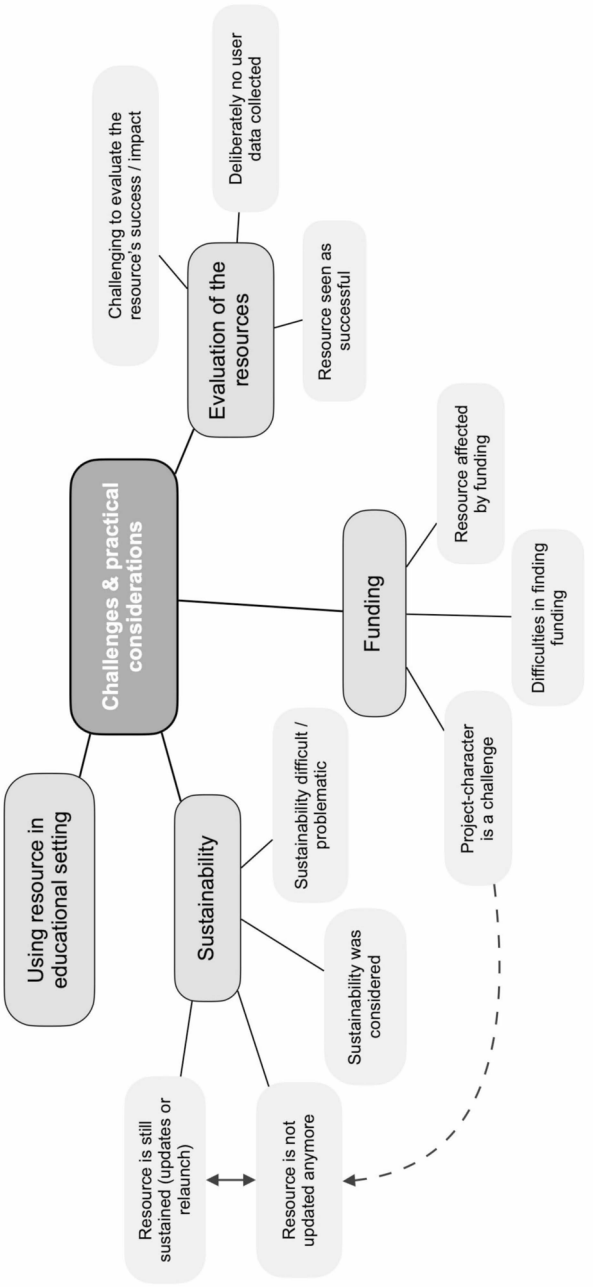
Apart from being pointless, many interviewees further argued that individual solutions to datafication shift responsibility to the individuals. Similar to academic scholars (see above), they emphasised that "putting that burden on the individual" is the "wrong approach" (Gaylor Interview, 2021) and that instead of "shifting everything to the consumers, the legislator has to step in" (Reicherstorfer Interview, 2021). In her own research, interviewee Stoilova even found that "technical skills on their own […] can actually increase the risk for children and the harmful outcomes" if they are not fostered along with critical reflection (Stoilova Interview, 2021; see also Livingstone et al. 2021a). Only when children learn technical skills together with critical thinking, she explained, can this lead to "better outcomes for children and reduces risk" (ibid.). Jansen further stressed that this education cannot be provided by individual actors such as NGOs, but that "a good data literacy strategy would be something that is offered […] in the system so that governments prescribe [it] in educational packages" (Jansen Interview, 2020).

Overall, the question of data protection advice remains a dilemma. The interviewed creators in my study did not agree on a common stance towards whether or not, how much, and what type of practical advice should be included in critical data literacy resources. Often, the interviewees themselves saw both sides of the issues, highlighting the advantages of practical advice as well as the risks that come with it. Thus, the inclusion of practical advice remains challenging when implementing critical data literacy into practice.

### 5.2.4 Challenges and Practical Considerations in Developing Critical Data Literacy Resources

Apart from the already discussed dilemma of data protection advice, several other challenges and practical considerations in developing critical data literacy resources were identified in the analysis. Three key challenges kept emerging in the different interviews along with considerations on an educational use of the resources.

*Figure 15: Main themes and subthemes in the category "challenges and practical considerations" in the expert interview analysis.*



## Dilemma: Evaluating Resource While Protecting User Data

The first of the three key challenges that was identified relates to two different statements by the creators. First, they argued that it is generally a *challenge to evaluate a resource's success or impact*. Even if statistics about the resource's use are measured – for example through collecting user statistics or generating conversion rates (e.g., how many website clicks lead to how many email newsletter sign-ups) – one of the creators, Stoilva, argued that this does not say much about the learning effect that the resource had for its users. This uncertainty about the resource's use and impact is for her "one of the biggest shortcomings" of her project (Stoilova Interview, 2021).

The second challenge was that many interviewees wanted to lead by example and *deliberately did not collect any user data* in order to protect their users' privacy. In most cases, this meant not being able to make any statements on the resource's use or success. While many interviewees were happy with this decision, one creator stated that he would be "less extreme and a bit more pragmatic" if he designed another resource since he has "no idea whether anyone has looked at it" (Parkes Interview, 2021). In other words, this creator would create a less privacy-sensitive resource in the future in order to gain some knowledge on its use. Another interviewee found a compromise in this dilemma: Julien Schekter outlined how his project team put considerable effort into finding ways to measure their resource's use while at the same time protecting their users' data. He explained the elaborate technical solutions they implemented to collect user statistics in an entirely anonymous manner.[4]

Overall, however, most interviewees *saw their resource as successful*, which was usually based on anecdotal feedback they received from users or educators. Considering the dilemmas around evaluating a resource and protecting user data, anecdotal feedback was the main or only form of success evaluation for most creators. Two interviewed creators further mentioned that their resource was "critically […] very well received" (Gaylor Interview, 2020) and that they were nominated for and won several awards and prizes for their resource (Gaylor, Schekter). Yet, this finding is not without contradictions as another creator stated he was unhappy with the success of his resource because his privacy-protecting measures made it difficult to reach a large audience (Parkes Interview, 2021).

## Funding of Resources

The interviewed creators further highlighted funding as a major challenge for developing critical data literacy resources. The interviewees spoke about the diverse funding avenues for their resources, including state and national programmes and

4 They erased the five last digits of each IP address, getting only a rough area (e.g., country) for each player; their game respected the "do not track" setting in people's browsers; any data that users entered was deleted; and they used the local storage in people's browsers to allow users to continue a game they had started without using any cookies or a log in.

organisations,[5] Federal and State Ministries,[6] foundations, broadcasters, city governments, and private donors. Diverging statements were made on whether the interviewees' *resources were affected by the funding*. While some outlined how the funding influenced the way their target group was set (Stoilova), the topic and contents decided (Lordieck, Parkes) or which format was used (Gaylor); others reported they were given complete freedom from the funders for developing their resources (Reicherstorfer, Siegenthaler).

Overall, many interviewees reported on *difficulties in finding funding*. Some were mostly self-funded (Younge, Yusuf, Truong) or had minimal funding and thus were unable to hire external designers or developers (Stoilova), which impacted their resources. Ed Parkes further argued that when he was working with open data in the public sector, he could "never get anyone to fund a public literacy programme around data" (Parkes Interview, 2021). In his view, not many funders would want to foster people's literacy and data transparency, but he rather thinks that "it's in a lot of people's interest that that doesn't happen" (ibid.).

A specific issue with funding that kept occurring in different interviews was that the *project-character is a challenge*. Often, funding comes in the form of a project with finite financial and time resources. While this can give flexibility to the creators (Parkes Interview, 2021), several interviewees argued that this project-character had a detrimental effect on their work and their resource. They emphasised that the short time frame presented a constant challenge and, in some cases, did not allow for any testing of the resource. Moreover, the project character often meant that keeping the resource updated was impossible as the project is finished, and it is "easier to get new money for new products than it is to update old products" (Jansen Interview, 2020) – an issue that will be discussed in more detail below. Therefore, the creators called for permanent funding for critical data literacy resources.

## Sustainability

This leads to the next main theme identified in the analysis: several interviewees highlighted how *difficult it is to keep an online resource up to date* since the "web is increasingly changing" (Gaylor Interview, 2021), and the resource should be "relevant to the discussions that are happening at the moment" (Stoilova Interview, 2021). Moreover, when other resources are recommended, there is a risk that they expire or the links

5 E.g., Swiss state federal programme "Youth and Media"; Canada Council for the Arts; British Columbia Arts Council; National Fund Switzerland; German Federal Agency for Civic Education; UK Information Commissioner's Office.

6 E.g., German Federal Ministry for Justice and Consumer Protection; North Rhine-Westfalia Ministry for Children, Families, Refugees and Integration; North Rhine-Westfalia Ministry for Culture and Science.

change and thus they have to be checked regularly (ibid.). If the resource is interactive, some parts of it might also stop working for technical reasons: "every few months, there's different aspects of it that break and we have to fix them" (Gaylor Interview, 2021). This maintenance requires time and effort, which, due to the project-character of many resources, often has to take place in the creators' spare time.

For this reason, some of the interviewed creators explained that they already *considered questions around sustainability* during the development of their resource. For example, Younge and Truong decided against building a very interactive resource because they knew they would not be able to provide the long-term maintenance (Younge and Truong Interview, 2021). Others purposely included no current real-life examples but set their resource in a fictional future to prevent it from outdating too quickly (Reicherstorfer Interview, 2021), or contacted the creators of other resources they recommended to ask how long their resources would be online (Siegenthaler Interview, 2021). Finally, Jansen explained that another way to ensure longer sustainability is to include more generic rather than detailed content in the resource, although this, on the other hand, reduces the "added value" of the resource (Jansen Interview, 2020).

Apart from these valuable recommendations on how to consider sustainability when designing a resource, I was interested in finding out how many of the resources were still updated. Overall, five creators stated that their resources are *not updated anymore* (usually due to their project-character) and four explained that they are *still updating their resource*. This could be by adding new content and making sure the resource works on a technical level (Schekter), by regularly checking all recommended links and examining if the content is still up to date (Siegenthaler), adding new recommendations (Stoilova) or even planning a relaunch of the resource (Lordieck). Yet, one creator questioned if sustainability should even be desirable for such resources. In his view, these resources are "un-updatable" as they represent "a snapshot of a moment in time of the way that the web worked and we built something with that set of assumptions" (Gaylor Interview, 2021). Because the internet is changing continuously, but also because he as an artist would rather focus on new projects than having "the burden of maintaining these for the rest of my career", Gaylor sees updating these resources as undesirable and rather argues that an appropriate way of archiving digital works is needed. This demonstrates that there are many open questions and dilemmas regarding the sustainability of online critical data literacy resources.

## Interest in Using Resource in an Educational Setting

A final main theme was that many of the interviewed creators expressed explicit interest in a use of their resource in educational settings. Overall, eight of the ten interviewees reported interest from educators in their resource. Particularly teachers often reached out to the interviewed creators to express their interest, to share

feedback that they found the resource useful in their teaching, or to ask for further material. These perspectives on critical data literacy resources by educators will be investigated in more detail in the next chapter (5.3). While some creators stated that their resource was not necessarily created for use in a formal education setting, others described this as the "dream use case" for their resource (Younge Interview, 2021). In this context, Esther Lordieck further highlighted a relevant point, arguing that creators of critical data literacy resources require both expertise in understanding datafication as well as pedagogical expertise (Lordieck Interview, 2021). This again highlights the crucial work of resource creators in this field, constituting an intermediary between academic knowledge and educational settings.

