4. Methods

4.1 Introduction and Project Design

The empirical research in my study examined online educational resources about datafication and how they are created as well as applied by educators as one way to teach about datafication. Although these resources constitute one of the longest-standing and most established approaches to critical data education, they have been examined in very few studies thus far. Little is known about their objectives, educational strategies, their creators' considerations, and their use by educators. My study addresses these gaps in research and aims to learn from these practices in order to develop a theoretically and empirically grounded framework for critical datafication literacy. In line with this, the empirical research took three different approaches, which examined three key research questions:

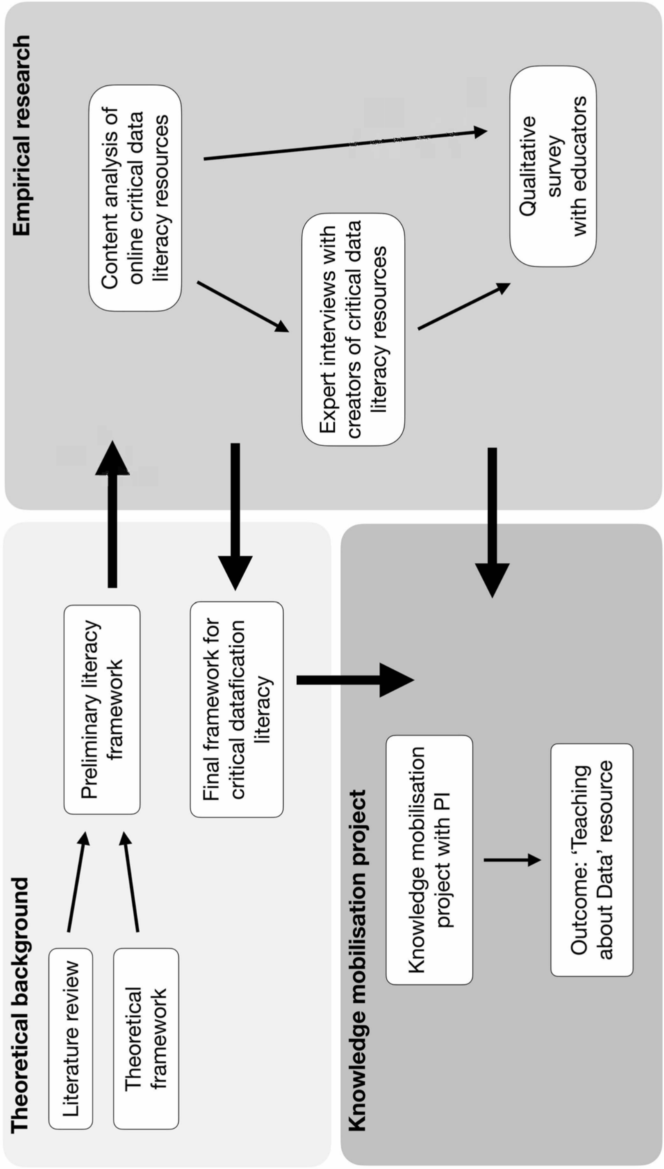
a) What is the range, shape and focus of *online critical data literacy resources*?
b) What are the goals, strategies, and experiences of *creators* of online critical data literacy resources?
c) What are *educators*' experiences with the topic of datafication and what do they need and wish for from a critical data literacy resource?

The research design of the study took a mixed methods approach, combining qualitative methodologies such as expert interviews and a qualitative survey with more quantitative methods such as a content analysis. This mixed methods approach helped to address the different research questions of my study and allowed insights into critical data literacy practice from different perspectives. The expert interviews were able to complement the '*what*' (do online resources look like?) of the content analysis with a '*why*' (are they created this way?). Combining qualitative with quantitative methods can help in locating a target population (in this study the online critical data literacy resource creators); can increase the generalisability, validity and reliability of research; and, importantly, it can provide more robust understanding of research results by triangulation of methods (Hesse-Biber 2010, p. 465f). Triangulating seeks to "find convergence" or validate research findings by comparing results from different methods (ibid.). In my study, the triangulation of methods allowed for a more complete picture of critical data literacy – through identifying parallels as well as contradictions between different findings. As will be outlined throughout this chapter, one key characteristic of my study was that the different stages and methodologies continuously built on and informed each other. These reciprocal influences are illustrated in figure 3.

Moreover, as outlined in the introduction chapter, my study included a collaboration with the NGO Privacy International. The NGO and I closely collaborated in the final knowledge mobilisation project (see chapter 4.5); but the NGO also acted as an advisor throughout conducting the research, and knowledge exchange in the form of online meetings and email communication with PI executive director Dr Gus Hosein took place in the different stages of the research.[1] During this exchange, Dr Gus Hosein provided feedback on many of the study's methodological decisions. While this feedback and the NGO's considerable experience in practically educating about datafication constituted a very valuable second perspective, which helped to inform my methodological decisions, it should be clarified that the NGO never tried to exert influence over how the project was designed, or the research conducted. The final say in all methodological decisions was mine and the NGO was not involved in the analysis or interpretation of the findings. The following chapter will discuss the study's methodological considerations and highlight the NGO's involvement in this process.

1 In person meetings were originally intended but were not possible in the first 2.5 years of the research project due to the ongoing COVID-19 pandemic.

Figure 3: Visualisation of the project's mixed methods approach and its reciprocal influences.



4.2 Identifying, Analysing and Selecting Online Critical Data Literacy Resources

In order to gain better understanding of how critical education about datafication is fostered through online resources (such as websites, videos, interactive tools and others), and what can be learnt from their creators and educators for the further development of critical datafication literacy, the first step consisted of gaining an overview of such resources and their characteristics. This was also necessary to make an informed decision on the sample of resource creators for the expert interviews. Thus, the research questions for this first stage of empirical research were:

1) What examples of critical data literacy resources can be identified?
2) What are their defining features and who created them?
3) Are the identified resources in line with the preliminary framework for critical data literacy?
4) Which (best) implement the ideas, goals and approaches presented in this framework? Which take other, unusual approaches?

In order to systematically record the resources that can be identified (question one) and their characteristics (question two), and to analyse to what extent they are in line with the preliminary theoretical framework (questions three and four), I conducted a content analysis of online critical data literacy resources.

4.2.1 Content Analysis as a Method

Content analysis is a research technique that allows for the "objective, systematic, and quantitative description of the manifest content of communications" (Berelson 1952, p. 147). The method was originally designed to "bring the rigour and authority of 'natural' scientific inquiry to the study of human and social phenomena" (Deacon et al. 2007, p. 118). However, despite its goal of a "systematic and objective analysis of any particular text" by "essentially counting things" (Davies and Mosdell 2009, p. 98), content analysis does not provide entirely "value-free insights to the study of content" (Deacon et al. 2007, p. 118). One reason for this is that content analysis is "a directive method; it gives answers to the questions you pose" (ibid., p. 119). Nevertheless, the method's ability to "count things" is ideal to "quantify salient and manifest features of a large number of texts" (ibid.). Its key purpose is to "identify and count the occurrence of specified characteristics or dimensions of texts" (Hansen 1998, p. 95) – in this case, to record and count characteristics of a large number of online critical data literacy resources. Although originally developed for "the analysis of textual materials, namely newsprint, in social research", the method can easily be adapted to other forms of media – such as online educational resources about datafication – and has been used for "nearly any cultural artifact" (ibid.).

Content analysis can be seen as a "hybrid technique" between quantitative and qualitative methods, bridging "statistical formalism and the qualitative analysis of the materials" (Bauer 2000, p. 132). One key strength of the method is its ability to reduce the complexity of a collection of texts in a systematic manner, thereby "distil[ling] a large amount of material into a short description of some of its features" (ibid., p. 132f). This ability to produce "a big picture" (Deacon et al. 2007, p. 119) makes content analysis an ideal method to gain an overview of the key characteristics of a large number of online critical data literacy resources that have been hardly researched so far. Further strengths of the method include its "systematic and public" approach, that it "mainly uses 'naturally' occurring raw data", "can deal with large amounts of data", and offers a set of "mature and well-documented procedures" (Bauer 2000, p. 147). Bauer further describes content analysis as "far from being the last word" but argues that it "may be the first step in ordering and characterizing materials in an extended research effort" (ibid., p. 148), which ideally describes the way content analysis is applied in my study.

