

Critical Datafication Literacy – A Framework for Educating about Datafication

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Critical Datafication Literacy – A Framework for Educating about Datafication

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Abstract:

Purpose:

In light of a need for more critical education about datafication, this paper develops a framework for *critical datafication literacy* that is grounded in theoretical and empirical research. The framework draws upon existing critical data literacies, an in-depth analysis of three well-established educational approaches – media literacy, the German ‘(politische) Bildung’, and Freirean ‘critical pedagogy’, and empirical analyses of online educational resources about datafication.

Methodology:

The study interconnects theoretical analyses with an empirical mixed methods investigation that includes expert interviews with creators of online educational resources about datafication and a qualitative survey with educators interested in teaching about data technologies.

Findings:

The research identified novel findings on the goals of resource creators and educators, such as a focus on empowering and emancipatory approaches, fostering systemic understanding of datafication, and encouraging collective action. Such perspectives are rare in existing critical data literacy conceptualisations but show resemblance to traditional education scholarship. This highlights how much can be learnt from practitioners and from these more established educational approaches. Based on these findings, a framework for *critical datafication literacy* is suggested that aims for *systemic understanding* of datafication, encouraging *critical thinking*, and enabling learners to make *enlightened choices* and *take different forms of action*.

Originality/value:

The study is unique in its interconnection of theoretical and empirical research, and it advances previous research by suggesting a grounded framework for critical datafication literacy.

Keywords: Critical data literacy, Datafication, Online resources, Media literacy, Bildung, Politische Bildung, Critical pedagogy

Article classification: Research paper

Introduction

In our datafied societies, people not only use digital and data-based technologies in their daily lives, but they themselves are increasingly subjected to data systems, which quantify, track, profile and score their lives (Dencik et al. 2022). Algorithms affect virtually all areas of life and are used to guide life-changing decisions such as who is considered for a new job position, who is likely to commit a felony, or whose children are at risk of being neglected (O’Neil 2016; Kitchin 2021; Dencik et al. 2022). In light of these ubiquitous influences of data technologies, scholars speak of the ‘datafication’ of our societies. This neologism describes a “profound transformation in how society is ordered, decisions are made, and citizens are monitored through ‘big data’” (Hintz et al. 2019, p.2f). While many data systems are developed with good intentions, scholars have highlighted that social outcomes often do not align with these original intentions (Redden et al. 2022). Instead, many argue that datafication endangers privacy, increases surveillance, reinforces existing discriminations and racial inequalities, has caused actual harm to citizens, and constitutes “a new means of controlling how publics come to be represented and so understood” (Kennedy and Moss 2015, p.2; Eubanks 2018; Noble 2018; Benjamin 2019; Redden 2022). Hence, the datafication of our societies amplifies asymmetric power relations between those who are being monitored and profiled, and those who have access to data governance systems (Dencik et al. 2022). Thus, it has been argued that datafication poses “severe challenges for democracy” (Hintz et al. 2022, p.81) and limits citizens’ agency (Miloni and Papa 2019; Dencik et al. 2022).

Yet, citizens’ knowledge about these data practices remains limited. Across different countries and various data practices, studies have repeatedly demonstrated a “major understanding gap” (Doteveryone 2018, p.5) of citizens regarding how their data is collected and used, how technology companies earn money, or how algorithms are already being used in many areas of life (Turow et al. 2015; Miller et al. 2018; Grzymek and Puntschuh 2019). Despite increasing calls for more education about digital technologies (see below), knowledge seems to have increased little over the past years (Miller et al. 2020; Overdiek and Petersen 2022), and particularly citizens’ understanding of the business models of technology companies “remains shallow” (Miller et al. 2020, p.15). Furthermore, studies show that many people feel “uncomfortable” about current data practices (Dencik and Cable 2017, p.771), and find them “intrusive or creepy” (Akman 2022, p.25), or even “unacceptable” (Worledge and Bamford 2019, p.5). Large parts of the public are highly concerned about certain data uses and wish for more knowledge, control over their data, better regulation, and more ethical data technologies (Kennedy et al. 2021; Ada Lovelace Institute 2022). Moreover, some people feel resigned toward data collection and believe that any efforts to protect their data are futile because data collection is inevitable (see e.g., Hargittai and Marwick 2016; Dencik and Cable 2017; Draper and Turow 2019). Yet, studies have demonstrated that even resigned users do not *consent* to datafication, nor do they feel indifferent about it (Kennedy et al. 2020, pp.24; 48) or see data collection as a “tradeoff for benefits they receive” (Turow et al. 2015, p.3).