### 5.2.5 Conclusion and Discussion

In total, twelve main themes in three different categories were identified in the analysis of the resource creator interviews. Some findings constituted strong, relatively homogenous themes that most or all interviewees seemed to agree on, but the analysis also revealed several contradictions. In some cases, the themes represented dilemmas rather than a coherent opinion: the interviewed creators did not necessarily agree on a solution, but the same issue (e.g., fear-based approaches or sustainability) kept emerging for nearly all of them. Apart from that, issues that are debated controversially in academic research also appeared to be controversial for the interviewed creators (e.g., the dilemma of data protection or the challenge of designing target-group specific resources). Overall, the expert interviewees agreed on the importance of educating about datafication and they called for more critical data literacy resources, for more research on education about datafication, a stronger public debate on these issues and for systemic solutions that go beyond the individual approach of fostering people's literacy.

#### Goals: What Does a 'Critically Data Literate' Citizen Look Like?

Although it was highlighted that literacy is a never-ending process and a 'fully literate' person does not exist, the interviewed creators voiced many specific goals for their resources – outlining their understanding of critical data literacy. They aimed not just at raising people's awareness of data systems but wanted to demystify technology and foster understanding of how data systems work. A key goal of the interviewees was to encourage critical thinking. Through their resources, they wanted to provide people with frameworks to think critically about datafication, the risks and harms that come with it and how this might affect them, and to support learners in gaining deeper understanding of the systemic forces and structures behind processes of datafication. Such systemic, structural understanding is a key aspect of the critical datafication literacy framework that is being developed throughout

my study and is a perspective that, as argued in chapter 2.2, does not yet get enough attention in existing academic critical data literacy concepts.

Apart from understanding and critical reflection, the creators wanted users of their resources to take action. A common criticism about literacy approaches is that there is no clear idea of what follows once someone is 'literate'. For the interviewed creators, literacy included the goal of taking action and they outlined many specific actions they wanted their users to take. In part, this included common approaches such as advice on how to better protect one's data online or how to make informed decisions on which services to use, that are also suggested by critical data literacy scholars (e.g., Pangrazio and Sefton-Green 2020). However, many interviewees recognised the limitations of such individual steps and of citizens' agency, and promoted approaches that go beyond the individual level. Several encouraged their users to take political or societal action or wanted to contribute to a movement. These constitute unusual approaches, which are rarely found in academic concepts of critical data literacy but recall the goals of (re-active) data activism that educates about as well as fights against the datafication of our societies (see chapter 2.1). However, while data activists encourage "practices of resistance" such as "self-defence, civil disobedience and disruption" (Milan and Gutiérrez 2015, p. 122; Milan and van der Velden 2016, p. 67), the interviewed creators aimed to support citizens in enacting their democratic right to make their voices heard.

The interviewees further argued (and, in part, criticised) that citizens need the "right" language in order to take part in public debates and to be taken seriously. For this reason, several interviewed creators aimed to provide people with such "data language" through their resource. This approach to empowering citizens of datafied societies is not very present in the critical data literacy literature but constitutes a key insight on how to engage citizens in public data debates. Another goal of the interviewees was to enable citizens to educate others. This is in line with scholarly calls for starting a "chain reaction" of critical thought (Markham 2019, p. 756) and supporting "networks of literacy" (Carmi et al. 2020, p. 12).

## Strategies and Principles for Implementing Critical Data Literacy into Practice

When analysing the creators' strategies and principles for implementing critical data literacy into practice, several divergent findings emerged. However, there were also approaches that all interviewees seemed to agree on: for example, that it is important to create personal involvement to overcome people's "issue fatigue" (Yusuf Interview, 2020). Ways to achieve this included connecting to people's real-life experiences, using personas and supporting people in forming their own opinion rather than telling them what to think. These approaches correspond with scholars who argue that educators should not try to convince learners that certain data practices are good or bad (Fontichiaro et al. 2017; Markham 2019), but rather act as

"problem posers" (Aliakbari and Faraji 2011, p. 80), who present learners with real-world problems and enter into dialogue with them (Freire 2017). Concrete implementation examples by the interviewed creators included using open questions or including stories that promote a certain narrative rather than simply telling learners that narrative. Moreover, some creators called for presenting users with different future scenarios of a datafied society to create personal involvement. Similar calls for different future imaginaries have been made by academic scholars, for example Gray et al., who aim for "infrastructural imagination" about the creation and use of datasets (2018, p. 3).

Similar to the student users in my prior study (Sander 2020c), the interviewed creators expressed divergent opinions on how negative or scary a resource should be and if fear should be used to get people personally involved. Although some creators admitted that fear does get people's attention, most agreed that scaring people was not the right approach but that critical data literacy resources should rather be colourful and fun. A main theme that was identified, and that was in line with the literature, was that resources should be easily accessible and engaging, for example by using interactive and playful approaches (e.g., D'Ignazio and Bhargava 2015; Iliadis and Russo 2016; Markham 2019; Ahlborn et al. 2021). Moreover, the interviewees' call to use tangible, non-stereotypical visualisations to materialise the intangible world of data matches scholarly findings (e.g., D'Ignazio and Bhargava 2015; Windeyer 2019; Pangrazio and Selwyn 2020). A novel finding in this context was further that several creators suggested that a critical data literacy resource should constitute an "experience" in itself, which leads people to new insights.

Apart from that, most creators emphasised the importance of developing target-group specific resources and to adapt the resource to people's narratives. In this context, one interviewee defined literacy as explicitly different from persuasion or propaganda since it considers people's different existing narratives, adapts to these and empowers people to form their own opinions (Gaylor Interview, 2020). This focus on people's existing narratives constitutes a highly relevant approach to literacy that is not much discussed in critical data literacy scholarship. The general need for target group specific resources, however, aligns with scholarly research on critical data literacy, which has emphasised the need to consider different populations and "address different social contexts", particularly of marginalised communities, and has argued that "a 'universal' one size fits all solution" for data literacy is not possible (Carmi et al. 2020, pp. 16; 11). However, the interviewed creators also reported on the difficulties of implementing this into practice – for example when addressing a large audience – and of reaching their intended audience. Moreover, the analysis demonstrated that many resources originated from larger background projects, such as a research project or a journalistic investigation; were informed by theory; or applied extensive testing – all leading to well-founded decisions on content and design.

Finally, the question of providing data protection advice remained a dilemma. Although, or possibly because, it could not be solved here, this dilemma constitutes one of the most significant findings of this analysis. Already in chapters 3.4 and 5.1, the difficult balance between empowerment versus a shift of responsibility was outlined. Although I did not bring up this dilemma in the interviews, many interviewees acknowledged the issue and discussed it in detail. Several interviewees stressed that they did not want to shift "the burden of time and responsibility" to the individual, as expressed by scholars Pangrazio and Selwyn (2019, p. 425), and they further highlighted that the individual citizen's agency is limited, and systemic solutions for issues around datafication are needed. This correlates with academic research, for example by Young and Pridmore, who argue that "personal protection can superficially make people feel better" but is a "small bandage approach to systemic problems" (Forthcoming). In the same context, several interviewees drew parallels to individual solutions in the area of climate activism – a comparison that may also be fruitful as a metaphor when educating about datafication. On the other hand, many interviewees highlighted that data protection advice can empower people, foster their confidence, and help against feelings of powerlessness, as also suggested in the literature (e.g., Bilstrup et al. 2022).

### Challenges and Practical Considerations

As a first key challenge, the expert interviewees reported that it is generally difficult to evaluate a resource's 'success', but it is even more difficult if its creators want to lead by example and develop a privacy-sensitive resource that protects its users' data. For this reason, most interviewees' assessment of their resource's success was based on anecdotal feedback. Secondly, funding for critical data literacy resources can be difficult to find; can sometimes affect the resource's content or format; and – most crucially – often comes in the form of time-limited projects with tight deadlines and little opportunity for extensive testing or long-term maintenance. Related to this, the third major challenge was the sustainability of critical data literacy resources. Although several interviewees outlined that they considered sustainability in the design of their resource and provided valuable advice for keeping a resource up to date, half of the resources in this sample were not updated anymore and will likely be outdated soon. However, one creator also called the goal of sustainability into question and instead called for better archiving opportunities. This open question as well as the other controversies that emerged in the interview analysis will be further discussed in chapter six.

Finally, although not all resources were intended for usage in formal education settings, many creators reported interest from educators in their resource. In particular, many had received feedback from teachers who liked using their resource in the classroom. This highlights the value of online critical data literacy resources not just for reaching individual citizens, but also for supporting educators in address-

ing topics around datafication in their teaching. The next chapter will provide more details on educators' experiences with the topic of datafication as well as their needs and wishes for critical data literacy resources.

## 5.3 Teaching about Data – Educators' Perspectives, Experiences and Needs

In order to investigate and learn from educators' experiences with the topic of digital technologies and datafication and their needs and wishes for critical data literacy resources, a qualitative survey with 57 participants from a variety of educational backgrounds was conducted. The survey demonstrated that educators already address a wide range of topics around digital and data technologies in their educational practice, and that they often follow similar goals and methods as identified in the previous chapter. Moreover, many surveyed educators found resources such as the ones examined in chapter 5.1 useful. Novel and, in part, divergent findings were identified on the practical skills the survey participants aimed for, the way they combined critical with practical approaches, and their stance towards shocking learners to engage them. The participants further highlighted several challenges for educating about digital technologies and using online critical data literacy resources. In particular, the interplay of open and closed questions in the survey led to new findings on educators' perspectives on teaching about data that complemented my study's previous two empirical perspectives and provided valuable insights for the further development of the critical datafication literacy framework.

### 5.3.1 Learning from Educators from Different Backgrounds

The first finding of the survey was that topics around digital technologies and datafication are already being addressed by educators from a variety of backgrounds. As intended by the sampling (see chapter four), the survey included educators from many different areas of education and nationalities. In total, 18 nationalities and countries of residence were represented, with the majority of participants living in Germany (24), 14 in the UK, eleven in other European,[7] and seven in non-European countries.[8] Gender and age also showed a diverse and even near-equal distribution, with 30 female and 23 male participants (4 preferred to omit their gender), and between 11–18 participants in each of the 10-year age spans between "30-39" and "over

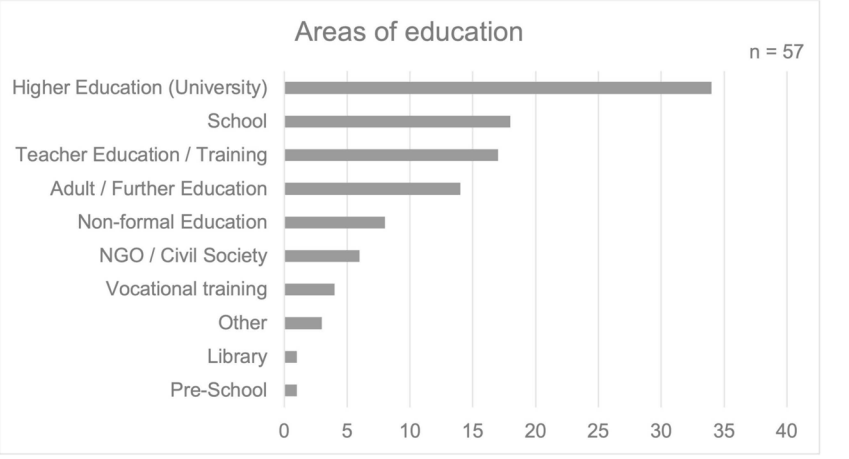
7 In order of numbers of participants: Austria, Netherlands, Hungary, Spain, Cyprus, Switzerland, Turkey, Italy, Denmark.