Limitations of Content Analysis

One key challenge of content analysis has already been outlined above: it can only provide answers to the questions the researcher poses, thus harbouring the risk of overlooking unexpected findings. Moreover, it "tends to focus on frequencies, and so neglects the rare and the absent" (Bauer 2000, p. 148). In my study, this was addressed by including a variable asking for unusual approaches (see below). Content analysis is further "not well suited to studying 'deep' questions about textual and discursive forms" (Deacon et al. 2007, p. 119), or to "interpret the wider social significance or meaning of the quantitative indicators" it generates (Hansen 1998, p. 123). These aspects, Hansen continues, need to be "drawn and developed from the theoretical framework" of one's study (ibid.), which is the case in my study. Related to this, a common fallacy of content analysis is to make inferences about "particular intentions or understandings from the text alone", as "intentions and reception are features of the communicative situation and do not depend on the text alone" but are "co-determined by situational variables" (Bauer 2000, p. 145). My study addressed this limitation by combining the content analysis with qualitative interviews with the resource creators.

A further key challenge of content analysis is the accurate quantification of variables as content analysis does not work reliably "when coders are required to 'read between the lines' to get at latent structures of meaning" (Deacon et al. 2007, p. 124), or when "a considerable degree of interpretation by the coder" is needed (Hansen 1998, p. 115). To overcome these challenges, a detailed codebook (including example cases) was created, and a pilot study conducted.

4.2.2 Conducting the Content Analysis

Sources and Sampling

The total range of content, or *population*, that this study's content analysis examined consisted of English- and German language online resources that educate about datafication. Resources in both languages were considered in order to reach a wider population and because I speak these two languages fluently. The individual resource, such as a website, an online series, a short video or an interactive game was the *sampling unit*, and its characteristics in terms of format and content were the *units of measurement*.

As a first step, a "set of decisions [...] to identify systematically which units of [my] sample fall within the remit of [my] study" was necessary (Deacon et al. 2007, p. 125) – in other words: what counts as an "online resource that educates about datafication"? First, I decided that "online resource" would be understood in very general terms, encompassing *any resource that is available online*, also including, for example, PDF brochures or websites that provided print-out material for educational simulation games. The second question was more difficult to determine: how can resources that "educate about datafication" be defined? To make systematic decisions on this, I defined three qualifying criteria for critical data literacy. These were developed based on this study's theoretical framework and findings from my prior research (2020c), and they aimed at defining critical data literacy resources in the broadest way possible: the resources needed to 1) educate about datafication (the transformation of our societies through data technologies); 2) foster critical reflection of the implications of datafication; and 3) should not require any prior knowledge (see also below).

After specifying this, a decision needed to be made on what sample size of the population to analyse in order to "construct a credible, representative sample" (Deacon et al. 2007, p. 121). Since little research has been conducted on online critical data literacy resources so far, no list of such resources existed and also data on their use and popularity was scarce. Therefore, no sampling frame existed, and a truly representative sample was not possible. Instead, "sampling validity" – finding a sample that "represents the whole body of the text" (Bauer 2000, p. 144) – was considered by identifying a sample that is as broad, diverse and comprehensive as possible, yet feasible in the given time frame.

In order to reach such sample, a variety of sources for critical data literacy resources were examined, including my prior publications (Brand and Sander 2020; Sander 2020c; Sander 2020b); all resources in the database by the Critical Big Data and Algorithmic Literacy Network as of 07.05.2021;[2] resources that were recom-

2 An international network of critical data literacy scholars and practitioners I co-founded in 2020 and that provides an online database of online resources that critically educate about

mended by the project partner Privacy International or during the 2021 Data Justice Conference; and all resources on a list of potential critical data literacy resources that I had maintained for two years prior to starting the content analysis, which included all online resources that I came across or that others had recommended and that, on first glance, seemed to be educating about datafication. In addition, a small number of resources were identified via other, already examined resources. A detailed description of the sampling process and an overview of the numbers of resources identified through each of the sources can be found in the "methodology annotations" (appendix I, section I.I.I).[3]

After all sources listed above were examined, 250 resources were identified in total. Of these, 75 met all three qualifying criteria and were thus fully coded. While the sample was not representative, it consisted of a broad and diverse selection of critical data literacy resources. This was further confirmed by the coding, which highlighted a large variety of the resources' creation contexts and formats. For these reasons, the sample size was considered sufficient for my study. However, the analysis later demonstrated that some characteristics prevailed in the sample. For example, a predominance of resources with a German background was identified. This could be traced back to the high 'success rate' of the German sources of the sample in comparison to the international sources: the two sources through which most critical data literacy resources were identified were 1) the database by the Critical Big Data and Algorithmic Literacy Network, which has many very active German members; and 2) an online collection of German critical data literacy resources that I created as part of my prior work.

Codebook and Coding Sheet

Deciding on "what to count" is a crucial step in any content analysis (Deacon et al. 2007, p. 119). In this regard, my study's interconnection between theory and practice proved useful. The preliminary framework for critical datafication literacy (chapter 3.4) as well as my small previous study of online critical data literacy resources (Sander 2020c) provided a thorough grounding for the content analysis and reduced the risk of asking the "wrong" questions or overlooking relevant aspects and helped to ensure semantic and construct validity (see Bauer 2000, pp. 148; 144; 145). Based on these considerations, the codebook and coding sheet for the content analysis were

datafication and that were recommended by network members. For more information on the database and the resources it includes, see appendix I.I.I.

3 These annotations provide detailed descriptions of the execution of different methodological approaches in this study. This aims to ensure transparency and replicability of the study's methods, which often needed to find novel and creative approaches due to a lack of sampling frames and generally little existing information on online critical data literacy resources.

developed (see appendix III). As described in more detail in the methodology annotations (see appendix I.I.II), the variables were categorised into four sections: section A recorded the resource and its sampling source; B tested for the qualifying criteria for the analysis; C described the resource and its creator; and D examined to what extent a resource was in line with the preliminary critical datafication literacy framework. Section D consisted of five variables: interactive design, different audiences, practical advice, individual responsibility, and real-life examples. These represented key aspects of the preliminary literacy framework and key findings on implementing such literacy into practice. Only if a resource met *all three* of the qualifying criteria, sections C and D were coded.

The variables in section C were either open text fields (e.g., creator name) or gave several answer options (including "other"). If no information on a variable could be found (e.g., publication date), the field was omitted. Moreover, if a resource older than 2015 was identified, it was excluded as it would likely be outdated and not include current issues around datafication.[4] Section D then used the same three answer options for each variable: variable somewhat met, met, or met very well (see appendix I.I.II for further details). As most variables in this section required some amount of interpretation or judgement, "very clear interpretation guidelines" for these variables (Hansen 1998, p. 115) as well as concrete examples were included in the codebook. Finally, the last variable, '19. Special category' intended to highlight resources that take an unusual approach (content or format). Particularly in light of how under-researched the resources are, this helped to balance the content analysis' focus on frequencies, which can sometimes neglect "the rare and the absent" (Bauer 2000, p. 148). Moreover, this focus on unusual approaches helped to avoid a 'self-fulfilling prophecy' in the further development of the literacy framework, and it allowed for an open-minded selection of diverse resources for the next empirical step.

Coding took place using an Excel table to save time and prevent errors (see appendix I.I.II for more details), and a logbook was used to record coding solutions for unexpected cases (see Deacon et al. 2007, p. 130). Being the only coder further minimised reliability challenges, such as inter and intra-coder reliability (see Bauer 2000, p. 143f.).

Piloting

A pilot study was conducted to prepare the content analysis. This "test coding of a small sub-sample of the material [...] helps to reveal inadequacies and/or inconsistencies in the category systems of the coding schedule" (Hansen 1998, p. 118). The pilot was conducted with 20 resources, which were deliberately not taken from sources

4 The sample thus included resources created between 2015–2021, along with some resources for which no publication date could be identified.

related to my prior research as this had informed the development of the variables in the first place. The pilot confirmed the usefulness of coding in an excel-sheet and led to a number of smaller changes in the order of variables, the way some variables were coded, and solutions for uncertainties in coding (for details, see appendix I.I.III).