In light of the risks related to data technologies, citizen’s lacking understanding of datafication, and their simultaneously strong concerns, many scholars argue that “change is needed” (Kennedy et al. 2021, p.9). Several solutions have been suggested, including regulatory, tactical (such as blocking or anonymisation tools), and educational responses (Pangrazio and Sefton-Green 2020, p.210ff). Of the three, educational responses have been posited as not only “the dominant” but also the “most plausible and successful strategy to combat the challenges of datafication” (ibid., p.212, emphasis in original). While better regulation of data technologies is still urgently required, critical education constitutes a key component or even prerequisite of legal and tactical responses to datafication (ibid., p.218).

However, the overwhelming majority of educational approaches to data take a practical, skills-based perspective, usually aiming to foster people's ability to read, work with, analyse and argue with data (e.g., Schüller et al. 2021). Fostering such technical skills alone, without promoting understanding or critical reflection, has been highlighted as a "problematic strategy" as it can lead to "more exposure [of children] to online risks" (Livingstone et al. 2021, pp.21; 22) and to "'data (il)literacy' – an uncritical, one-dimensional understanding of data and datafication" (Mertala 2020, p.1). While learning how to use data can be important for today's and future citizens, such technical competences shed little light on the wide-reaching societal implications of datafication, and a "more complex" approach to data literacy is needed (Markham 2020, p.230).

In academic research, this perspective is particularly emphasised in the emerging field of *critical data literacy*.¹ This field has suggested educational approaches such as big data literacy (François and Monteiro 2018), data infrastructure literacy (Gray et al. 2018), critical algorithmic literacies (Dasgupta and Hill 2021), or critical big data literacy (Sander 2020b). However, only few studies have as yet thoroughly reviewed and analysed existing conceptual suggestions to (critical) data literacy (e.g., Gray et al. 2018; Pangrazio and Selwyn 2019; Pötzsch 2019). Even fewer focus on critical and reflective understanding of the structural implications of datafication on society and build on established educational concepts such as the German 'Bildung' or Paulo Freire's critical pedagogy that foster such broader societal understanding (e.g., Gapski et al. 2017; Markham 2019). Thus, more critical approaches to data literacy that promote understanding of the structures and mechanisms of datafication (Hartong and Sander 2021) and "a more complete theorisation" of such critical data literacy are required (Pangrazio and Sefton-Green 2020, p.217).

This study addresses these gaps in research by suggesting a framework for critical datafication literacy that is grounded in theoretical and empirical research. First, existing critical data literacy concepts are reviewed and three well-established theoretical approaches from traditional education research – media literacy, the German concept of 'Bildung' (including 'politische Bildung' / political literacy), and Paulo Freire's critical pedagogy – are analysed in depth. The theoretical insights are interconnected with empirical research that includes expert interviews with creators of online educational resources about datafication and a qualitative survey with educators interested in teaching about data technologies. The overarching goal of the study is to develop a *framework for critical datafication literacy* that is informed by insights from all stages of the research – thus building on the existing literacy discourse and learning from different critical theories as well as from practitioners of critical data education.

Review of Existing (Critical) Data Literacies

As a first step, this study conducted a comprehensive – yet not exhaustive – review of existing data literacy conceptualisations. Based on this, a categorisation of literacy approaches with three overlapping categories on a spectrum between practical-instrumental and critical-reflective literacy understandings was suggested (see figure 1).

¹ In this paper, the term 'critical data literacy' is used as a generalising descriptor of different academic and practical approaches to critical education about data(fication). The term 'critical datafication literacy' is used when referring to the specific literacy framework that has been developed throughout the study.