8 In order of numbers of participants: Argentina, Nigeria, Colombia, Saudi Arabia, Australia, US, Canada.

60" (only one participant was younger than 30). These findings begin to highlight the diversity of educators interested in teaching about digital and data technologies.

However, the most relevant finding in this context concerned the professional background and the subject area of the surveyed educators. As illustrated in figure 16, the sample showed a strong predominance of educators working in formal education and specifically in higher education (34 participants). While this may be an adequate representation of the areas of education in which data topics are already covered, it may also be explained by the study's non-representative sample. Either way, this predominance of formal education fields should be kept in mind when interpreting the survey findings. Yet, it should be noted that many participants who indicated that they worked in higher education *also* worked in other educational areas, such as teacher training or adult education.[9] The second most common area represented was the school (primary and secondary, 18 participants), closely followed by "teacher education / training" (17) and "adult / further education" (14). Fewer participants worked in the non-formal education sector (8), civil society (6) or vocational training (4). Three indicated additional areas such as "business leaders, leaders in the public sector", one participant worked in a library, and one in a preschool.

*Figure 16: The surveyed educators' areas of education.*




Moreover, a total of 22 different roles – from professor to high school teacher to privacy trainer – was identified, and many participants used an open text field to

9 All numbers and figures in this chapter include such duplicates, e.g., participants working in several areas (such as higher education and teacher training).

specify the context in which they taught about data and digital technologies. This revealed a number of specific contexts, such as teaching in a school with a digital skills pathway, providing further training for kindergarten staff on digital and data technologies, or giving courses on journalism or screenwriting. The participants' subject contexts also differed widely and included, among others, media education, informatics, politics and economics, Italian, Greek, and even religion. These novel findings highlight that educators in various educational settings already educate about digital and data technologies. This diversity is at the same time an opportunity to establish critical data literacy approaches in a variety of subjects and fields, and a challenge as all of these different contexts require different approaches in practically fostering such literacy.

### 5.3.2 Educators' Experiences and Goals for Teaching about Digital and Data Technologies

#### Teaching about Different Aspects of Digital Technologies and Datafication

A key goal of the survey was to learn about the topics that educators cover when teaching about digital and data technologies, and their goals for this education. Among others, the survey tested whether the surveyed educators' topics for their teaching were in line with imbalances in academic digital and data literacy approaches. These discourses show a predominance of general topics around the use and content of digital technologies (e.g., "Where can I find information online?") and attempts to promote a more secure internet usage (e.g., "How do I recognise safe websites?") in contrast to more complex topics around (big) data systems and algorithms (e.g., "How do algorithms work?") or the way they affect society (e.g., "How is my data used online?").

The findings demonstrated that the majority of surveyed educators felt very or extremely well-equipped (77%) and experienced (61%) to teach about *digital technologies generally*, and nearly as many felt well-equipped (70%) and experienced (61%) to teach about *societal implications*. This represents a contrast to scholarly approaches to digital and data literacy, which only rarely address societal implications of digital and data technologies. Educators' confidence in fostering reflection of digital technologies constitutes a significant finding, particularly as the survey's sampling did not specifically address educators with critical perspectives. However, it should be noted that it is unclear which implications educators addressed, and this could range from more basic aspects such as how digital media have changed our personal communication to more advanced questions around the consequences of automated decision-making systems.

Only about half of the educators (52%) felt very or extremely equipped to teach about *data security*, and this topic emerged as the one that the least educators felt very or extremely experienced in (32%). This stands in contrast to the literature and the

analysed resources, in which a more secure internet usage and protection of one's data was a common theme (see chapters 2.2 and 5.1). Finally, and corresponding to the literature, the topic of *(big) data systems and algorithms* reached comparatively low numbers, with 42% indicating that they felt very of extremely well-equipped, and 39% feeling very or extremely experienced in this topic.

*Figure 17: Total numbers of surveyed educators indicating how well-equipped they feel to teach about the four given topics.*

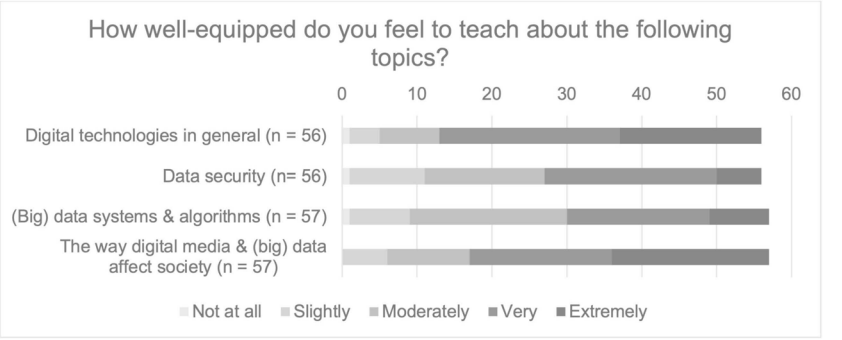
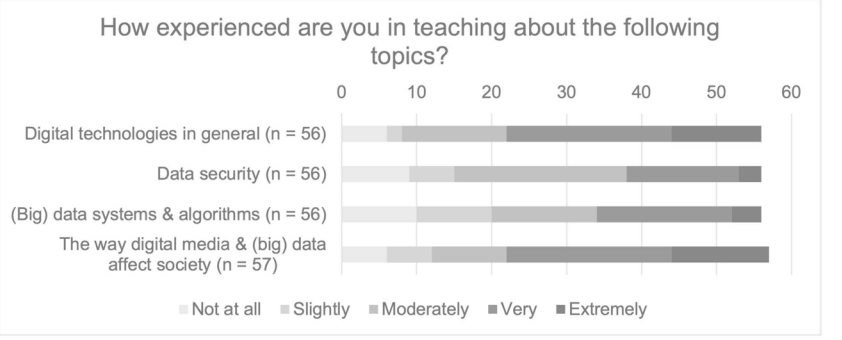



*Figure 18: Total numbers of surveyed educators indicating how experienced they are in teaching about the four given topics.*




On average, across all topics, only 13% of the surveyed educators felt not at all or slightly equipped, and 25% felt not at all or slightly experienced in teaching about digital and data technologies. Thus, the educators overall felt fairly well-equipped (average per topic between 3.4 and 4 on a scale of 1–5), and also well, but a little less experienced (average per topic 2.9 to 3.6). These are positive findings as they sug-

gest that of those educators who are interested in teaching about digital and data technologies, many feel that they to have the knowledge, resources and experience to do so. However, distinct differences between topical areas could be identified and the surveyed educators highlighted a number of challenges in teaching about digital and data technologies (see section 5.3.4).

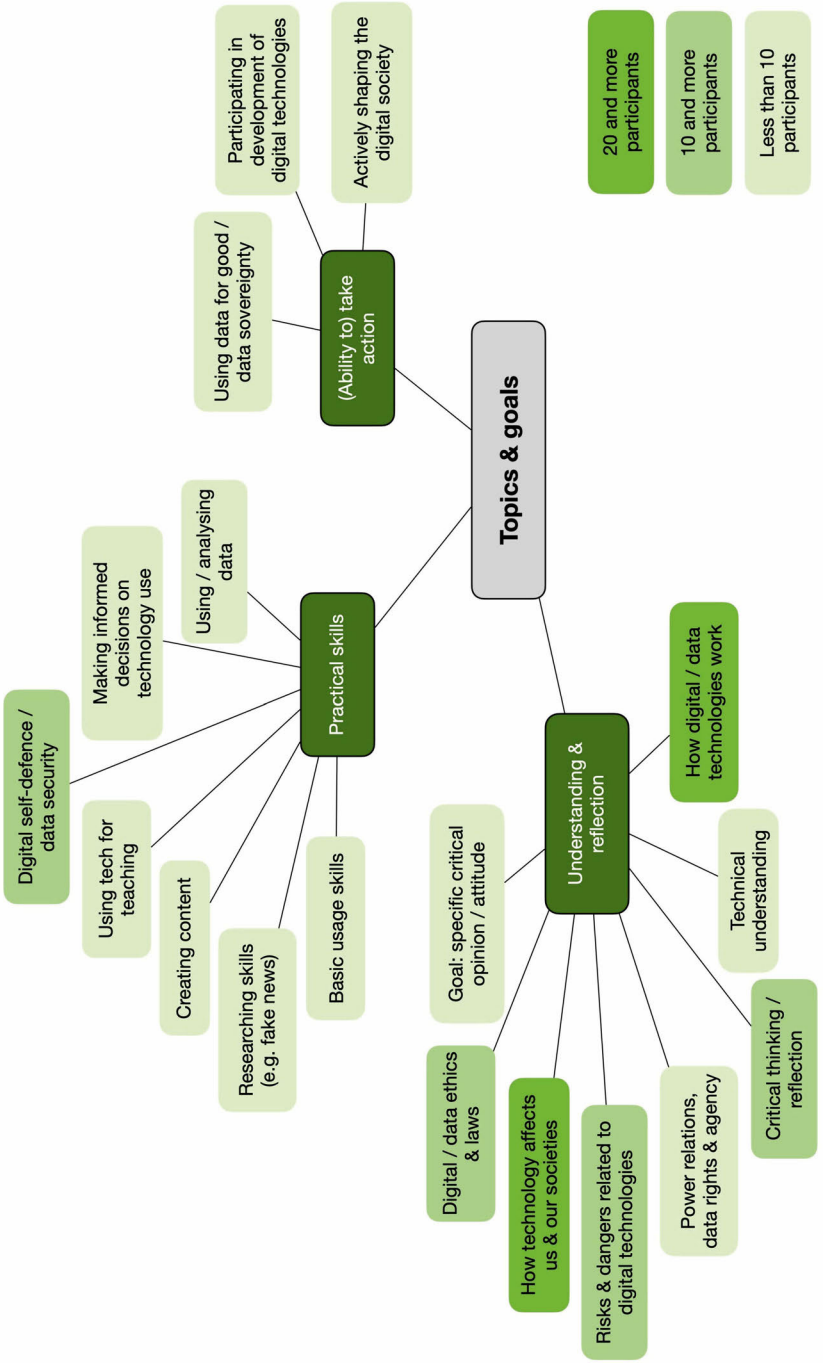
### Topics and Goals of the Educators

Apart from asking about pre-defined topical areas based on the literature, the survey also invited educators to expound on the topics and goals of their teaching in several open questions. Several of the themes and the three categories that were identified resembled the findings of the previous chapter: topics and goals; methods and approaches; and challenges, needs and wishes. However, due to the open nature of the survey, participants covered very different aspects in their answers and some themes were much more common than others. To illustrate this and improve transparency, the data visualisations in this chapter use different colour shades that represent the number of participants who were found to support each subtheme (see fig. 19, 21, 23).