Finally, the analysis of the variables consisted of counting frequencies, calculating total numbers and percentages, comparing results, and creating tables and graphs for data visualisation.

4.3 Learning from the Experts

The next stage of empirical research investigated the inspirations, ideas, and strategies behind the online critical data literacy resources that were analysed in the first stage and examined their creators' underlying understanding of critical data literacy. Expert interviews with ten creators of such resources were conducted in order to learn from them for the conceptualisation of critical datafication literacy and for ways of implementing such literacy into practice.

4.3.1 Qualitative Interviewing and the Special Case of Expert Interviews

Interviews are a commonly used research method in social science research and other research fields. The expert interviews conducted in my study consisted of semi-structured interviews, which are defined by their "flexible and fluid structure" (Mason 2004, p. 1020). Semi-structured interviews are usually organised around a topic list or interview guide rather than using a sequenced script of standardised questions (ibid.). This allows for an open conversation that can be shaped by the interviewee's understandings and the researcher's interests and ensures flexibility in changing the order of questions or reacting to unexpected aspects, while still addressing all questions and themes necessary for the research question (ibid.). Criticisms that semi-structured interviews produce data that cannot be compared are misplaced because they use "a logic where comparison is based on the fullness of understanding of each case, rather than standardization of the data across cases" (ibid., p. 1021). However, semi-structured interviews alone can only produce "partial interpretive understandings" (ibid.), and can therefore usefully be supplemented by other methods, as is the case in the method triangulation of my study. Moreover, interview research always comes with complex power dynamics that need to be considered (Edwards and Holland 2013, p. 78; see also below).

Expert Interviews

Expert interviews are "qualitative semi-structured or open interview[s] with a person holding 'expert knowledge'" (van Audenhove and Donders 2019, p. 179). This "systematic and theory guided process" (ibid., p. 181) has "long been popular in social research" (Bogner et al. 2009, p. 1). The literature differentiates between different types of expert interviews based on the kind of knowledge that is produced. The expert interviews conducted in my study can be categorised as a mix of "systematizing interviews", producing "process knowledge" about the *process of creating critical data literacy resources*, and "explanatory interviews", producing "explanatory knowledge" about my *interviewees' understanding of critical data literacy* (van Audenhove and Donders 2019, p. 183ff).

Strengths and Weaknesses of Expert Interviews

Key advantages of expert interviews are that experts are often relatively easy to access as they are usually embedded in organisational structures (Bogner et al. 2009, p. 2), and that they are confident in their knowledge and opinions so that exclusive knowledge can be created in a comparatively reliable way (van Audenhove and Donders 2019, p. 181). Talking to an expert can further be an "efficient and concentrated method of gathering data", in part because the interviewer and the interviewee often "share a common scientific background or relevance system", which makes "quickly obtaining good results" more likely (Bogner et al. 2009, p. 2). This "shared understanding of the social relevance of the research" together with experts' "professional curiosity", their "desire to help 'make a difference'", and their interest in sharing their "thoughts and ideas with an external expert" can further "increase the level of motivation on the part of the expert to participate" (Bogner et al. 2009, p. 2). Such shared interest in, in this case, educating about datafication often emerged during my interviews.

Nevertheless, expert interviews also come with some methodological weaknesses. As expert interviews are very time consuming, most authors recommend using them only when knowledge is "otherwise difficult to generate" (van Audenhove and Donders 2019, p. 182). Moreover, the "naïve image of the expert as source of objective information [...] has long been problematic" (Bogner et al. 2009, p. 5). Especially when the interviews aim to reconstruct "latent content of meaning", they require "careful validation and a solid theoretical basis" (ibid., p. 5f), which, as outlined above, is the case in my study. Furthermore, expert interviewees can have their own agenda on the topic that is discussed, making it crucial for the researchers to maintain a critical distance. Expert interviews also come with complex power dynamics, as while the interviewer is the one who "defines the situation and who frames the topic and course of the interview" (Edwards and Holland 2013, p. 78), the expert interviewee holds exclusive knowledge and thus has the "power of defining the situation" that they are interviewed about (Meuser and Nagel 2009, p. 18). Therefore, power positions can shift around in expert interviews (Edwards and Holland 2013, p. 78).

Finally, it can be difficult to identify who is an expert, and some authors argue that with an increasing specialisation of expertise, experts can become "mere representatives of specialized knowledge" (Bogner et al. 2009, p. 5). However, Meuser and Nagel provide a useful definition of experts in the context of scientific research, arguing that an individual is defined as an expert "because the researcher assumes – for whatever reason – that she or he has knowledge, which she or he may not necessarily possess alone, but which is not accessible to anybody in the field of action under study" (2009, p. 18).

According to this definition, it is primarily the "exclusive realm of knowledge" that constitutes an expert, and it is this knowledge that the expert interview aims to discover (Meuser and Nagel 2009, p. 18). Thus, the term "expert" is decoupled from "holding a formal position in a hierarchy of occupational status positions", and also, for example, citizen groups or NGOs can be seen as experts (ibid., p. 25). This last argument is particularly relevant for the expert interviews in my study as the interviewees held different formal positions, but all were active participants in the process of creating critical data literacy resources, and this experience and expertise constituted their "exclusive realm of knowledge" for this study.

4.3.2 The Sampling Process and the Final Sample

Purposive Sampling

In order to find the right experts for a study, different strategies can be applied, such as screening specialised literature in the field or using a snowball sampling approach (van Audenhove and Donders 2019, p. 189). However, particularly when different groups or stakeholders are involved, "purposive sampling representing the different perspectives/groups" is recommended (ibid., p. 190). Purposive sampling is a "non-probability form of sampling", in which participants are sampled "in a strategic way, so that those sampled are relevant to the research questions that are posed" (Bryman 2016, p. 408). Often, the goal of purposive sampling is to reach variety in the final sample, with participants "differ[ing] from each other in terms of key characteristics relevant to the research question" (ibid.). As outlined below, this was the case in my study. Thus, while purposive sampling does not lead to a strictly representative sample and does not allow for generalising findings, it can lead to a diverse sample that is relevant to the individual study's research questions. It is therefore particularly suitable when, as in my study, not much is known about the population that is to be interviewed, and the researcher is interested in understanding different perspectives.

Specifically, my study took a sampling approach that has been called "generic purposive sampling" (Bryman 2016, p. 412). In this sampling approach, the researcher initially "establishes criteria concerning the kinds of cases needed to address the research questions" and identifies appropriate cases (ibid. p. 413). Based on this initial sample, the researcher then "samples from those cases that have been identified" (ibid.). In a mixed methods study, this process can be implemented by using the findings of a survey "as the basis for the selection of a purposive sample" (ibid., p. 414). This describes my study's sampling process very well, with the 75 resources identified in the content analysis constituting the initial sample, which constituted the basis to select resource creators for the expert interviews (see below).

Sample Size

Moreover, an appropriate sample size had to be determined. The literature on qualitative interviewing highlights that it is difficult to establish at the outset of a study how many interviews will be necessary (e.g., Bryman 2016, p. 416ff; Malterud et al. 2016). However, there are some guidelines to determine a suitable sample size. As expert interviews are a time-intensive method and the interviews in my study aimed at "generating fine-grained data" rather than making comparisons between groups, a small sample size was appropriate (Bryman 2016, p. 416f). Moreover, Malterud et al.'s notion of "information power" helped to identify a suitable sample size for my study (2016, p. 1753). As the aim for my study's expert interviews was *specific and narrow*; the sample specificity was *dense*; there was a *strong theoretical background*; the study aimed for an *in-depth analysis of a few, selected cases*; and the *quality of dialogue* was expected to be satisfactory due to a strong common interest between participants and researcher, Malterud et al.'s guidelines suggest that the sample held substantial information power (ibid.). Furthermore, the population of interest for my study was very specific and likely small. Based on these methodological considerations, I decided to conduct ten expert interviews, and to reconsider this number as needed during the course of the research based on the knowledge gathered in the interviews.