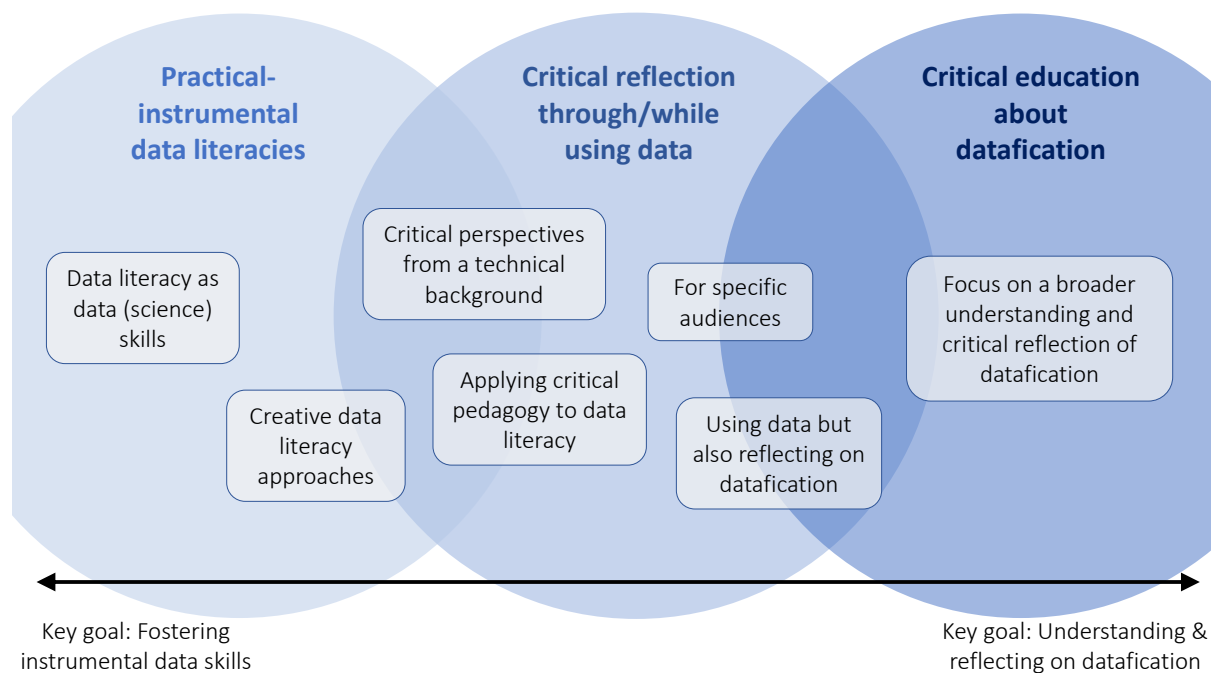


Figure 1: Categorisation of (critical) data literacy concepts along a spectrum from practical-instrumental to critical-reflective approaches. Source: Ina Sander.

The first identified category, *practical-instrumental data literacy understandings*, fosters the skills to use, clean, analyse, interpret, and visualise datasets (e.g., Wolff et al. 2016; Schüller et al. 2021). This technical understanding of data literacy often originates from data science tradition and clearly dominates current academic discourses (Seymoens et al. 2020; Pangrazio and Sefton-Green 2022), as demonstrated by several recent literature review studies (Maybee and Zilinski 2015; Raffaghelli and Stewart 2020; Yousef et al. 2021). In addition, overlaps with numerical literacy, statistical literacy and IT literacy occur (Frank et al. 2016; Gould 2017). This study’s literature review confirmed the strong dominance of practical-instrumental literacy understandings, but also identified a small number of *creative* data literacy approaches, which suggest that learners should work creatively and critically with data and datasets (D’Ignazio 2017; Ahlborn et al. 2021).

Such critical approaches to data literacy were rare when this paper’s author first reviewed the field (see Sander 2020b) but have increased significantly in recent years. During the course of this study alone (2019-2023), a large increase of critical data literacy approaches was identified. The majority of such concepts aim to foster *critical perspectives through or while using data* by combining “data literacy goals” in the sense of data usage skills with “critical literacy goals” (Louie 2022, pp.4; 6). Examples include approaches from technical backgrounds (e.g., Koltay et al. 2015; François and Monteiro 2018); concepts that address specific audiences (e.g., Hautea et al. 2017; Fotopoulou 2020); and some that apply Paulo Freire’s critical pedagogy approach to data literacy (for overview, see Špiranec et al. 2019). However, the critical reflection these concepts aim for is often limited to reflecting the *content* of digital media or learners’ *own use of data*, for example by recognising “how the data was generated [, ...] who produced it, in which context and why” (Tygel and Kirsch 2016, p.117). Put differently, only a minority of concepts combines data usage skills with critical reflection of how datafied systems impact our society (e.g., Crusoe 2016; Gray et al. 2018; Nguyen 2021; Davies 2022). Moreover, many concepts in this category focus on “individualised rather than collective forms” (Hintz et al. 2022, p.149) by predominantly fostering data protection skills