Overall, the participants clearly provided most information on the first category: topics and goals. Nearly every participant expressed some perspective on their topics and goals, and nearly 200 codes were identified in this category. The first finding when analysing these was that "teaching about digital and data technologies" can include an extremely wide range of topics: from a general understanding of the internet to the psychological mechanisms in digital technologies and the attention economy; from identifying fake news to understanding data privacy laws; from using office software to applying data analytics. This wide range of topics on the one hand shows why it is so difficult to develop succinct definitions of digital or data literacy and why implementing these literacies into practice and into curricula is challenging. On the other hand, it also highlights how many different skills and understandings citizens need to navigate our digital and datafied societies and why digital and data literacies are so urgently needed.

In total, three main themes and 18 subthemes were identified in relation to the educators' topics and goals (see fig. 19). While many of these showed remarkable similarities to the creator interviews, it is important to keep in mind that some themes were only brought up by a small number of participants. Not being able to make assertions about how the rest of the educators in the sample feel about these subthemes is a limitation of the qualitative survey approach. However, in some cases this limitation could be addressed by combining these results with the data derived from the closed questions.

*Figure 19: Main themes and subthemes in the category "topics and goals" in educator survey.*



### Key Goal of Educators: Understanding and Reflection of Digital Technologies

A large majority of 46 of the 57 educators emphasised some aspect of understanding or reflection as a goal for their teaching about digital and data technologies. A first strong subtheme that could be identified was that educators wanted learners to understand *how digital and data technologies work*. This was highlighted by 27 educators in total, and encompassed both technical and infrastructural aspects, such as learning about algorithms, big data, how search engines work, how data is used, the "myth of objective knowledge" (participant 209), or the business models behind digital services (mentioned by five participants). But more complex topics were also mentioned, such as "educational and communications policy around digital media" (345), the "economy of attention" (209), understanding "the social factors shaping technology" (202) or that "societal decisions on technology affect all of us" (122, own translation).[10] These aspects show strong similarities to the resource creators' goal of understanding how technology works and unpacking shortcomings, which was detailed in chapter 5.2. Some educators further provided detailed elaborations on the kind of understanding that learners need:

> Firstly, I believe the learners must understand that data practices and narratives are various and represent a complex problem. There are several orders of elements imbricated that must be disentangled.
>
> Firstly, the several beliefs and dispositions around data stem from the philosophical problem of an external reality that can be perfectly and objectively captured. The discourses about metrics and data as source of objective information are not new, and have been the drivers of what we see nowadays as an excessive hope on what AI systems and data-driven technologies can do for us.
>
> Secondly, I believe they must understand that we live in a post-digital society. Therefore, it is not enough to understand the digital as it is, but it is relevant to engage with the techno-structure, with the data infrastructures that shape our experience as users […]. (209)

This educator's third point – that "this type of engagement is political" – will be discussed below. These statements represent a thoughtful attitude to educating about data, which strongly correlates with goals for my preliminary critical datafication literacy framework and shows strong parallels to the creators' goals of a 'systemic understanding of data and technology' and 'promoting critical frameworks' (see chapter 5.2). Beside these comprehensive or systemic types of understandings, some educators aimed for a *technical understanding* of digital and data technologies, for example of "how encryption works" (339) or of "secure communications and data collection, storage and sharing" (316). These technical understandings were not common among the interviewed creators or in academic approaches to critical

10 All originally German quotes in this chapter were translated into English.

data literacy, again emphasising the wide variety of topics that can be covered by education about digital technologies.

Another strong subtheme that was identified was that educators aimed to teach about *how technology affects us and our societies*. In total, 23 educators emphasised this goal. They highlighted general objectives such as educating about the "social, political and economic implications of digital media and (big) data" (226), or how digital technology affects different societal sectors (e.g., work, consumption or communication). Yet, specific aspects were also mentioned, including how digital technologies affect democracy and "how they are used in political communications" (196), or teaching about "media effects research (physical, psychosocial and cognitive implications of screen media)" (102). Moreover, a small number of educators highlighted implications of digital technologies on teaching and learning themselves. These educators aimed to teach about "changes in learning and thinking through the use of digital media" (229), "the limits of educational technology" (345), and the "effect of [the] EdTech sector on education policy" (102). This is a significant finding as these topics are not commonly considered by critical data literacy scholarship – although considerable critical research on the datafication of education exists (e.g., Williamson 2017; Hartong and Förschler 2019; Manolev et al. 2019). Nonetheless, it is understandable that this is a perspective that is of interest for educators.

Related to this, a number of educators specified that they aimed to educate people about *power relations in digital technologies as well as their agency and data rights*. While this was only mentioned by six participants, it constitutes an important novel finding as this does not get much attention in critical data literacy scholarship, nor in the analysed resources (see previous chapters). Yet, these educators seemed to have very specific ideas for teaching about power in relation to technology, for example that learners should "understand how society shapes technology and how technology shapes society, and what role power and agency play in these things" (301). Others mentioned teaching about people's "own data rights" (181) and "what they can do but also how what they do is small compared to the change that's needed" (321). This last aspect constitutes a significant finding, as it again highlights the need for systemic solutions, which has already been identified in the interview analysis. However, as will be further discussed below, several other educators nevertheless saw individuals as responsible to protect their own data.

Two further common goals of educators were to teach about *risks and dangers of digital technologies*, and – related to this – to foster *critical thinking or reflection*. Apart from risks to people's privacy, some educators mentioned very specific aspects such as "danger of personalisation for forming an opinion" (122), the "digital divide" (292), "ability to recognise bias" (289) or "understand how software/ algorithms can discriminate" (202), demonstrating an advanced knowledge level. Many of these educators further specifically highlighted critical thinking, ethical thinking or critical reflection as key goals. Some emphasised that "technical perspectives" and skills

are less important to them than "analytical-reflexive abilities" (174) and "social scientific perspectives as well as understanding the bigger picture" (172). These positions stand in contrast to academic data literacy concepts, which show a clear dominance of practical-instrumental approaches, as well as to studies that have identified a predominantly "instrumental and technical approach" to data topics in educational institutions (Raffaghelli and Stewart 2020, p. 448). This is a particularly significant finding when considering that the survey sample – in contrast to the interview sample – did *not* specify that educators should be interested in fostering *critical* perspectives to digital and data technologies. However, these positions are very much in line with this study's preliminary critical datafication literacy framework.

One educator further provided details on their approach to fostering critical thinking:

> I prefer to combine critical media scholarship on big data with analytical applied ethics studies. […] Rather than a principled debate, a process oriented balancing discussion is encouraged to promote critical thinking. […] I also prefer this process oriented debate so that the students are prepared for an ethical thinking on unforeseeable yet emerging technologies. (282)

This is a particularly relevant approach as it not only encourages learners to form their own opinions through critical thinking and discussion, but it also invites learners to apply this critical thinking to future developments of digital technologies. Considering the fast-changing landscape of digital and data systems, this approach could provide a more sustainable solution. Moreover, this correlates with approaches of politische Bildung, which emphasise continual adaption of topics to address current societal challenges (see chapter 3.2). Furthermore, twelve educators indicated that they teach about *digital and data ethics and laws*. This is another topic that is not common in academic critical data literacy approaches, nor was it identified in the creator interviews. The educators detailed several legal aspects they covered in their teaching: media law, copyright law, privacy law, media ethics and data ethics. Particularly the last three constitute relevant topics for critical datafication literacy in the sense of systemic understanding and critical reflection of the datafication of our societies.

Finally, some educators aimed to promote a *specific critical opinion or attitude* in their teaching. For example, two educators, referring to the use of educational technologies, wanted their learners to understand about "data assemblages, false promises and broken dreams" (209) and that the "use of digital media/content does not replace pedagogical decisions of the educators" (229). Others specified that they wanted learners to criticise the "individualisation" of digital technologies (102), to see the "dangers of a cybernetic control society" (174), or to understand "the necessity of a political-societal design of new technologies" (233). By aiming

for learners to take a specific stance towards digital and data technologies, these educators seem to take a normative approach in their teaching. Although the goals themselves are similar to other themes outlined above, this normative approach somewhat contradicts prior findings of letting learners form their own opinion (see chapter 5.2). However, one educator who took this normative stance also wondered how they can balance "sober informational description and charged room for interpretation (through science fiction, drastic examples)", yet also take a position themselves (174).

### From Basic Usage Skills to Digital Self-Defence: Educators Aim for Practical Skills

Besides promoting understanding and critical reflection, a second key goal of the educators was to foster their learners' practical skills. In total, 33 of the 57 educators indicated aiming for practical competences in some form. However, what kind of skills the educators fostered differed widely among the survey participants. Moreover, some contrasts between participants' goals *in terms of understanding* and their goals *in terms of skills* were identified. For example, participant 249 teaches digital and web design as well as website administration – very practical usage skills that do not indicate a particularly critical or reflective attitude. However, the participant detailed critical reflection, engaging with surveillance capitalism and with surveillance through digital technologies as key goals for their teaching. This important finding highlights that critical and reflective perspectives can also be included in teaching that is very practical and focussed on technical skills, and that educators who teach usage skills do not necessarily endorse an unreflecting, enthusiastic use of digital technologies.

This finding further helps to interpret the fact that many educators aimed for practical usage skills. Several indicated fostering *basic usage skills* for digital technologies, such as using office technologies or aiming for "basic facility in accessing and using technology" (345). This is another example for the importance of understanding the data in its context, as participant 345 continues:

> but my primary aim would be to do with CRITICAL digital literacy, based on a conceptual understanding of how these media are used to communicate, how they are produced and used, and how they represent the world. (345)

This again emphasises the above finding that teaching technical skills can go hand in hand with a critical perspective. A similarly usage-focused goal of educators was to foster learners' *researching skills*, such as using "technologies for news gathering" or being able to "detect fake news" (148). Other educators wanted to support learners in *creating content*, promoting, for example, "production skills for social media" (319),

"social media strategy" (112), "thinking creatively" and "writing for the web" (141), or "online community management" (319).

A small number of educators also aimed to foster skills of *using and analysing data*, such as "statistical literacy" (289) or data visualisation. One also taught "skills to anal[y]ze school related data (e.g., general achi[e]vement data, competence measur[e]ment, etc.)" (186). This highlights another novel finding: several educators wanted to foster skills for *using technologies for teaching*, such as "using ICT in classroom, LMS [Learning Management Systems], analysing general educational data" (186), or using "learning analytics [and] AI in primary education" (270). Many of the indicated practical skills stand in contrast to the strong emphasis on critical reflection outlined above. This controversy might be explained by divergent opinions of different educators; however, it is also possible that these educators – as highlighted above – aim for practical skills as well as a critical perspective.

Besides the basic usage skills outlined thus far, the second most common skill that educators wanted to foster was *digital self-defence or data security*. Thirteen educators in total indicated this goal. The educators' responses included different dimensions of data protection, from data security, the "correct and secure use of IT products" (206) and the "technical details of password selection and protection" (339), to aiming for a more critical and empowered use of digital technologies. This included "digital selfdefense (ethi[c]al tools, alternatives to big tech)" and learners taking "control of their own data [and] avoid[ing] tracking and surveillance and manipulation" (341) – similar approaches to those suggested by the examined online resources.