Sample Selection Process

As a next step, an informed selection of ten creators from the 75 analysed resources had to be made. This selection, on the one hand, aimed at selecting resources that are *in line with the preliminary framework for critical datafication literacy* and are thus particularly relevant for my study. On the other hand, the selection intended to *ensure diversity* as there is no one-size-fits-all approach to literacy and different people need different approaches (see e.g., Carmi et al. 2020, p. 43; chapter 3.4), and in order to gain new insights for the further development of the framework and avoid a self-fulfilling prophecy. The goal was thus to balance these two objectives rather than selecting the 'best' ten resources for the expert interviews.

In addition, two crucial findings from the literature were considered in the selection process. First, the selected resources should include *constructive advice*. This is important to encourage learners to take action and for avoiding learners' resignation (Pangrazio and Sefton-Green 2020, p. 218; Sander 2020c, p. 13; Bilstrup et al.

2022, p. 234). Second, the resources should *not convey the idea that it is up to the individual to address the challenges of datafication* (for example through self-data protection). Such shift of responsibility to the individuals is highly problematic as it can be discouraging and may lead to resignation, but also because citizens' agency to control the collection and use of their data is limited (Aßmann et al. 2016; Mihailidis 2018; Pangrazio and Selwyn 2019; Carmi et al. 2020). A detailed description of how I implemented these considerations and objectives in the multi-level selection process and selected the final ten resources in cooperation with the project partner Privacy International can be found in appendix I.II.I.

The Final Sample

The final sample for the expert interviews then consisted of ten resources, which were produced in six different countries (Canada, France, Germany, Switzerland, United Kingdom, United States), addressed different target groups (adults in general, teenagers, kids, parents, educators, activists, policymakers and technologists), and applied a variety of different design formats (see table 2). Moreover, the creator backgrounds varied, with three civil society actors, two journalistic creation contexts, two resources created by researchers or private individuals, one by a public institution, one by a museum, and one by a commercial actor. Thus, it can be said that the goal of reaching a diverse sample was achieved.

Table 2: The final sample of ten resources, including the interviewed creators and the different design formats the resources applied.

Nr.	Resource Name and URL	Creator / Interviewee	Format(s)
1	Anna. Das vernetzte Leben https://www.annasleben.de/	Ludwig Reichers-torfer	Website, including videos, podcasts, short stories and downloadable dossiers
2	Automating NYC https://automating.nyc/	Akina Younge, Deepra Yusuf, (Elyse Voegeli), Jon Truong	Interactive website
3	Center for Humane Technology https://www.humanetech.com/	David Jay	Website, including videos, podcasts, teaching material, data protection toolkits and recommendations for further resources

4	Clear Your Tracks https://www.clearyourtracks.org/	Ed Parkes	Website
5	Datak – A game about personal data https://www.datak.ch/	Julien Schekter	Online serious game
6	Do Not Track https://donottrack-doc.com/en/	Brett Gaylor	Interactive web series
7	Lehrmittel Big Data https://www.mfk.ch/bigdata/	Carmen Siegenthaler	Website and teaching material, including videos and recommendations for further resources
8	Lernparcours Big Data http://bigdata.jfc.info/lernparcours.html	Esther Lordieck	Website, including teaching material, videos and recommendations for further resources
9	Me and My Shadow https://myshadow.org/	Fieke Jansen	Website, including teaching material, videos and data protection toolkits
10	My Data and Privacy Online https://www.lse.ac.uk/my-privacy-uk	Mariya Stoilova	Website, including videos and recommendations for further resources

4.3.3 Developing the Interview Guide

As outlined above, the expert interviews in my study were organised around an interview guide. The key goal was to understand the creators' *idea of literacy* and the *strategies* they applied to foster this literacy with the users of their resource.

Cooperation with the "Civic Participation Project" by the Data Justice Lab

In a first step, a preliminary interview guide was developed and tested in preliminary interviews. This took place in cooperation with a research project called "Towards Democratic Auditing: Civic Participation in the Scoring Society" by the Data Justice Lab, Cardiff University.[5] One way in which I cooperated with this project was

5 This project was closely interrelated with my research, and I participated in the workstream of the project by informing the literature review on data literacy, co-developing and co-publishing a guidebook on "Critical data literacy tools for advancing data justice" together with Jess Brand (Brand and Sander 2020), and conducting and analysing expert interviews together. A first summary of these findings can already be found in a project report (Hintz et al. 2022, p. 145–160), and more detailed findings are presented in this study (chapter 5.2).

by conducting and analysing expert interviews with creators of critical data literacy resources together with Jess Brand in May and June 2020. These preliminary expert interviews acted as a pilot study for my research project. We asked all interviewees if they agreed to a follow-up interview one year later and all agreed. Despite the Civic Participation project's slightly different perspective on critical data literacy – examining ways to foster critical data literacy *for public sector workers* – three resource creators interviewed in these preliminary interviews were part of my study's final interview sample: Akina Younge and Deepra Yusuf (*Automating NYC*), Brett Gaylor (*Do Not Track*), and Fieke Jansen (*Me and My Shadow*). Thus, my interviews with these creators were conducted as follow-up interviews,[6] allowing me to inquire further about aspects that were mentioned in the first interview and to ask questions specific to my project focus and the findings of my content analysis.

Developing the Final Interview Guide

These preliminary expert interviews helped refine the focus of this study's expert interviews and informed the development of the interview guide. After my study's theoretical framework had identified *scholarly insights for critical datafication literacy*, the content analysis had examined *existing educational resources about datafication*, and the preliminary interviews in cooperation with the Civic Participation project focussed on the *practical process of creating* such resources and their *strengths and limitations*; the expert interviews in this study aimed to close gaps in understanding. Therefore, the goal was to analyse the creators' *understanding of literacy* and their *idea of an empowered datafied citizen* as well as their *strategies* in reaching such literacy and empowerment. Besides the cooperation with the Civic Participation project, the collaboration with Privacy International informed the development of the interview guide, with PI providing valuable insights and open questions on the process of creating educational resources about data.

The final interview guide then consisted of four sections (see appendix VI): The first section served as an introduction, asking general questions about the creator's *background and their resource*. The second section asked about the *strategies and approaches* that were used to reach the creators' educational goals, including one question about findings of the content analysis in regard to the specific resource. The third section then inquired about *practical considerations*, including more sensitive questions, for example about finding funding. This section was particularly informed by Privacy International's experience and the challenges they encountered in their resource creation. Finally, the last section invited interviewees to reflect freely on their field of expertise and provide *final comments*. The design of the interview guide took recommendations from the methodological literature into account, such as asking sensitive and very open questions later in the interview; not forcing

6 Two follow-up interviews were conducted as virtual face-to-face interviews and one via email.

the order of questions but rather leaving room for flexibility and open conversation; adapting the interview guide to each interviewee; and avoiding leading questions (Warren 2004; Meuser and Nagel 2009; van Audenhove and Donders 2019). Moreover, some *optional questions* were included, which were omitted in the question list sent to the interviewees, as they were not key to answering the research question but focussed on specific additional aspects or helped to clarify when an interviewee misunderstood a question (highlighted in grey font, see appendix VI).

After the English interview guide was developed, it was translated into German as the literature recommends conducting expert interviews in the native language of the interviewee (Littig and Pöchhacker 2014). Since I am fluent in both languages and all my interviewees were fluent in either of these languages, with the majority speaking English or German as their native language, this considerably helped the interviewees to "express themselves freely and without the constraints arising from the use of a foreign language" (ibid., p. 1086). My own "cultural experiences" in the United Kingdom and Germany and my familiarity with the academic discourse in both languages allowed for a smooth translation process and accurate translation of key terms (ibid., p. 1092). This further enabled me to conduct the interview analysis bilingually, working with the original transcripts in both languages, and English-language themes – thus keeping the data as original as possible.

4.3.4 Preparing and Conducting the Interviews

After the interview guide was finalised and translated, potential interviewees were contacted via email with a short summary of the research project. Upon positive response, they were sent a comprehensive information sheet and a consent form, providing details on their participation, the use of their data, and giving participants the opportunity to choose if they wanted to remain anonymous (see appendix IV; V). These documents as well as the invitation email and the study's overall research plan were reviewed and approved by the Cardiff University's School of Journalism, Media and Culture Ethics Committee before contacting the interviewees. All ten interviewees indicated in their written consent forms that they wished to be quoted by name. Interviewees were given the choice to be interviewed via telephone or video call. If they chose the latter – which all did – they were further given the choice of their preferred platform (such as Zoom, Teams, Jitsi, Skype or others). This ensured convenience for the interviewees and minimised the likelihood of technical problems, yet it required a certain 'privacy pragmatism' from my side (for more details, see appendix I.II.II).