alongside data usage skills. This approach can be problematic as it can shift “the burden of time and responsibility” to individuals (Pangrazio and Selwyn 2019, p.425), and because citizens’ agency is limited and notions of informed consent, notice and choice have been called into question (Kazansky 2015; Larsson et al. 2021).

Literacy approaches from the third category go one step further and *place critical thinking and reflection at their core*. These concepts focus on promoting broader understanding and reflection of the *structural and systemic implications of datafication* that are becoming deeply engrained into today’s societies and *how to effectively challenge them*. While such approaches to data literacy are still rare in the literature, a handful of concepts were identified that this study’s framework builds on. These empower learners to understand the wide-reaching impacts of data systems (D’Ignazio and Bhargava 2015) and foster a “nuanced understanding of power and ideology” (Pangrazio 2016, p.168) and of the “technological infrastructure and the political economy of digital platforms” (Pangrazio and Sefton-Green 2020, p.214). In line with these approaches, this paper’s author has previously argued that critical data literacy should enable citizens to “scrutinise the socio-technical systems of big data practices” and empower them to make informed choices and get involved in public debates (Sander 2020b, p.5). Other authors similarly encourage citizens to “exercise their digital / data human rights” (Yates et al. 2021, p.22), and aim for democratic participation and “a self-determined future citizenry” (Pötzsch 2019, p.236).

Overall, the literature review conducted as part of this study demonstrated that practical-instrumental data literacy understandings dominate the field, and that while critical perspectives are increasing, many take an individual approach and focus predominantly on critical reflection of using data or of the content of digital media. Data literacy conceptualisations that *place critical thinking at their core* and aim for understanding of the *broader societal implications* of datafication are rare. Moreover, some of the analysed approaches come with little theoretical grounding, which can leave them disconnected from insights of traditional education scholarship. Finally, the “seeming[...] ‘neutrality’” of existing data literacy concepts has been criticised, and the need for a “(re)politicization of data literacy” highlighted (Jansen 2021, p.1). A (re)politicised data literacy should learn from pedagogical approaches that aim for “democratic engagement, dismantling power structures, policy reform and activism” (ibid., p.8). To address the highlighted gaps, this study investigated what critical data literacy can learn from well-established educational approaches.

Learning from Established Educational Approaches

Three approaches from traditional education scholarship were selected as most relevant: 1. *media literacy*; 2. *the German concept of ‘Bildung’* (including ‘politische Bildung’ / political literacy)²; and 3. *Paulo Freire’s critical pedagogy*. These approaches were selected because they a) constitute well-established, internationally recognised educational approaches with strong theoretical groundings; b) foster broader understanding of the world and empowerment of learners rather than education in the sense of ‘training’ or mere passing of knowledge; and c) have already been connected to education about data, which emphasises their relevance and how much can be learnt from these approaches for a theoretically grounded conceptualisation of critical datafication literacy. For each approach, key texts were selected

² For clarity, the original German term ‘Bildung’ (and a small number of other specific original terms) is used in this paper to refer to the specific, narrow concepts they describe – similar to other scholars who use ‘Bildung’ as a foreign word in their English-language publications (e.g., Lovlie and Standish 2002; Nordenbo 2002).

and analysed in-depth. This included well-recognised, canonical conceptualisations of each educational approach; secondary literature for additional framing; and a selection of publications that have already adapted the respective educational approach to education about data. The analysis included publications from the German academic discourse – not only because of the long and rich history of German education research, but also since internationally recognised concepts such as ‘Bildung’ or ‘politische Bildung’, that provide important insights for critical data literacy, originate in Germany.