Finally, and related to the prior theme, some educators aimed to support their learners in *making informed decisions on technology use*. One educator summarised this goal under the term "tech intuition":

> Tech intuition: the ability to make confident decisions about technology due to an understanding of social impact even if lacking a full understanding of the nuts and bolts of every tool or system. (316)

This definition constitutes a novel and particularly relevant approach to educating about data systems as it admits to a common problem in this education: the functional workings of these systems are often unknown and impossible to uncover. Aiming for an 'intuitive' approach to make informed decisions based on social impact constitutes a valuable solution to this issue. Others aimed for "critical consumption" (173) or, likely relating to educational technologies, wanted people to "choos[e] a digital tool based on pedagogical criteria" (256). Especially these last two themes – the goals of data protection skills and informed decisions – show strong similarities to my prior findings from the content analysis and the expert interviews, and to my preliminary framework for critical datafication literacy.

### Supporting Learners in Taking Action

Finally, some educators also aimed for learners to take action – a theme that was very common among the interviewed creators. Most of the ten educators who indicated this goal wanted to support their learners in *actively shaping the digital society*. One educator, whose elaborate definition of critical data education was already quoted above, detailed:

> Thirdly, that this type of engagement is political. To be a citizen in the post-digital society is to engage in participatory processes to decide and control about the data extraction, classification, label[l]ing, and of course usage, particularly if there is monetisation of our data. (209)

This understanding of citizenship in modern societies is reminiscent of academic definitions of "data citizenship" (Carmi et al. 2020, p. 3) or of "digital citizenship in a datafied society" (Hintz et al. 2019, p. 19). Other educators made similar points, emphasising the goal of "actively helping to shape the digitising society" (218) and highlighting that "in society, decisions are made that affect all of us […] willingness and interest [are needed] to engage with societal challenges" (122). These arguments and goals, which are supported by a closed question on the importance of political and societal action (see below), correspond with the creators' goals outlined in chapter 5.2.

A related goal of the surveyed educators was to enable learners to *use data for good and support people's data sovereignty*. This is a novel finding that has not come up much in the prior analyses. These educators wanted to show learners "how to empower themselves with their data", taking "a proactive approach", which includes "data sovereignty, Open Data for learning, [and] Open scholarship and open data" (341). Another novel theme that emerged was that a small number of educators aimed for learners to *participate in the development of digital technologies*, hoping that learners could take part in "user-centric development" and could "critically evaluate" suggestions in this process (96).

Overall, the educators outlined a wide range of topics that they cover in their teaching about digital and data technologies. Many parallels to prior findings emerged, particularly in regard to educators' goal of understanding and critical reflection of digital technologies. However, some novel approaches and divergences from the previous findings could also be identified, such as different ideas of skills and actions that learners should take. The next section analyses the ways in which educators try to reach their educational goals.

### 5.3.3 How Do Educators Teach about Digital and Data Technologies?

#### Educators' Access to Information and Educational Material

Overall, the survey identified many parallels between the educators' preferred methods and approaches to teaching about digital and data technologies, and the previous findings of my study. The findings on how educators inform themselves and find teaching material were encouraging. After literature, which 35 participants indicated as a source for information, the second most common source was the internet (22 participants); followed by colleagues, friends or communities of learning (15); educational formats such as courses, workshops or talks (13); and news media (10). Less commonly mentioned sources of information were institutions or organisations (6 participants), participants' own research (6); videos, movies or documentaries (5); surveying the technology or industry landscape and discourses (3); podcasts (2) and museum exhibitions (1).

Overall, these findings show that choosing an open design for this question and coding it afterwards was the right approach, as these answers include several options I could not have foreseen. This included that educators read "policy materials" (295) and "trade regulations" or "reports from inquiries, commissions, regulatory investigations, thinktanks" (196); that they survey the technology industry discourses; and that they use museum exhibitions as a source of information. Moreover, the predominance of literature rather than the internet as the most common source of information was a significant finding considering the fast-changing landscape of digital technologies. Equally, I underestimated the importance of learning from one's colleagues, which reemphasises the already highlighted approach of "networks of literacy" (see prior chapters and Carmi et al. 2020).

Particularly the findings on how educators find teaching material offered valuable insights: most surveyed educators who provided information on this found materials online (17 participants), followed by literature (12). The popularity of the internet to identify teaching material is encouraging considering the large amount of existing online critical data literacy resources examined in chapter 5.1. Apart from this, twelve participants indicated that they create their own resources. Reasons for this included that participants were unhappy with existing materials, have "not found ready-made in exactly what I am teaching" (196), or found that "materials from corporate e-learning providers tend to be inaccurate, and free resources are usually just marketing vehicles for commercial products" (289). In addition, some gave details on how they create this material, for example that they include "current events and debates" (196) or build on ideas that "emerged in situations of (further) training, through experiences and questions of the participants, which led to discussions" (102). Finally, educators indicated that they also find material through institutions or organisations (4 participants), lectures or talks (4), news media (3), colleagues (3) or documentaries (1).

## Resources Recommended by Educators

Additionally, many educators provided specific examples of educational resources they have used in the past. This led to novel findings as it gave a first idea of whether the resources examined in chapter 5.1 – and similar ones – are found and used by educators. The first finding here was that existing collections of online resources were mentioned: two educators indicated using the database by the Critical Big Data and Algorithmic Literacy Network and one mentioned the guidebook published by Jess Brand and myself as a source for material. Both of these also acted as sources for the sampling in chapter 5.1. Moreover, two resources from the content analysis itself were mentioned: the video series "Screening Surveillance" by The Surveillance Studies Centre, Canada (R63), and the Advocacy Assembly website with courses on various topics, including privacy (R5).

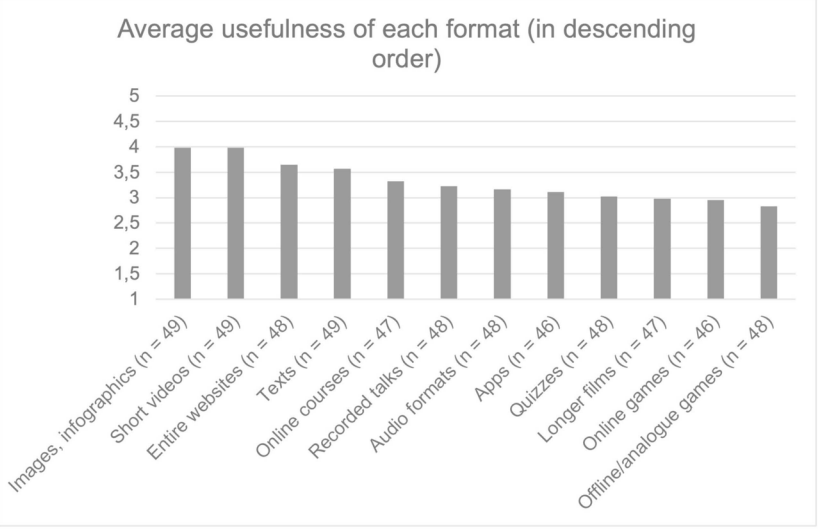
Apart from that, several resources in a similar style and structure to those analysed in chapter 5.1 were recommended by the educators, for example websites with learning and teaching material specifically for kids (Österreichisches Institut für angewandte Telekommunikation [no date]; Seitenstark e.V. [no date]); a comic-essay on "dimensions and implications of the groundbreaking technology, discussing important opportunities and limitations" (Schneider and Ziyal 2019); and a website on a research project that aims to "support educators in improving their critical data literacies" and includes modules on different topics around data, justice and politics and collects interactive tools (Kuhn et al. [no date]). These recommendations suggest that the online resources analysed in my study seem to be on the right track. Apart from that, novel formats were identified, such as LinkedIn Learning resources, a symposium, exhibitions, theatre plays and movies and institutional websites (for example from state institutes for teacher training or associations of educators). Moreover, several more practice-oriented resources were mentioned (e.g., Bhargava [no date]; Lupi and Posavec [no date]; Utrecht Data School [no date]). These recommendations highlighted the variety of formats and resources that can be used to educate about digital and data technologies.

## Usefulness of Specific Formats for Educators

Another goal of the survey was to understand which *formats* of educational resources are most useful for educators who teach about digital and data technologies. Overall, images or infographics and short videos clearly emerged as the most useful formats, with a very high average usefulness of 3.98 each (between 1 – not at all useful, and 5 – extremely useful), and with 80% (images / infographics) and 76% (short videos) of educators indicating that they find these formats very or extremely useful. These results were complemented by the analysis of the open text fields, in which participants highlighted visual approaches such as illustrated texts, infographics, movies, videos of talks, and short videos as useful. This correlates with findings from the previous chapters, in which visualisations and multimedia resources emerged as par-

ticularly suitable approaches to make complex issues around datafication tangible and understandable. However, these findings were also contradictory: one educator questioned if videos as a format work well "because we need that larger amount of time to explain context and experience; but people just don't have the time, IMHO [abbreviation for: in my humble opinion] (though I have no analytics on the use of long-form video)" (321).

*Figure 20: Average usefulness of resources' formats in the educator survey in descending order.*




Moreover, "entire websites" emerged as the third most useful format (average 3.65). Before conducting the survey, I was uncertain whether entire websites were actually useful for educators, or if they might see them as overwhelming or not suitable for the classroom. Considering the high number of websites in the content analysis sample, learning that this format is helpful for the surveyed educators was encouraging. Furthermore, texts were also very popular (average 3.57), with 63% of educators indicating they find texts very or extremely useful. The fifth most useful format were online courses (average 3.32), which more than half (51%) of the educators found very or extremely useful. This is another valuable finding as also with this format, I was uncertain about how easily it could be implemented into existing classroom settings.

Formats that the educators identified as somewhat useful included recorded talks (average 3.23), audio formats (3.17), apps (3.11), quizzes (3.02) and longer films

(2.98). Finally, the two game formats the survey asked about raised some questions. Based on the average usefulness, it seems that neither online games (2.96) nor offline or analogue games (2.83) were particularly useful for the surveyed educators (see fig. 20). However, a closer look at the number gives a clearer picture. In both cases, more than a third of the educators indicated they found games very or extremely useful: 37% for online games, 33% for offline games. However, nearly half of the participants saw games as not at all or only slightly useful: 41% for online games, 48% for offline games. This shows the educators' divergent opinions – some seemed to be very convinced of using games for teaching about data, whereas others seemed to entirely disagree. This is a significant finding, particularly considering the emphasis that the interviewed creators laid on playful and interactive approaches in online critical data literacy resources. Moreover, my sample in chapter 5.1 included several games that were developed specifically for educators and classroom settings. Thus, future resources should consider these divergent opinions and ideally offer different formats in each resource to cater to different needs.

The open text analysis further revealed that the surveyed educators generally found resources useful that do not need a long preparation time, are well-structured, provide links to other resources or include a teaching guide. These approaches are in line with many of the resources analysed in chapter 5.1. However, also some novel findings were identified. For example, two educators highlighted that education about digital and data technologies can also take place using analogue material. This argument has been identified in some academic approaches to critical data literacy as well (e.g., Pötzsch 2019), but it did not come up in the expert interviews nor was it strongly emphasised by the resources that were examined in chapter 5.1. Moreover, educators indicated that curricula of colleagues as well as academic texts or blog entries constituted useful resources for them.