Considering the context in which the interviews took place (June-September 2021, amidst the ongoing COVID-19 pandemic with social distancing regulations and travel restrictions) and the different locations of the experts (Canada, Germany, Netherlands, Switzerland, UK, US), in-person face-to-face interviews were not an option. Virtual face-to-face interviews further came with several benefits, such as flexibility in terms of geographical locations and scheduling and greater control for participants (Hanna and Mwale 2017, p. 259ff). The normalisation of video calling for work and for staying in touch with loved ones during the COVID-19 pandemic likely contributed to a smooth interview experience. However, many people experienced a "Zoom fatigue" in light of too many video calls in 2021 (cf. Brown Epstein 2020; Bailenson 2021). Furthermore, technical problems and poor internet connection that impact the quality of conversation constitute challenges of virtual interviews. Having already conducted several expert interviews in person, via telephone and through video calling in research projects in the past helped me navigate the process and its challenges. As recommended in the literature, all interviews were audio-recorded with participants giving consent in written form as well as verbally (see e.g., van Audenhove and Donders 2019, p. 192).

Given the qualitative nature of the interviews and the interviewees' passion and interest in the topics of conversation, many interviews were very extensive. Overall, the 12 interviews (including preliminary and follow-up interviews) lasted on average 55 minutes, with two shorter interviews of 26 and 34 minutes, and the ten others ranging from 45 to 81 minutes. This extensive dataset together with my first impression of the interview contents suggested that saturation was reached.

4.3.5 Analysing the Interviews

After conducting the interviews, each interview was transcribed in full. This is recommended for expert interviews, as already the transcription itself is "a reduction of the information available" (van Audenhove and Donders 2019, p. 193). I transcribed some interviews myself and used a professional transcription service for others – all applying the intelligent verbatim style. In total, the interviews produced a significant amount of 192 pages of textual, qualitative data: 142 pages of transcripts and 50 pages of additional documents. The additional documents were provided by the interviewees and included, among others, project concepts and reports on the development of the resource as well as adult learning principles and other methodologies that were applied in creating the resource.

This data was analysed in a thematic analysis using the software NVivo. Thematic analysis "involves the searching across a data set [...] to find repeated patterns of meaning" (Braun and Clarke 2006, p. 15). This method of analysis focusses on "identifying and describing both implicit and explicit ideas within the data" (Guest et al. 2012, p. 10), which are identified by first developing codes from the data and then aggregating these into themes. This makes thematic analysis "the most useful in capturing the complexities of meaning within a textual data set" and a common method of analysis for qualitative interviews (ibid., p. 11). Thematic analyses are particularly useful for *expert* interviews because these typically consist of thematic units –

"passages with similar topics which are scattered about the interviews" (Meuser and Nagel 2009, p. 35). Sequentiality within an individual interview is less relevant than the overall context of the expert's position, which is taken into account for assessing the meaning and significance of every expert statement (ibid.).

Inspired by Polizzi's study on digital literacy (2020a), the thematic analysis conducted in my study combined inductive and deductive approaches and can be described as a mix of the "conventional content analysis" and a "directed content analysis" (Hsieh and Shannon 2005, pp. 1279; 1281). The directed content analysis is applied when "existing theory or prior research exists about a phenomenon that is incomplete or would benefit from further description" (ibid.). The goal of this method is thus to "validate or extend conceptually a theoretical framework or theory" (ibid.) – in this case my preliminary framework for critical datafication literacy. This approach uses a more deductive and structured approach than conventional content analysis, which helps in supporting, extending, or questioning existing theory, but this also means that the researcher approaches the data "with an informed but, nonetheless, strong bias" (ibid., p. 1283). Yet, as inductive elements played a by far greater role in my study's thematic analysis than deductive approaches, this limitation could be mitigated.

After a preliminary step of developing some categories and nodes deductively, the thematic analysis followed the guidelines by Meuser and Nagel (2009) in combination with Braun and Clarke (2006). I first paraphrased the transcripts and then coded them into 332 initial codes. After this, I revised the codes, identified initial themes, and reviewed the initial thematic framework in several rounds of revision (including the 680 extracts for all themes in NVivo). Through this process, I developed a final thematic framework of 12 main themes and 45 subthemes and visualised this in a mind map. While the three categories that were developed deductively proved helpful in sorting the codes and themes, the analysis demonstrated that an inductive, bottom-up approach worked better to identify themes in the data, and the final thematic framework thus only included few deductive themes. A detailed description of how the thematic analysis was conducted and how it combined deductive and inductive approaches is provided in appendix I.II.III.

4.4 Learning from the Educators

In the third and last empirical stage of my study, a qualitative online survey with educators was conducted. The key goal here was to understand educators' expectations, requirements and wishes when it comes to critical data literacy resources, complementing the prior foci on the resources themselves and their creators' intentions. Thus, I was interested in the educators' experiences in teaching about datafication and in the materials and resources they use for this. The term "educators" is used very broadly here, encompassing people who teach, train and raise awareness about datafication in a number of educational contexts.

4.4.1 Qualitative Online Surveys

The challenge in this empirical stage was the scope and the diversity of the education field, as educators in a number of different professions may already educate about digital and data technologies. An appropriate method for reaching a wide and diverse audience while still allowing for qualitative insights was needed. Based on these considerations, I decided to conduct a qualitative online survey.

Advantages of Self-Administered Online Questionnaires

In contrast to qualitative interviews, questionnaires – especially self-administered online questionnaires – can be distributed to a large sample at the same time and are thus particularly suitable when the population is large and geographically dispersed (Clark et al. 2021, p. 212). Further advantages include low financial costs; low time effort; considerably less risk of interviewer effects or social desirability bias; and the ability to customise the appearance of the questionnaire (Regmi et al. 2017, p. 641; Clark et al. 2021, pp. 212f, 222). Finally, online questionnaires are convenient for respondents as they have greater control over the time and place where they answer the questions and complete the questionnaire at their own pace, taking as much time as they need, and potentially completing it over several sessions (Couper 2004, p. 506; Regmi et al. 2017, p. 641; Clark et al. 2021, p. 213).

The Special Case of Qualitative Online Surveys

Although the survey is a "familiar tool in social research", qualitative surveys are less widely used, potentially because of the very limited methodological literature available (Braun et al. 2021, p. 1). These surveys typically use open-ended questions as they seek "nuanced, in-depth and sometimes new understandings of social issues" (ibid.). Thus, they "*can* provide richness and depth, when viewed in their entirety, even if individual responses might themselves be brief" (ibid., p. 2, emphasis in original).

The key advantage of qualitative surveys in contrast to other qualitative methods is their "wide-angle lens" through which a "diversity of perspectives, experiences, or sense-making" can be captured (Braun et al. 2021, p. 3). This is particularly useful when the topic is under-explored, the population of interest is large, geographically dispersed, and diverse, or when "perspectives from different groups within a wider population are sought" (ibid.). All of this was the case in my study, making a qualitative survey the ideal method of study. It allowed for hearing a range of "'within-group' voices" rather than treating one person as a "spokesperson" for their background or group – thus enabling "diversity rather than typicality" (ibid.). Further advantages of online qualitative surveys include their openness and flexibility towards different research questions; that they can give a voice to those who would not be able or willing to take part in an interview; that they can "feel anonymous"; come with less social pressure and potentially more social comfort than face-to-face settings; are less burdensome for respondents; and less risky for researchers (ibid., pp. 2; 4–6).