The first educational approach that was analysed, *media literacy*, was perhaps the most obvious choice as it constitutes a decade-old research field that has produced countless educational concepts about media technologies. While there are some conceptual overlaps, media literacy not only has a much longer history but also generally applies a wider lens than data literacy, educating about various kinds of media. Nevertheless, media literacy definitions offer relevant insights for education about datafication. One ‘classic’ concept in the German research field is Baacke’s media literacy (1997). Besides fostering knowledge, use and design of media, Baacke places a particularly strong focus on promoting media criticism. He argues that learners should *analytically* apprehend problematic societal processes; *reflectively* apply the analysed knowledge to their selves and their actions; and take an *ethical* and socially responsible perspective (ibid., p.98). According to Baacke, media literacy should go beyond the subjective-individualistic level and be implemented at a supra-individual, societal level, fostering public discourse (ibid., p.99). This supra-individual perspective and Baacke’s focus on ethical reflection of societal processes are highly relevant approaches for educating about datafication. These views are complemented by more recent conceptualisations that frame media literacy as “intentionally civic”, fostering civic participation and citizens’ agency (Mihailidis 2018, p.1), or that argue that media literacy should address ethical issues around data systems and empower citizens to work towards more diverse and democratic data societies (Aßmann et al. 2016). Such civic and emancipatory perspectives are rare in existing critical data literacy discourses.

As a second educational approach, the field of ‘(politische) Bildung’ was analysed. ‘Bildung’ is a well-established and internationally recognised concept that dates back to ancient Greece (Nordenbo 2022), but has been particularly influenced by German scholars such as Humboldt. Humboldt argues that humans seek to understand the world around them and their position in this world, and that this ‘Bildung’ can be exercised through “every business of life”, when approached with the right mindset (translation published in 2000, p.60). In other words, ‘Bildung’ is not concerned with the passive acquisition of knowledge or attaining practical skills but rather constitutes a never-ending, emancipatory process of understanding and reflection, ultimately aiming for self-determination (Bauer 2003; Masschelein and Ricken 2003). Such perspectives are not yet common in current critical data literacy concepts although they offer highly relevant insights for educating about the societal transformations related to datafication. A specific type of ‘Bildung’ is ‘politische Bildung’, usually translated as ‘political literacy’, ‘citizenship education’ or ‘civic education’. Its core goal is “Mündigkeit” (‘responsibility’ or ‘autonomy’), which describes the “ability to grapple with society, politics and economy in an independent, informed and interest-based manner, to act self-determined and self-efficacious in these areas, and to justify one’s actions transparently” (Autorengruppe Fachdidaktik 2016, p.15, own translation). Such empowerment of citizens is crucial in light of the challenges datafication poses for democracy and citizens’ agency. ‘Politische Bildung’ further does not set any predefined topics but instead fosters citizens’ “power of judgement”, ability to “orient oneself in the social world”, and “political participation and civic involvement”, and teaches about whatever challenges citizens’ ‘Mündigkeit’ and democratic self-determination at the time

(ibid., p.7; 8). These critical and collective approaches stand in contrast to the individualised approaches of many critical data literacy concepts. Learning from this field could contribute to a (re)politicisation of data literacy that has been called for (Jansen 2021).

Finally, Paulo Freire's critical pedagogy was examined as a third relevant educational approach. Although its specific context of origin – teaching “teaching poor peasants how to read and write” (Tygel and Kirsch 2016, p.109) – should always be taken into account, this transformative educational approach offers a highly relevant educational approach for teaching about datafication and has already been applied to data education (e.g., Tygel and Kirsch 2016; Markham 2019; Dasgupta and Hill 2021). Key tenets of critical pedagogy are that education must take place *with* the learner rather than *for* them, should engage in dialogue, confront learners with “problems relating to themselves in the world and with the world”, and support learners in critical thinking (Freire 2017, p. 54). Ultimately, critical pedagogy aims for “*conscientização*” – a critical consciousness of oneself and one's situation in the world (ibid., p.42f), which is “joined by meaningful praxis” (hooks 1994, p.47) that encourages learners to “act as active agents” (Aliakbari and Faraji 2011, p.80) and view their situation in the world as a “limiting situation which they can transform” (Freire 2017, p.23). Other scholars have built on Freire and have, for example, applied a feminist perspective to critical pedagogy, suggesting an “engaged pedagogy” that aims for “self-actualization” of teachers and students alike (hooks 1994, p.15; hooks 2009, p.8). Similarly, Freire's critical pedagogy has often been applied to education about data (Špiranec et al. 2019). However, few of these concepts place critical consciousness at their core and even fewer view critical thinking as an emancipatory tool for self-determination and civic engagement.