Finally, several educators further outlined that for them, the format of a resource is not actually of much importance. They argued that it "all depends on the content, not the format" (345) and that, for example, visual resources only work well "if they are integrated in a good lesson and human communication" (201). This perspective corresponds with the fact that the question about formats showed many "not applicable" answers. Two educators who used the "not applicable" option explained their stance in the next open text field:

> I find this question difficult to answer because in my opinion, it is mainly the teaching format that matters, not the format of the resource. For me, good tasks are important as well as accessible methods, which allow learners to deal with the topics in a proactive manner. The mentioned resources are mainly useful to complement this. (96)

> What applies for every format: depending on the pedagogical design, suitability for the target group and usage context, any format can be useful or not. In my opinion it is particularly important that resources are connected to people's daily lives and that they allow for a behind-the-scenes glimpse with an 'aha effect'. (174)

These arguments emphasise a crucial point: Even having perfect educational resources about digital and data technologies is not a fool-proof 'recipe for success' when it comes to fostering critical data literacy. Instead, the role and importance of the educators themselves cannot be underestimated. For this reason, it is even more relevant to examine which methods and approaches the educators apply in their teaching about data, which will be the focus of the next section.

## Educators' Methods and Approaches for Teaching about Data

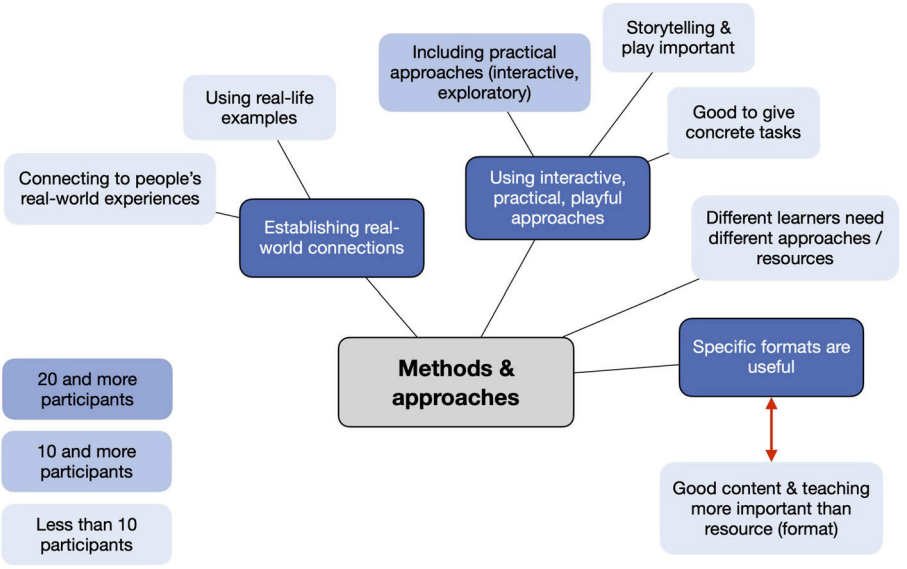
Two themes concerning the educators' methods and approaches have already been discussed: many educators highlighted that specific formats are useful, whereas others argued that good content and teaching are more important than a resource or its format. As the next paragraphs will highlight, the remaining themes identified in this category showed remarkable parallels to the interview findings presented in chapter 5.2. To highlight these parallels, even subthemes with very small numbers were included in the thematic framework, and colour shades were used to visualise the frequency of each theme.

The strongest main theme in this category was that educators *used interactive, practical and playful approaches* (15 participants). This represents a contrast to the above findings that many of the surveyed educators found playful formats such as quizzes, apps and particularly games less useful. One explanation for this might be that some educators find interactive resources less useful because they already apply interactive, practical or playful approaches in their teaching, for example in the form of individual tasks, group work or discussions. In this case, they might prefer 'passive' resources such as images or videos as teaching material. This would also explain educators' strong agreement with a statement about interactive approaches as a way to engage learners (see next section). However, another possible explanation is that the surveyed educators' perspectives are diverse and that they have divergent opinions about playful approaches, as speculated above.

Twelve educators indicated that they *included practical approaches, such as interactive or exploratory approaches*, in their teaching, making this the strongest subtheme in this category. The arguments here resemble the creator interviewees' calls for engaging formats, including interactive, experiential, or conversational approaches. The educators highlighted the importance of combining theory and practice, and of using active and exploratory tasks, for example asking students to research issues for themselves and to then apply their knowledge practically. In line with this, some educators highlighted that it is *good to give concrete tasks* (2 participants) and that *story-*

*telling and play is important* (2). These subthemes were not mentioned often, but they show strong parallels to the creator interviewees who argued that it is important to make resources fun and that a story-based approach can help in reaching people. One educator further elaborated: "I use storyb[…]uilding games for children in university work – getting people to play is very important. […] I wish resources would be more p[…]layful and challenging" (141).

*Figure 21: Main themes and subthemes in the category "methods and approaches" in the educator survey.*




The second main theme regarding educators' methods and approaches is that they wanted to *establish real-world connections* (7 participants). This theme shows strong parallels to the creators' goal to create personal involvement. Six educators indicated aiming to *connect to people's real-world experiences*. As a "proven method" they suggested a "reflection of one's own media biography and current usage patterns (in partner interviews, with recording own usage behaviour, …)" (102), or recommended to "problematise" (96) topics around digital technologies and to "discuss ambivalences" (122). Moreover, two educators highlighted *using real-life examples*. Despite the small number, this is a significant finding as this approach emerged in every stage of my study, which indicates this as a key approach for fostering critical data literacy. One educator explained that concrete examples can help with people's "'fear' of not being able to understand technology", which should be taken seriously

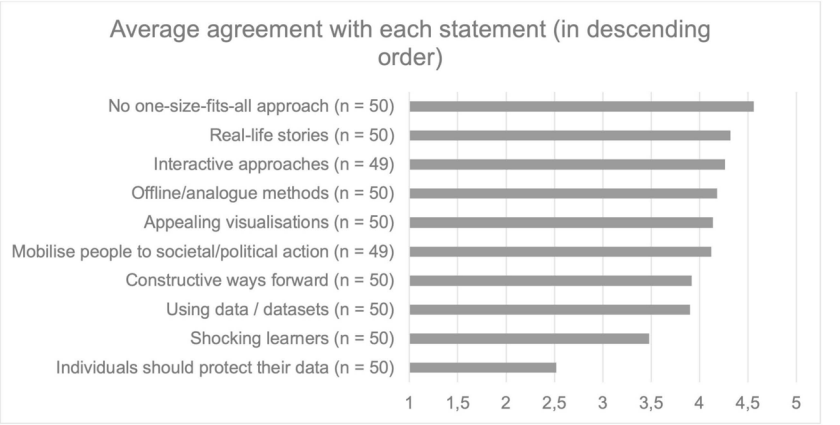
and "the demystification of technology has to be a central goal when working with people who do not normally deal with these topics" (172). These are valuable insights for critical education about datafication, particularly when addressing non-technical and lay audiences, which may otherwise feel resigned in light of the new information (see chapter 2.1).

Finally, five educators highlighted that *different learners need different approaches or resources*. This argument further received most agreement by educators when they were directly asked about it (see next section). One concern that was raised in this context was "the intercultural issue", arguing that it is not enough to provide resources in different languages but that "there is a problem of cultural adaptation and contextualization" as it is questionable that resources can be "applied to several contexts […] in all sectors of lifelong learning" (209). For these reasons, one participant wished for "sites with activities organized according to the Level and/or age of students" (256) – essentially describing the database by the Critical Big Data and Algorithmic Literacy Network (CBDALN) that was used as a source for my study's content analysis.

### Are Educators' Experiences in Line with Key Research Findings?

While the previous sections already provided some insight to parallels between the educators' experiences and scholarly research findings, the survey also directly asked educators about their agreement to ten specific research findings. As detailed in the methodology annotations, the ten statements that were tested were selected with care, intending to cover key findings along with controversial aspects. This approach confirmed some expectations from the literature and prior findings of my study, but also led to several novel findings. Overall, one statement emerged as a clear 'winner': 94% of surveyed educators (strongly) agreed with the statement "There is no one-size-fits-all approach and different learners need different approaches" (average of 4.56, see also fig. 22). This corresponded with the strong emphasis on this perspective in the previous findings chapters – yet, agreement within the survey sample was remarkably high and not a single educator strongly disagreed. The second highest ranked statement equally reiterates prior findings: "Including real-life stories can help learners understand complex issues" (4.32). With 86% of educators (strongly) agreeing and no disagreement at all, this approach seems to constitute a second virtually undisputed best practice for educating about data, which was confirmed in every methodological approach in my study.

*Figure 22: Average agreement to research statements in the educator survey in descending order.*




The statement that, on average, received the third highest agreement by the educators was: "Interactive approaches are a great way to engage learners" (4.27). As already discussed above, the comparatively unpopular formats of games, apps and quizzes seemed to have given a wrong impression of educators' perspective to interactive approaches, with 84% (strongly) agreeing and no participant strongly disagreeing to this statement. Thus, it seems that the surveyed educators were almost entirely united in their enthusiasm for interactive approaches for teaching about data, yet they have divergent opinions on certain interactive formats, such as games, when it comes to educational resources. Moreover, the fourth statement "Appealing visualisations of data systems can help learners to engage emotionally" (4.14), with 84% agreement and no strong disagreement clearly confirmed the study's previous findings. Thus, it seems that these four approaches constitute clear best practice approaches for fostering critical data literacy according to my study's samples.

Further statements that received high agreement from the surveyed educators were that "Education about digital technologies can also take place through offline/analogue methods" (average of 4.18; 83% agreement), and that "It is important to not just raise awareness, but also to mobilise people to take societal/political action" (4.12; 86% agreement). Both approaches were already identified in the open text analysis, albeit with very low numbers (two and six participants). This demonstrates the value of combining open and closed questions in this survey, as the statements revealed that two very rare themes in the open text analysis in fact found widespread agreement in the sample when directly asked about. Moreover, the high agreement with societal and political action constituted another parallel to the creator interviews. Furthermore, 68% of surveyed educators agreed that "When

educating about critical developments in society, educators should always present constructive ways forward" (3.92). Based on the high agreement with the previous statement on mobilising people and my study's prior empirical and theoretical findings, however, I would have expected even stronger agreement with the importance of constructive advice.

Another novel finding was the educators' strong *disagreement* with the statement: with "It is up to the individuals to protect their data online", which only reached an average agreement of 2.52, and 56% of educators (strongly) *dis*agreed with this approach. Considering that individual data protection emerged as clearly the most common form of constructive advice in the content analysis and that scholars have warned of a shift of responsibility to individuals (e.g., Pangrazio and Selwyn 2019, p. 425), stronger agreement with individual responsibility could have been expected. In total, only 24% (strongly) agreed to individuals' responsibility and 20% neither agreed nor disagreed. These numbers – together with the focus on political or societal action – are very encouraging. It seems that many of the surveyed educators were aware of citizens' limited agency and the systemic nature of challenges of datafication, which cannot be solved by individuals alone.