Limitations and Challenges of Qualitative Online Surveys

Limitations of surveys include that they do not allow researchers to prompt or probe to avoid misunderstandings or inquire further (Clark et al. 2021, p. 213f). Furthermore, some complex questions are difficult to ask, and the number of questions is limited because of the possibility of "respondent fatigue" (ibid.). Online surveys in particular can come with representational issues as certain literacy (ability to read and write), digital equipment and internet access are required to participate (Couper 2004, p. 506; Braun et al. 2021, p. 4; Clark et al. 2021, p. 214). Moreover, response rates in online surveys can be lower and the researcher cannot be certain if the questionnaire was completed by the intended respondent (Clark et al. 2021, p. 213f). These limitations were considered in the questionnaire design. The common critique that the depth of data is lost in a survey, however, is, according to Braun et al., "falsely based on imagining what qualitative surveys cannot offer, and an idealization of what interviews will offer" (2021, p. 4). The authors argue that "while an individual response may lack the meandering detail of an interview transcript", the dataset as a whole, when executed properly, "will be likely be rich and complex" and able to "deliver rich, deep and complex data" (ibid.).

4.4.2 The Survey Sample

The goal for this survey was to reach educators from different backgrounds who are interested in teaching about digital and data technologies and might even have already done so in the past, potentially using online critical data literacy resources. In order to reach this population of interest, I contacted large numbers of educators with my survey, specifying that "any educator who is interested in teaching about digital technologies and (big) data is invited to take part in my study".

Aiming at Diversity rather than Representativeness

As there exists no list of educators with this particular interest, no sampling frame was available and a probability sampling not possible. This was not very problematic for my study as my interest in hearing from a diverse range of voices stemmed – as is typical for qualitative researchers – from the goal of "gaining rich(er) insights into the topic of interest, not generating a sample that achieves statistical representativeness and allows simple claims of generalizability" (Braun et al. 2021, p. 3).

Braun et al emphasise that "this diversity of voices matters" – for "quality and validity of knowledge"; for "what knowledge might inform practice" and also from a "social justice and inclusion point of view" (ibid., p. 3f). When no sampling frame is available and representativeness is not a significant concern for the researcher, online surveys provide useful possibilities of reaching a diverse sample, such as posting "an invitation to answer a questionnaire on a relevant message board, email it to suitable mailing lists, or share it on websites and social media" (Clark et al. 2021, p. 186). While this will lead to a sample of unknown representativeness and response rate, it allows the researcher to "target groups that have a specific interest or form of behaviour" (ibid.). This, together with its cost-effectiveness, makes this approach an "attractive means of contacting sample members" (ibid). Moreover, Braun et al. highlight that also in a sample that is not statistically representative, "wider inferences may be drawn" (2021, p. 3).

Finding the Sample

The next step was to identify how the population of interest for the online survey could be reached. First, specific groups of educators were identified as likely most relevant for this survey: teachers, student teachers, teacher trainers, higher education lecturers, adult educators, media education centres and trainers in civil society. In order to further narrow down this large population, I decided to focus on three (supra)national contexts: Germany, the United Kingdom and the European Union. I selected these areas because they a) are addressed by common educational programmes and frameworks (for example "DigComp", EU Science Hub – European Commission [no date]); b) correspond to the scholarly literature that was analysed in my study's theoretical framework; c) offer existing connections to educators interested in the topic of datafication through the collaboration with Privacy International and several projects and research networks I am involved in; d) as English and German are widely spoken by educators in these places, limiting language barriers.

As a second step, I identified communication channels – mailing lists, social media accounts, organisations and well-connected individuals – to reach this population. This included large mailing lists by, for example, the European Communication Research and Education Association (ECREA), but also smaller groups that specifically address educators who are interested in learning more about digital technologies. In identifying these channels, also the project partner Privacy International's connections were useful. The full list of contacted organisations and individuals can be found in appendix VII. Moreover, a detailed discussion of the sampling process, including challenges, strategies in reaching a diverse sample, and a reflection on how successful the different communication channels were in reaching the survey's sample can be found in the methodological annotations in appendix I.III.I. Overall, it can be said that information about the survey reached several thousand people (particularly through large mailing lists by different organisations), although likely only a small fraction of these was part of the survey's target population: educators interested in teaching about digital and data technologies.

The Final Sample

As the literature emphasises, it is difficult to determine an appropriate sample size for a survey (Freedman 2004, p. 988; Braun et al. 2021, p. 9). Qualitative online surveys in particular will likely have larger samples than typical for qualitative studies but smaller samples than typical for quantitative and representative online surveys (Braun et al. 2021, p. 9). The appropriate sample size is determined by the following factors: "the scope of the study and breadth of the topic; the research question [...]; the characteristics of, and diversity within, the population; the motivation of participants; and, relatedly, the depth and detail of the individual responses" (ibid.). Braun et al. further stress that not all of these factors can be anticipated in advance, and "dataset richness and ability to address the questions" are more important than reaching an exact number (ibid.). For these reasons, a sample size was not determined before conducting the survey, but the goal was rather to reach a wide and diverse sample and achieve data richness.

In total, 265 people opened the link to my survey in the three months it was open (25.11.2021 – 25.02.2022), but only 102 began completing the questionnaire. This gap is likely explained by the very specific population that the survey addressed and that was highlighted on the survey's landing page: educators "interested in teaching about digital technologies and (big) data". As these topics are not yet routinely covered in many curricula, it is likely that not many educators teach about topics of digital technologies and datafication yet. Of the 102 people who began completing the questionnaire, 44 aborted when they saw the first open question asking about their experience. This effect is described in the literature and was therefore expected (see 4.4.3). All of these as well as one participant who clicked through the questionnaire without completing any field were excluded from the final sample. Of the remaining participants, the majority completed the full questionnaire, but some (10) omitted parts of it. I decided that all participants who completed over half of the questionnaire would be included in the final sample. Thus, a final sample of 57 participants was determined.

Before closing the survey, I examined the sample's breadth and diversity in terms of different areas of education (such as pre-school, school, teacher education, vocational training, and many others) and nationalities. Both showed great variety (see chapter 5.3 for a more detailed discussion of the sample's demographics), and even several non-European educators participated in the survey. While these were not specifically addressed in the sampling, their answers were nevertheless included in the analysis as they added more diversity and novel insights. Moreover, data richness could be achieved as participants often provided extensive answers to the open questions, which generated extensive qualitative data. Therefore, I decided that 57 participants was an appropriate sample size.

4.4.3 Developing the Questionnaire

Methodological Considerations about Questionnaire Design

The wording, type and order, and layout and length of questions in the survey were informed by methodological literature on (qualitative) online surveys. All questions were worded carefully, aiming for open, but short, clear and unambiguous questions and avoiding making any assumptions (Braun et al. 2021, p. 8). At times, I provided examples as guidance for participants (ibid.). Qualitative surveys typically use open-ended questions, which allow participants to type their responses in their own words and can produce the "rich and complex accounts of the type of sense-making typically of interest to qualitative researchers" (ibid.). This further allows researchers to access their participants' language and terminology (ibid), and tends to lead to a much more diverse set of answers than by using close-ended questions (Reja et al. 2003, p. 159).

However, open-ended questions also need extensive coding and have higher rates of non-response, and participants are most likely to abandon a questionnaire in the middle of a series of open-ended questions (Reja et al. 2003, p. 159; Crawford et al. 2001 in Clark et al. 2021, p. 187). Therefore, Clark et al. suggest minimising the number of open-ended questions in self-completion questionnaires (2021, p. 187). Taking these considerations into account, I decided to include both closed and open-ended questions, aiming for a balance between convenience for the respondents – and thus hopefully high response rates – while still collecting rich and in-depth data about the key questions of the survey (see below). As recommended by Braun et al., all closed questions further included an "other – please specify" or "not applicable" option to ensure no perspective is left out (2021, p. 7).

The questionnaire was kept as short as possible, began with closed, easy demographic questions before the first open-ended questions were introduced, and an honest estimate of the required time was provided on the starting page. Subsequently, closed questions alternated with open-ended questions, while clustering questions on similar aspects and of a similar format together in distinct and coherent sections, always keeping questions and answer options close together and providing clear instructions how to respond and the opportunity to skip questions (Regmi et al. 2017, p. 642; Braun et al. 2021, p. 8; Clark et al. 2021, p. 220). The layout and design of the questionnaire was further as user-friendly, easy to follow and visually attractive as possible (Regmi et al. 2017, p. 641). Key terms of each question were underlined, and a progress indicator was used to help participants navigate the questionnaire.