Insights from the Theory

As highlighted throughout the previous paragraphs, traditional educational concepts offer manifold insights for critical data literacy. The analysed educational approaches reemphasise the importance of going beyond passive acquisition of knowledge and practical skills and rather fostering *critical education and ethical reflection*. Moreover, the goals of fostering *understanding of the world on an (infra)structural level* and promoting *reflection of one's own position in the world* are rare in existing critical data literacies but constitute highly relevant approaches for educating about the structural transformation of society through datafication. In addition, a strong focus on fostering *civic involvement* and *empowering learners to participate politically* was identified. Such collective approaches are not yet common in current data literacy concepts, which predominantly focus on promoting individual approaches such as data protection skills. Thus, established education theories can advance the critical data literacy discourse and can strengthen and provide theoretical grounding to the few existing concepts that already take systemic and emancipatory approaches (see third category above).

Research Methodology

The aim of this study was to develop an in-depth theoretical framework for critical datafication literacy by taking existing critical data literacy concepts into consideration, building on well-established education scholarship, and learning from practitioners of critical data education. To achieve this, the study design closely interconnected theoretical research with an empirical mixed methods investigation. First, a preliminary literacy framework was developed based on the theoretical analyses (see figure 2). These theoretical findings then informed the empirical research, guiding, among others, sample selections, coding decisions and survey design. In turn, key insights from the empirical research then shaped the development of the final literacy

framework. Ultimately, the theoretical and empirical findings were mobilised for educators in cooperation with the NGO Privacy International in the form of an online resource.

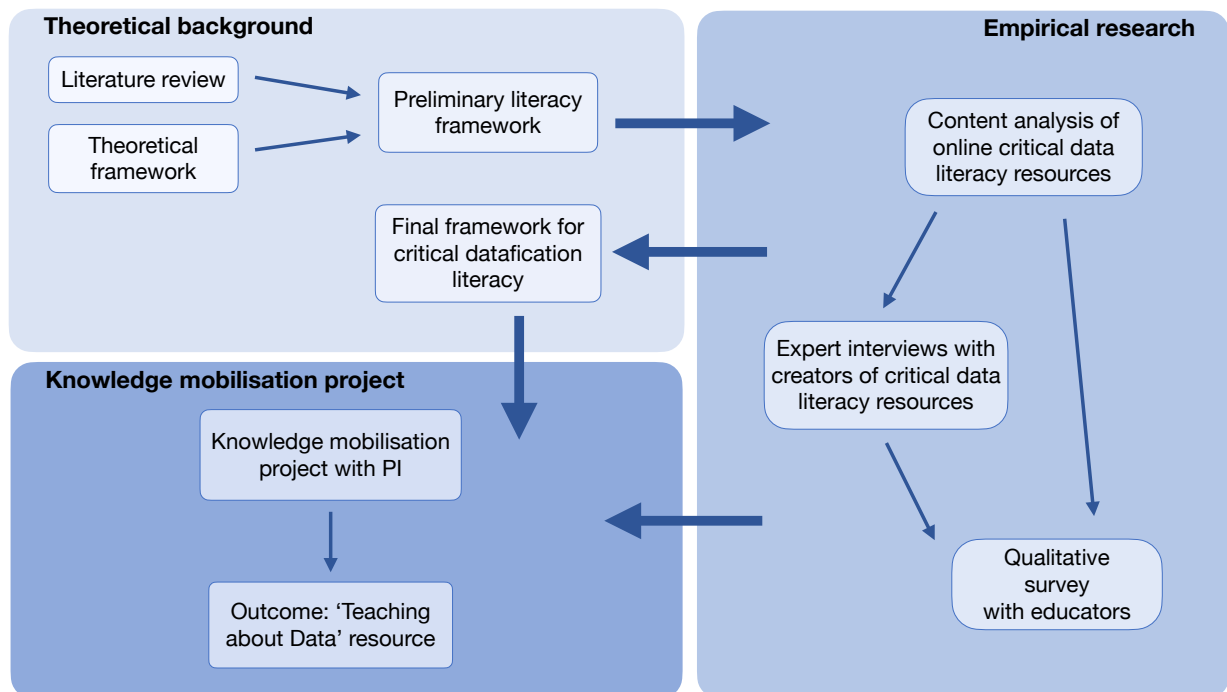


Figure 2: Visualisation of the study's mixed methods approach and its reciprocal influences. Source: Ina Sander.