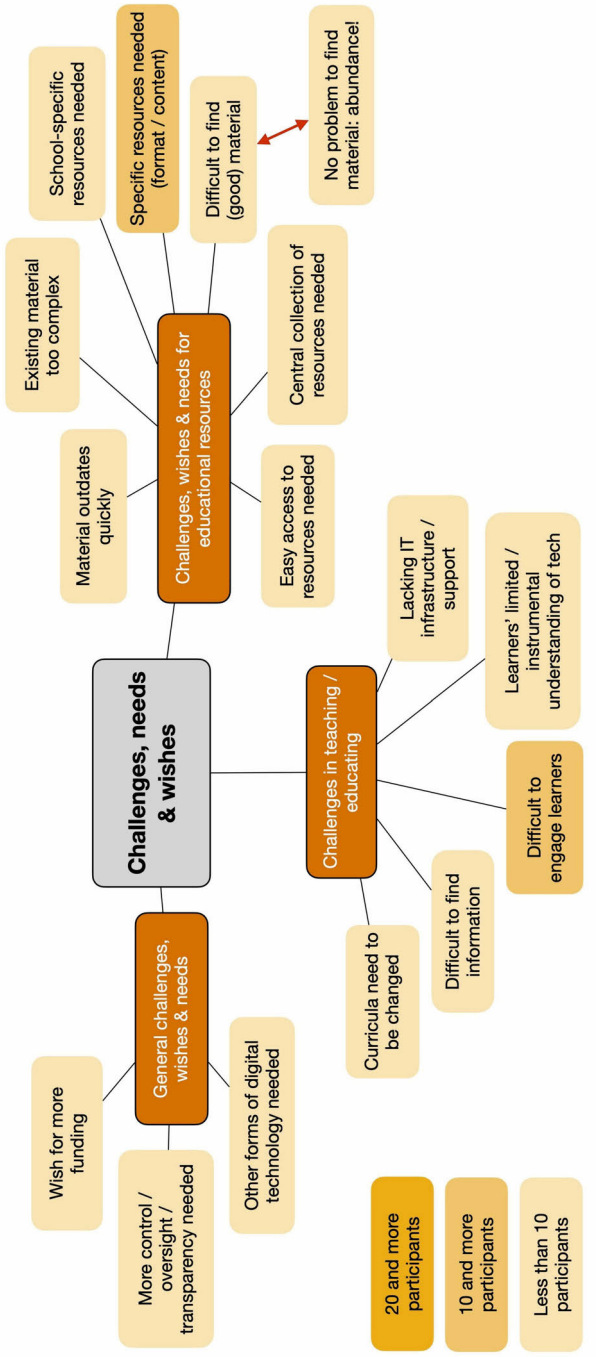
Finally, two further statements received comparatively low agreement by the educators. The first addressed the ongoing open question of whether critical data literacy approaches should foster people's data skills. Educators' opinions on this seemed to be mixed – yet with overall clearly more agreement (68%) than disagreement (10%). This correlates with scholars' perspectives on this, which are equally divergent (see chapter 2.2). Mixed opinions were further indicated for "Shocking learners in order to make them realise that they are affected by a certain societal issue can be a beneficial approach" (3.48): 56% of the surveyed educators (strongly) agreed, 28% neither agreed nor disagreed and only 16% (strongly) disagreed to the statement. While also the expert interviews revealed some divergent opinions, the overall stance of the creators was that the risks of this approach outweigh its benefits (see chapter 5.2). In light of the strong agreement of the educators, the question of shocking learners thus remains ambiguous and controversial.

### 5.3.4 What Challenges Emerge? What Do Educators Need and Wish for?

#### General Challenges When Teaching about Digital Technologies and Data

Ultimately, the analysis identified several challenges that educators encounter and needs and wishes they have for better education about digital technologies and data. Twenty-four survey participants reported challenges in relation to their teaching about these topics (see fig. 23). The most common subtheme was that the educators found it *difficult to engage learners*. This is very much in line with the interview findings, in which creators spoke about how difficult it is to overcome people's "issue fatigue" and to enter their "circle of worry". In the survey, educators argued that learners are often "rooted in their everyday life experiences and knowledge" (226) about digital technologies, and "big data and related dangers are seen as hardly relevant to their own life" (195). This is particularly difficult with younger learners and teenagers, who are often difficult to reach in general and whose "entire attention is captured by their smartphone" (184). For these learners, critical reflection of digital technologies can lead to "cognitive dissonances", which are "understandably uncomfortable" and can evoke resistance rather than a more in-depth examination of the topic (102). Moreover, people's convenience (249) and a "dystopian pull" (174) were highlighted – challenges that are also outlined in the academic literature (e.g., Turow et al. 2015; Draper and Turow 2019; Müller-Peters 2020, p. 125).

*Figure 23: Main themes and subthemes in the category "challenges, needs and wishes" in the educator survey.*



Related to this, several educators identified *learners' limited or instrumental understanding of technology* as a challenge. The educators reported that many learners underestimate the complexity of digital technologies and have little technical knowledge and limited understanding of relations between different technologies, for example of social networks and big data. Particularly learners' instrumental understanding of digital technologies was seen as challenging:

> Historically, I would say the main challenge has been overcoming (on the one hand) instrumental/functional views of technology and (on the other) uncritical enthusiasm about the 'empowering' potential of digital media. (345)

According to this educator, such instrumental views have overall decreased, but are still dominant in schools, where "narrow concerns about internet safety" prevail (345). Another educator made a similar argument about university students, who "have a very instrumental understanding of digital technologies", which is why problematisation is crucial (96).

As further challenges, some survey participants highlighted *lacking IT infrastructure and support*. Some mentioned lacking internet access or access to specific software in their educational institution. Others argued that their school's "digital support unit is less interested in data security" and that they would like to better control the data of their pupils and themselves but would "need competent support by IT Management Systems" for this (201). Similarly, some complained that there is "little willingness to discuss big data among staff and authorities in the field of standard school education" (230), and little interest and understanding particularly by their "younger colleagues" (201). This comment further calls the narrative of "digital natives", who are better skilled at using digital technologies, into question (see e.g., Kirschner and De Bruyckere 2017).

Moreover, some educators called for *curricula to be changed*. They argued that a strong positioning of topics around digital technologies in curricula is missing and that the fact that these topics affect all school subjects leads to a situation in which "no one feels responsible" (218). One educator even called for a "decluttering of all curricula in all school types and education levels", replacing traditional subjects with new ones such as "media usage", "basic social science education" or "the future of work" (218). Similar to some expert interviewees, another educator further highlighted the challenge that teachers need a basic knowledge of digital technologies as well as pedagogical expertise if they want to educate about digital technologies and data (95). Related to this, several educators outlined that they had *difficulties finding information* on data systems due to their "breadth, complexity and opacity" (122) and "the black box problem" (282).

## Educators' Challenges, Needs and Wishes for Educational Resources

This leads to another problematic area that 25 educators highlighted: the difficulties they encounter when trying to find and use educational resources as well as their needs and wishes for such resources. In line with the interview findings, one common issue was that *existing material outdates quickly*. Educators criticised that specialist literature is "often already outdated upon publication" (206) and outlined that "the biggest problem" is to view and select the wide range of material and keep up it to date (249). Furthermore, some argued that *existing material is too complex* – with resources being too "difficult for students to access due to complexity of langu[a]ge" (173) and overall being "too technical, too complicated, too detailed and/or ignor[ing] lack of capacity" (316). Several educators outlined that material for beginners and younger kids, for example in primary schools, is missing. Related to this, some educators *called for school-specific resources*. They highlighted a need for textbooks, planned lessons, material that matches the curriculum and resources that are "not several hours long max time we have is 60 mins a lesson" (181). These findings are extremely useful for creators who develop resources for formal educational settings.

Additionally, 13 participants took the opportunity to detail *specific formats and content they need in educational resources* about digital technologies and data. In terms of resource formats, they highlighted a lack of good texts and good videos and called for more offline formats and open-source material. Some further wished for more hands-on interactive resources, playful resources, podcasts and quizzes. Regarding the resources' content, the educators criticised that existing resources often ignore the learners' individual or organisational context – which reinforces the argument that different audiences require different approaches. Moreover, a variety of different needs was outlined, including the need for more practical material, such as resources for practical demonstration, e-learning platforms and material on effective uses of technology; guides to data privacy for parents and teachers; resources that combine different fields; and material that includes ethical thought experiments or covers datafication in more depth. These wishes highlight the variety of educators' needs and that many kinds of resources are required, but they also demonstrate that many of the resources analysed in my study are already on the right track.

## Educators' Satisfaction with Existing Educational Resources: "Basically There Is Nothing" versus "The Problem […] Is the Abundance"

The survey further led to divergent findings on educators' overall satisfaction with the existing resources. Seven educators used the open text fields to highlight that they struggled to find good material, arguing that there is "very little teaching material out there if any. […] But basically there is nothing!" (181), and that "almost all the digital resources are needed. None is available here" (148). Others criticised the quality of existing resources, outlining that some resources exist, but they are "way too superficial and factually wrong" (112), that "ther[e] is a lot of nonsense" (201), and

"MS and Co. [Microsoft and others] have a lot of influence" and alternative material is needed (201). Four educators further emphasised that *easier access to resources is needed*, particularly for those not fortunate enough to have access to university library licences, and four called for a *central collection of resources*, such as "a digital library for teaching material that is selected, tagged and commented by experts" (249), a "central pool of material" (218) or for "some form of compendium" (141). These calls are particularly relevant because some such collections already exist – for example the CBDALN database that was used as a source for my study's content analysis. Yet, apart from highlighting the significance of curated collections, these calls also demonstrate the difficulty of reaching the intended audience, as, it seems, these educators were not aware that several such collections already exist.

However, contrary to the arguments made above, four educators also used the open text fields to highlight that is it *no problem for them to find material*. They outline that they have not encountered any problems specific to topics around digital technologies, and that their only challenge is to make a choice on which resource to use out of the large range that exists. One explained that "5 years ago the materials were rather academic. But in the last two years there has been an explosion of very good materials" (209). This educator goes on to name several resource formats and specific resources that were helpful to them and concludes: "The problem, as usual, is the abundance" (209). Unfortunately, the reasons behind these very different perspectives of the educators on the existing material cannot be determined with certainty. One possible solution is that some educators are more informed about the many resources that already exist. Another explanation could be that different educators have different expectations and requirements for resources or – considering the wide range of topics that fall under "education about digital technologies" – that they look for resources on different topics.

These divergent perspectives are not just a singular impression based on the open text field analysis, but they were confirmed by a closed question on participants' satisfaction with their access to information and teaching material about digital technologies and data. Figure 24 demonstrates that the average satisfaction of educators with their access to material was mixed. A little over one third of educators indicated being not at all or slightly satisfied (37%), a little less than one third was moderately satisfied (30%), and exactly one third was very or extremely satisfied (33%).

This picture of mixed opinions remained unchanged when considering the individual topics that were asked about: digital technologies in general, data security, (big) data systems and algorithms, and the way digital media and (big) data affect society. As figure 25 shows, the differences between the topics were marginal, with educators being on average most satisfied with their access to material about digital technologies generally (average of 3.2), followed by data security (2.92), the effects of digital technologies (2.84), and finally (big) data systems and algorithms (2.63).