Applying a user-friendly design was considerably aided by using an online survey platform. This decision further protected against the loss of data, facilitated data transfer and eliminated transcription errors, improving the "reliability and validity of the data collection process and the collected data" (Regmi et al. 2017, p. 642). However, it is important to take care when selecting an online survey platform as particularly free platforms have been found to compromise confidentiality (Regmi et al. 2017, p. 642). Thus, considerable effort was put into identifying a secure and privacy-sensitive platform. The platform that was used, soscisurvey.com, was developed by communication scholars for academic surveys (SoSci Survey GmbH [no date]). It places a high value on data security (with servers located in Germany); is adapted specifically for academic research with a wide range of possible question formats and individual survey settings; and is free for non-commercial research. Moreover, ethical considerations influenced the design of the questionnaire. Based on recommendations from the literature on informed consent, the landing page of the survey included important participant information (Regmi et al. 2017, p. 642; Braun et al. 2021, p. 8f). It explained what participation meant, that it was voluntary and participants could withdraw at any point, and how data would be handled: that the survey data would be entirely anonymous, participants could not be identified, and all precautions for data security within the requirements of the General Data Protection Regulation would be taken.

Translation of the Questionnaire

Although online surveys give respondents the opportunity to read questions several times and take as much time as needed for answering, they should still ideally be conducted in a language the respondent speaks fluently. For this reason, my survey was offered in two languages – English and German – hoping that most European educators would feel comfortable enough in either language to complete an online questionnaire. Survey translation is not as straightforward as might be expected, as small changes in wording can make a difference and words can have several or ambiguous meanings, might not exist in another language and it can be difficult to translate gendered or gender-neutral language (Harkness et al. 2004, p. 456ff). Translation should further only take place once a "common source questionnaire" is finalised and comparability needs and concept operationalisations should be kept in mind (Behr 2018, pp. 7; 17). Translators should keep the content of the questions semantically similar, use the same question format and range of response options, and should aim to capture the "intended *sense of the question*" (Harkness et al. 2004, pp. 456; 462, emphasis in original; Harkness et al. 2010, p. 117f). In light of these challenges, translators of surveys should be "bilinguals, professional translators, people who understand empirical social science research, or some combination of these" (Harkness et al. 2004, p. 463). My bilingualism, my familiarity with both cultures and the fact that I am both the researcher and translator of the study therefore facilitated translation. Moreover, the questionnaire was piloted in German and in English to test the question wording, spot ambiguously worded questions and check for further issues around comprehensibility.

Pilot Study

It is generally recommended to carry out a pilot of questionnaires with potential participants (Regmi et al. 2017, p. 642; Braun et al. 2021, p. 9). Pilot studies can lead to unexpected findings and can help "ensure the adequacy of the questions" and the question order; test comprehensiveness; ensure clear instructions; and check for technological problems (Regmi et al. 2017, p. 642). Typical pilot sizes consist of 5–20% of the anticipated sample (Braun et al. 2021, p. 9). I decided on a pilot size of 10 participants, which would likely lie in the range between 5% and 20% of the final sample.

In order to test the questionnaire in both languages, 5 German and 5 international[7] pilot testers were selected. All testers were personal or professional acquaintances who were part of my target population – educators interested in teaching about digital technologies – and worked in a variety of educational sectors.[8] Some of these were well-versed in the field of critical data studies, whereas others had no experience in this field. This helped to ensure that any educator would understand the questions, regardless of their experience with these topics. Piloting the questionnaire with this very diverse set of pilot testers proved extremely valuable. The pilot testers provided detailed and extensive feedback and constructive suggestions. Changes made to the questionnaire after piloting included small changes in wording and refining some translations; changes to some answer options; breaking up long open questions; and adding examples in order to clarify the question or the answer options (for a detailed description of changes, see appendix I.III.II).

Final Questionnaire

Apart from these methodological considerations, the development of the questionnaire was strongly influenced by my study's previous theoretical and empirical findings. The survey aimed to investigate if these findings corresponded with educators' daily lived experience. To achieve this, seven specific goals for the survey were identified, such as investigating if the educators know and use the resources examined in this study's content analysis, which formats they find useful and if they agree with the 'best practice' approaches to educate about datafication that are suggested by

7 British, Dutch, Bulgarian, Israeli, and American. Some were native, some non-native speaker, but all fluent in English.

8 The pilot sample included one student teacher, one primary school teacher, two secondary school teachers, one teacher and media pedagogy trainer, one teacher trainer, three higher education lecturers (from different fields and countries), and one civil society trainer.

previous findings of this study and other scholars' findings (for more details, see appendix I.III.III). Moreover, feedback from the project collaborator Privacy International was considered when developing the final questionnaire.

The final questionnaire consisted of three thematic sections (see appendix VIII). It began with a landing page that provided information about the study and on participation and data handling. Moreover, the estimated completion time for the questionnaire was stated, giving a realistic estimation, as recommended in the literature (Clark et al. 2021, p. 187). The first thematic section of the questionnaire then consisted of a short demographics section that aimed at understanding the educational contexts in which aspects of datafication might already be covered, but also discovering if the survey was successful in reaching diverse educators from different fields and countries.

The second section examined educators' experience with topics around digital technologies. It included several rating scale questions (5-point scale, "not applicable" (N.A.) option provided), which tested how well-equipped and experienced the educators felt about four broad topical areas around digitisation and datafication (for more details on these topical areas and the methodological considerations behind the questionnaire design, see appendix I.III.III). In addition, open questions asked about educators' experiences, the topics they covered, their goals and methods, and challenges they encountered.

The third section then addressed educational resources about datafication. Open and rating questions were used to examine how educators find information and teaching material on digital and data technologies, how satisfied they are with this, and how useful they find different design formats. Moreover, one question tested agreement with ten statements about how best to educate about these topics – developed based on my study's previous findings and the literature (see appendix I.III.III). Finally, an open question invited participants to provide final remarks and comments. As Braun et al highlight, this can often generate "unanticipated and useful data" (2021, p. 8). After participants submitted their answers, the survey ended with a final thank you-page, which further invited the participants to contact me via email if they were interested in testing and providing feedback on a new educational resource that was being developed with Privacy International as part of my study.

4.4.4 Analysing the Educator Survey

After closing the survey, the survey data was exported and cleaned, and the final sample of 57 participants determined (see above). Subsequently, all closed questions and the short, single-line open questions (e.g., country of origin) were analysed in Excel, and the open question data analysed through a qualitative thematic content analysis similar to the one applied in the expert interview analysis.

Analysing the Closed and Single-Line Questions

For the multiple-choice questions, the frequencies were counted; percentages and totals calculated; and the data visualised in tables and graphs. Single-line questions first had to be coded manually. This was sometimes straightforward (e.g., nationality and country of residence), and sometimes more complex (e.g., the positions participants worked in). The coding for the latter question was conducted in a more detailed rather than too broad manner to provide maximum accuracy; and stringent coding decisions were followed. Finally, the rating questions were analysed by counting the frequencies of responses (including N.A. and missing responses); calculating percentages and totals (using the total number of valid answers for each answer option) as well as cumulative percentages (agreement versus disagreement) and average agreement; comparing results across topics and across questions; and finally visualising the data in tables and graphs.

Thematic Content Analysis of the Open Survey Questions

To analyse the seven long form open questions in the survey, a thematic content analysis was conducted using the software NVivo. In total, these seven questions produced 26 pages of qualitative textual data – on average half a page per respondent. This is a significant amount of writing, which highlights many respondents' passion for the topics the survey addressed (which some also emphasised in their comments, see chapter 5.3). As suggested in the literature on qualitative surveys, this data was not summarised by each question as this "typically results in an impoverished and underdeveloped qualitative analysis" (Braun et al. 2021, p. 10). Instead, the data was treated "as one cohesive dataset" and the coding was conducted one participant at a time, which allowed for "develop[ing] analytic patterns across the entire dataset" (ibid.). Throughout the analysis, it became clear that this was the right decision, as participants often referred to the same aspect – such as the topics and goals in their teaching – across different questions, and they sometimes referred back to something they wrote for an earlier question.