The empirical research in this study focussed on *online educational resources* as one way of educating about datafication. This includes web-based resources of various formats, such as websites, short videos, interactive tools, online courses and many others, that aim to raise awareness and critically educate about datafication. Although this format constitutes one of the longest-standing and most established approaches to critical data education, such resources have been examined in very few studies so far (e.g., Milioni and Papa 2019; Sander 2020a; Sander 2020b; Alegre 2021). A comprehensive overview of such resources and research into their goals, educational strategies, and their creators' considerations are lacking. This study investigated online educational resources about datafication from three perspectives: 1) a content analysis examined the range, shape and focus of these resources; 2) expert interviews explored the goals, strategies, and experiences of creators of such resources; 3) and a qualitative survey asked about educators' experiences with teaching about data technologies and their needs and wishes for literacy resources. This combination allowed for insights on *what* such resources look like, *why* they are created this way and *how* educators perceive and use these resources. This paper focusses on a specific part of the findings: the *goals* of the resource creators and educators for teaching about data(fication).

As a first step of the empirical research, a content analysis of online critical data literacy resources was conducted. This allowed for a qualitative analysis of a large amount of material (Bauer 2000, p.132f). 250 resources were initially identified, and 75 met the qualifying criteria for the analysis: they educated about datafication, fostered critical reflection of datafication, and did not require any prior knowledge. The coding and analysis focussed on the resources' creation background, formats, languages, publication date, as well as specific design and content characteristics that were identified in the literature (e.g., using interactive elements or providing constructive advice).

The sample of creators for the semi-structured expert interviews was then identified through a “generic purposive sampling” (Bryman 2016, p.412) that was informed by the study’s theoretical findings. Ten resources were selected from the content analysis sample through a multi-step selection process that aimed for a) identifying resources that were in line with the theoretical findings; b) took diverse approaches to cater for different learning types; c) included constructive advice to avoid resignation; and d) did not shift responsibility to address the challenges of datafication to individuals. The final ten resources applied a variety of design formats and originated from diverse national and creation backgrounds (see appendix I). The interview guide was developed in English and German – the native languages of most participants – to ensure that the interviewees could express themselves freely in a language they feel comfortable in (Littig and Pöchl 2014). Due to the Covid-19 pandemic and the different locations of the experts, virtual face-to-face interviews were conducted. The interviews were transcribed in full, and the 142 pages of transcripts and 50 pages of additional documents analysed in a thematic analysis using the software NVivo and following the guidelines by Meuser and Nagel (2009) in combination with Braun and Clarke (2006).

In addition, a qualitative online survey with educators was conducted. Through this method, a “wide-angle lens” on diverse perspectives in a large population of interest could be combined with open questions that collected rich data that allowed for qualitative insights (Braun et al. 2021, p.3). The survey included open-ended as well as closed questions (multiple-choice and rating-scale questions) and took various measures for participant convenience, transparency, informed consent, and the protection of participants’ privacy. The questionnaire was provided in English and German and piloted in both languages with ten educators from diverse national and educational backgrounds. The survey addressed a very specific group of educators: educators who are interested in *teaching about digital and data technologies* and might have already done so in the past, potentially using online critical data literacy resources. As there exists no list of educators with this particular interest, no sampling frame was available and a probability sampling not possible. Instead, British, German and European educator mailing lists, social media accounts, organisations and well-connected individuals were contacted to reach a large number of educators from different backgrounds.³ The invitation and the landing page of the survey then specified the survey’s specific target population. While information about the survey reached several thousand people, likely only a small fraction of these consisted of educators interested in teaching about digital and data technologies. 102 people began completing the questionnaire, but, as described in the literature (e.g., Reja et al. 2003, p.159), many aborted at the first open question. In total, 57 valid responses were identified. However, as these represented diverse educational and national backgrounds and provided detailed qualitative data, data richness could be achieved (see Braun et al. 2021, p.9). This qualitative data was analysed in a thematic content analysis, again using the software NVivo.