Across all four topics, divergent opinions could be identified. However, higher satisfaction was indicated towards material on digital technologies in general (41% very or extremely satisfied) in contrast to, for example, (big) data systems and algorithms (26% very or extremely satisfied).

*Figure 24: The surveyed educators' average satisfaction (across all four given topics) with access to information and teaching resources in percent (n per topic, see figure 25).*

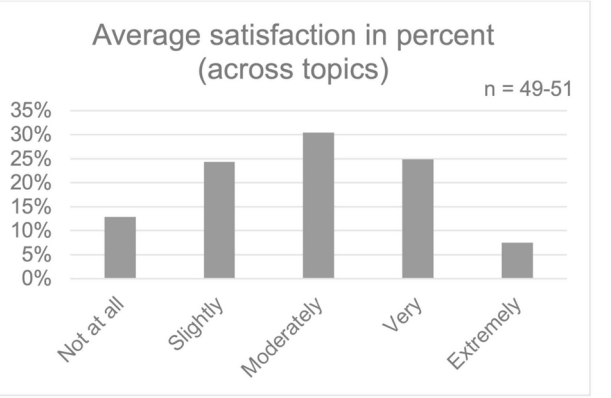
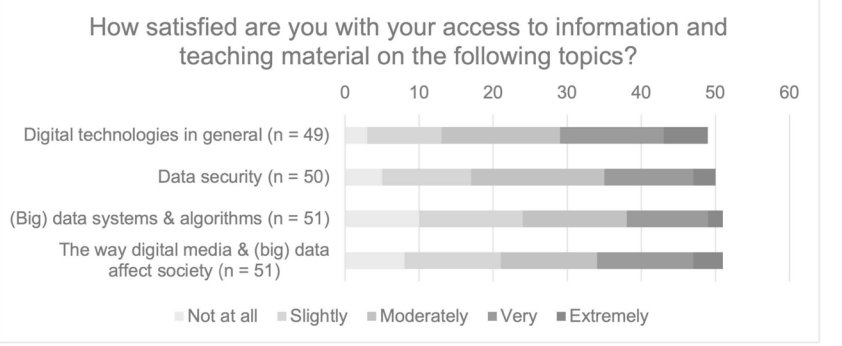



*Figure 25: Total numbers of surveyed educators indicating how satisfied they are with their access to information and teaching material on the four given topics.*




Thus, overall, it can be said that educators' satisfaction with their access to educational resources about digital technologies and data as well as with the resources themselves very much depended on the individual. While the surveyed educators

were slightly more content with their access to material on some topics than others, the key finding is one of mixed opinions. Moreover, the numbers for educators' satisfaction with their access to material (averages between 2.63 – 3.2) were consistently significantly lower than the numbers on how well-equipped the educators felt to teach about these topics (averages between 3.41 – 4). This suggests that while the surveyed educators have *some* material to teach about these topics, many do not seem to be very happy with this material.

### Educator's Perspectives on Societal Challenges

Finally, some educators took the opportunity to outline societal challenges in relation to digital technologies and data that they saw as most pressing. This gives an idea of their overall attitude to digital technologies and consequently on their motivation for teaching about digital and data technologies. Three key challenges were outlined. First, a small number of educators passionately called for *more control, oversight and transparency of digital technologies*, arguing that technologies need to be turned "back into tools in service to the people rather than degrading people into data suppliers in a data economy" (249), and that more control of companies, less exploitation, and easier data protection for people is needed (321). Related to this, others called for *other forms of digital technologies*, demanding more open data (218); a communal, non-commercial system (201); or "data-minimising and decentral systems, disclosing all source codes, making algorithms transparent and public and giving people data sovereignty" (249). Finally, the *need for more funding for resources and alternative educational formats* was outlined. In this context, educators called for more public support for education about data (184) and more "crowd science" and "collective approaches to generate educational tools" (209). Overall, these final comments of educators highlight the passion and motivation of some educators in addressing challenges around datafication, which suggests that excellent education about data is already being practised.

## 5.3.5 Conclusion and Discussion

The first key finding of the survey was that a diverse sample of educators could be reached, with educators from 18 different countries and a range of educational settings. Although a dominance of educators in formal education and those living in Germany was determined, the sample's variety nevertheless demonstrated that diverse educators and educational fields are already fostering education about digital technologies and data. Moreover, the participants' information on their subject contexts revealed a remarkable diversity, from journalism to screen writing, IT and data analysis training, or civic or political education, demonstrating for how many different educational contexts these topics are of relevance.

### Educators Cover a Variety of Topics in Their Teaching – Often Aiming for Similar Goals as the Resource Creators

This diversity was confirmed in the educators' goals and topics. While educators in the sample overall felt fairly experienced and well-equipped to teach about digital technologies and data, differences between topics were identified. The surveyed educators felt considerably more experienced and well-equipped to teach about digital technologies and their societal implications than about more technical or complex topics such as data security or data and algorithmic systems. In particular, the educators' experience in teaching about societal implications of digital technologies constituted a significant finding in this context. While "implications" is a broad term that can be interpreted in many ways, it was nevertheless encouraging that the surveyed educators go beyond instrumental skills in their teaching, and also include more reflective perspectives on technologies' impacts.

Overall, the educators often provided detailed descriptions of the topics and goals of their education about data, thus giving a good idea of the kind of literacy they aim to foster. Many similarities to the goals of the creators interviewed earlier in my study were identified. A large majority of educators highlighted understanding and critical reflection as key goals. In particular, many educators indicated to educate about how digital technologies and data systems work – including their shortcomings – and how they affect individuals and society. Although the survey did not specifically address educators with a critical stance towards technologies, these goals correspond with the creator interview findings and with my preliminary critical datafication framework. Yet, they represent a contrast to other studies that have found that instrumental and technical approaches to data literacy prevail in the education sector (Raffaghelli and Stewart 2020, p. 446ff). Moreover, novel approaches and goals were identified, such as applying critical thinking and "tech intuition" to new and emerging technologies. Furthermore, the vast majority of participants agreed that mobilising people to take societal or political action was important to them, which represents another parallel to the creator interview findings.

Further novel findings included the educators' objective of teaching about digital and data ethics and laws, and a strong focus on practical skills, such as using office technologies, creating media content, or using and analysing data. This focus on practical skills represents a contrast to many educators' emphasis on critical reflection; yet this perspective was sometimes indicated by the same educators who distinctly called for critical approaches. This significant finding again opens up the question of whether critical education about data should foster people's practical skills – a question that seems unresolved among critical data literacy scholars (see chapter 2.2). For many of the surveyed educators, it seemed that fostering critical reflection alongside practical media usage skills constituted no contradiction – even in relation to skills such as social media marketing, which supports the same busi-

ness models that many educators wanted learners to critically reflect upon. Overall, a wide range of different topics and goals was determined. This reemphasises the difficulty of defining what education about digital and data technologies entails and which topics should be addressed, but it also highlights the wide range of skills and understandings citizens require to navigate datafied societies.

### Parallels to Previous Findings

The analysis further demonstrated that, overall, the approaches that creators of online critical data literacy resources have been taking seem to be in line with educators' needs and requirements. Many of the surveyed educators stated that they search for information and teaching material online, and they found images, short videos, entire websites, texts and online courses very useful. Divergent opinions were identified on whether games – both online and offline – are useful for educators. However, some educators also highlighted that the format of a resource or even the resource itself is not as important as the teaching and pedagogical decisions in which it is embedded. This is a valuable reminder that the role of the educators themselves should not be underestimated when it comes to fostering critical data literacy. Furthermore, several educators recommended specific resources that they found useful, including resources examined in chapter 5.1 and some similar to those. All of these findings are encouraging as they suggest that online resources are useful for educators and that many of the critical data literacy resources examined in my study might be appreciated by educators. Thus, these findings also support the knowledge mobilisation taking place in this study, which, among others, aims to make these resources more easily accessible to educators. Moreover, several educators indicated that they like to create their own resources, which was a novel finding that inspired a section on "creating educational resources" in the knowledge mobilisation project resource (see appendix IX).

Almost all educators used the survey's open text fields to elaborate on the methods and approaches they use when teaching about digital technologies and data. The analysis of this data identified many parallels to the creator interviews, such as wanting to establish real-world connections by relating to people's everyday experiences and using real-life examples, or using interactive, practical and playful approaches including stories. Another strong theme that emerged was that different learners need different approaches. Further research statements the educators agreed on were that interactive approaches work well to engage learners – as found, for example, in my prior research (2020c); that education about digital technologies can also take place through analogue methods – as emphasised, among others, by Pötzsch (2019); and that appealing visualisations can help learners to engage emotionally – as, for example, highlighted by Kennedy and Hill (2018).

A key finding in this context was that the majority of educators did not agree that it is up to individuals to protect their data online. This represents a contrast to

the strong emphasis on self-data protection in most resources examined (see chapter 5.1) and in many academic concepts for critical data literacy (see chapter 2.2). A second significant finding was that more than half of the participants agreed that it can be beneficial to shock learners to make them realise that they are affected by a societal issue. The strong agreement with this among many surveyed educators represents a contrast to the divergent opinions on this that were identified in the expert interviews (see chapter 5.2) and in my prior research (2020c, p. 13).

### Challenges in Teaching and Finding the Right Material

Several parallels between the challenges highlighted by the educators and the creator interview findings emerged, for example that it is difficult to engage learners and make them realise that they are affected by issues around data systems. Some educators further highlighted structural challenges, such as the need for these topics to be better integrated in curricula and a lack of support for teachers who want to educate about digital technologies. In relation to educational resources, the difficulties of quickly outdating material and insufficient resources for younger children and beginners were outlined. In addition, the educators provided valuable feedback on existing resources, such as that many are too complex, that more school-specific resources are needed, and they called for a central collection of resources. This last point informed this study's knowledge mobilisation project (see appendix IX), but it also demonstrated that existing tools – including an already existing database of resources – often do not reach the intended audience, a challenge that was also raised by the interviewed creators.

Moreover, the analysis identified educators' divergent perspectives on the availability of existing resources. While some indicated being very satisfied with their access to information and material and spoke of an "abundance" of resources, others were not satisfied at all and stated that there was "basically nothing". As discussed above, there could be different reasons for these divergent opinions, for example that the educators were searching for material on different topics, had different expectations towards the material or had different access, with some seeming to be more informed about existing resources than others. For both problems – an abundance of material as well as not knowing of any good resources – a central collection of resources was suggested as a solution. Finally, some educators even highlighted a number of societal challenges in regard to digital and data technologies, demonstrating their passion and motivation for addressing concerns around datafication.

Overall, the survey led to valuable findings regarding educators' goals for teaching about digital and data technologies, the methods and approaches they apply in reaching these goals, and their challenges, needs and wishes when it comes to educational resources and teaching about these topics in general. Particularly the survey's combination of open and closed questions proved valuable in identifying novel findings, while also allowing for generalising statements about the sample's per-

spectives. With all of these findings, however, it is important to keep in mind that they only represent a small sample of international educators and that no representative statements about all educators can be inferred. Nevertheless, the goal of the qualitative survey – understanding rather than representativeness – was reached and much could be learnt from educators' experiences and perspectives. In addition to many parallels to the creator interview findings, novel approaches and goals were identified, many of which could be highly useful for the future development of critical data literacy resources. Thus, these findings ideally complement the prior two methods that examined existing online resources and their creators' perspectives.