The steps of the analysis were similar to the interview analysis (see section 4.3.5; appendix I.II.III). Based on the experiences with the interview analysis, the survey data was analysed inductively, taking a bottom-up approach to identify patterns. Furthermore, paraphrasing the data was omitted as participants had already submitted succinct arguments. The first step of the analysis thus consisted of a detailed coding, leading to 416 initial codes. Subsequently, these were sorted into initial categories that were identified inductively; the initial codes and categories were revised; and initial themes identified. Three of the six categories that were identified collected more 'straightforward' data, such as information on where educators search for material (e.g., "internet", "literature" etc.). These were represented in subthemes only as no overarching main themes could be identified. For the remaining three categories, main and subthemes were identified and reviewed in several rounds of revision. During this revision, it was decided that subthemes which were only mentioned rarely but showed strong parallels to the interview findings would be kept in order to highlight these parallels. The final thematic framework then consisted of nine main themes and 42 subthemes (in the three key categories). This framework was visualised in a mind map, which used different colour shades to highlight the different frequencies of the (sub)themes for reasons of transparency.

4.5 Knowledge Mobilisation: Developing the "Teaching about Data" Resource

After the empirical research was conducted and analysed, the findings of this study were mobilised in a knowledge mobilisation project in cooperation with the NGO Privacy International. As outlined in the previous subchapters, the NGO acted as an advisor throughout my study, with knowledge exchange taking place in the different stages of the research and the NGO providing feedback on a number of methodological decisions based on their practical experience. In this final stage, however, a close collaboration took place and an online learning resource for educators who are interested in teaching about data technologies was co-created. In the following, the methodological grounding of this co-creation project and its outcome in the form of an online resource will be outlined. Details on the goals for the resource, its target audience, the rationale behind design and content decisions as well as a detailed description of its creation process and a presentation of the resource itself can be found in a report on the cooperation with Privacy International in appendix IX.

What is Knowledge Mobilisation?

In the past, academic research has often been criticised for taking place in an "ivory tower" – distinct and disconnected from the real-life challenges of society (Gontcharov et al. 2021, p. 39). When this "gap between discovery and implementation" was highlighted as "a social problem", the proposed solution was that academic knowledge should increasingly be translated and transferred into other societal sectors in order to facilitate its implementation into everyday products and services (ibid., p. 35). However, as scholars argue, "30 years later, the gap is still there" (ibid.), and the academic knowledge production process "has failed consistently to move the most credible evidence from practice and research into improved outcomes" (Naidorf 2014, p. 15). Education research equally experiences a significant "gap between research, practice and policy", which is "mainly associated with the hiatus between knowledge producers (academic researchers) and knowledge users (teachers)" (Flores 2018, p. 622). There are many calls to address these gaps as well as a "growing recognition of the importance of the use of research to inform practice and to enhance teacher professionalism" (ibid., p. 621).

In this context, several new approaches that aim to better integrate research and practice have been developed. Examples include "*socially relevant research; knowledge mobilization; research impact; innovation*; and *university priorities*" (Naidorf 2014, p. 1, emphasis in original). A detailed analysis of the contexts and consequences of these different approaches can be found in Naidorf's 2014 paper. One term that is increasingly used in recent years and is of particular relevance for my study's goal of connecting research and practice is the term *knowledge mobilisation*. As Naidorf outlines, knowledge mobilisation differs from mere dissemination of research findings in that it "actively creates linkages and exchanges between producers and users of data, information and knowledge to engage in value-added activities" (2014, p. 15). While dissemination mainly describes the distribution of research results, for example in academic journals and at congresses, knowledge mobilisation "makes knowledge ready for service or action" by making it "more useful, proactive and applied" (ibid., p. 16).

Moreover, knowledge mobilisation goes beyond what is understood as "knowledge transfer". According to Gontcharov et al., the concept of knowledge mobilisation "emerged as a critical response to the overall ineffectiveness of the knowledge transfer paradigm" in closing the gap outlined above (2021, p. 35). While knowledge *transfer* or *translation* aims at "communicating a message from academia to other fields of research, sectors of the economy, policy makers, and the public", they explain that knowledge *mobilisation* "seeks to reimagine the very relationship between science and society" (ibid.). In doing so, it intends to "trigger deeper structural changes" in academia and in "*knowledge society* in general, a society in which 'academic science' is an embedded social institution" (ibid., emphasis in original).

To achieve these goals, Gontcharov et al. argue that "actual change needs to take place on the ground", with research institutions and individual researchers adopting innovative and reflexive research practices (2021, p. 38). The authors provide a number of suggestions on how individual researchers can promote knowledge mobilisation in their work, which Privacy International and I tried to follow in our project. First and foremost, they highlight that the process by which "engaged researchers" work should be "both *critical* and *reflexive*" (ibid., p. 33, emphasis in original). Researchers should implement ideas such as "*knowledge co-creation, citizen science, community-initiated studies,* and cooperation with alternative knowledge systems" and should think about how to provide open access to their research data (ibid., p. 39, emphasis in original). They should therefore rethink the public "from passive *informants/end users* to *collaborators/co-researchers*" and engage in "ongoing dialogue" (ibid., p. 39, emphasis in original). In doing so, the authors suggest that knowledge mobilisation projects should "exercise curiosity" and "accept a plurality of approaches to knowledge production" (ibid., p. 39). Thus, knowledge mobilisation can create "stronger meaningful links between academia and a knowledge society" (ibid., p. 39). The detailed report on the cooperation with PI provides more details on how these ideas and goals were implemented in our knowledge mobilisation project (appendix IX).

Mobilising Findings on Critical Data Literacy

The prior sections highlighted an overall need for more knowledge mobilisation in academia. In critical data literacy research specifically, the interconnection of research and practice could also be improved. Critical data literacy scholars Pangrazio and Sefton-Green have highlighted that translating the abstract objectives of academic concepts of critical data literacy "into a practical model that can be operationalised by educators is challenging" (2020, p. 215). While many "folk pedagogies of data" exist – programmes that aim to raise public awareness and critical understanding of data – replicating these approaches "in an educational setting requires further experimentation" (ibid., p. 217). Similarly, media pedagogy scholar Zorn has called for more support for educators who aim to teach about topics around big data and data protection (2015, p. 23). In line with these calls, my study intended to not only call for more critical data literacy, but to actively support educators in fostering this literacy by creating an online learning resource for "Teaching about Data" (Privacy International et al. 2022).

This resource, which was created between January and September 2022, is available at https://privacyinternational.org/learning-resources/teaching-about-data-resource-educators. It aims to provide educators with everything they need to foster critical data literacy in their educational setting – based on academic research findings and the practical experiences of educators and advocates. It addresses educators of any background: any person who wants to educate others about data and datafication but may not have the knowledge or material to do so. The resource intends to raise educators' own awareness and critical understanding of datafication, and to enable them to educate about datafication by providing best practice advice and research findings on suitable pedagogical approaches along with access to teaching material. These goals are addressed in five chapters, which each include a short video summary and many external links for further information. More details on the considerations behind the resource's content and design and on the creation process are provided in the report on the collaboration in appendix IX.

4.6 Conclusion

Overall, my study applied various methodological approaches throughout its different empirical stages. An overview of the methods that were used, the samples, and the time spans of conducting the research is provided below (table 3). Due to the limited research that exists on online critical data literacy resources thus far and a lack of sampling frames, the study often had to find novel and creative approaches to researching these resources. Particularly the triangulation of methods and the mixed methods approach – combining qualitative methodologies such as expert interviews and a qualitative survey with more quantitative methods such as a content analysis – proved very helpful in improving the study's quality, validity and reliability. This approach further allowed for a more complete picture of critical data literacy, as the different methods complemented each other: after the *'what'* (do online resources look like?) of the content analysis, the expert interviews addressed the *'why'* (are they created this way?), and the qualitative survey added a *'how'* (do educators perceive and use these resources?). The next chapters present the findings of the three empirical approaches and highlight parallels and contradictions between the different findings.

Table 3: Overview of research methods applied in the study.

Method	**Sample**	**Time span of data collection**
Content analysis	250 resources examined; 75 fit the qualifying criteria and were fully coded and analysed.	April – May 2021.
Expert interviews	10 interviewees (10 initial and three follow-up interviews were conducted).	Preliminary interviews in May and June 2020; Final interviews from June – November 2021.
Qualitative online survey	57 participants.	November 2021 – February 2022.