Empirical Findings

Resource Creators’ Goals for Educating about Data(fication)

The analysis of the resource creators’ goals identified three main themes: ‘awareness and basic understanding’, ‘thinking critically about datafication’ and ‘people take action’. The first, *awareness and understanding* of data technologies, constituted an expectable goal for creators of educational resources. However, the interviewees highlighted that they aimed not

³ Teachers, student teachers, teacher trainers, higher education lecturers, adult educators, media education centres and trainers in civil society were contacted.

just at raising people's awareness of data systems but wanted to demystify technology and foster understanding of how data systems work, including their shortcomings and the "assumptions baked into the product development process" (Jay Interview, 2021). One interviewee 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). The interviewees' focus on reflective understanding rather than passing specific knowledge corresponds with 'Bildung' but also with data literacy approaches from the third, distinctly critical category that was outlined above.

This reflective type of understanding was complemented by the interviewees' strong focus on encouraging *critical thinking about datafication*. They wanted to provide people with frameworks to think critically about datafication and its risks, and to encourage them to "continuously ask questions" (Siegenthaler Interview, 2021). A crucial insight was that many creators aimed for deeper understanding of the "systemic forces" behind datafication (Jay Interview, 2021). This constitutes a significant finding as such strong focus on critical thinking and the goal of systemic, (infra)structural, or "sociological, societal understanding" (Younge Interview, 2021) is rare in existing academic critical data literacy concepts (examples include Pangrazio and Sefton-Green 2020 or Pötzsch 2019). However, these objectives correspond with established educational approaches, such as critical pedagogy's strong focus on critical thinking (e.g., Giroux 2010) or 'politische Bildung' and its goal of societal and political understanding (e.g., Autorengruppe Fachdidaktik 2016). Moreover, the creators fostered understanding of "how data about you can impact your life online and offline" (Gaylor Interview, 2020) and aimed to create "personal involvement" (Reicherstorfer Interview, 2021).

As a third key goal, the creators wanted to empower learners to *take action*. A common criticism of literacy approaches is that there is no clear idea of what follows once someone is 'literate'. Although the interviewed creators had mixed opinions about how realistic it is to change the behaviour of learners, all resources aimed at people taking action in one way or another. This constitutes an encouraging finding as scholars have highlighted the importance of providing constructive advice to avoid learners' resignation when educating about data systems (e.g., Jansen 2021; Bilstrup et al. 2022). This approach further corresponds with critical pedagogy's goal of replacing resignation with a drive for transformation (Freire 2017, p.58). Common constructive goals of the interviewed creators were to give users "better control" of their data (Stoilova Interview, 2021) and to empower them to make "enlightened choices. If you give your data, just know what you are doing, that's the main goal" (Schechter Interview, 2021). These are also common goals in existing critical data literacy concepts and they correspond with 'Bildung', which fosters the ability to make judgements (Sander 2019).

However, many interviewees recognised the limitations of such individual steps and of citizens' agency, and promoted approaches that go beyond the individual level. This perspective corresponds with Baacke's supra-individual media literacy approach (1997). Several interviewees encouraged their users to become active on a societal or political level, for example by forming their own opinion, taking part in public debates and contacting political parties about data issues, or they even saw their resources as "someone's first step into a broader movement" (Jay Interview, 2021). Such very ambitious and political goals that aim for collective rather than individual action are rare in existing data literacy scholarship. However, they correspond with established education scholarship, such as 'politische Bildung', which promotes political participation and civic involvement (Autorengruppe Fachdidaktik 2016). Moreover, these goals resemble 're-active data activism', a form of activism that educates about data technologies and fights against datafication and its problematic implications (e.g., Milan and Gutiérrez 2015; Milan and van der Velden 2016). Finally, some interviewees 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; Carmi et al. 2020). Nevertheless, the interviewees highlighted that comprehensive data education cannot be provided by non-governmental organisations and other literacy resource creators but that a systematic literacy strategy should be developed by governments (Jansen Interview, 2020).

Overall, the expert interviews led to a number of novel insights on the creators' goals for their educational resources. The interviews demonstrated the *encompassing and critical education about datafication* that the interviewed creators foster through their online resources. Many aimed for structural and systemic understanding of datafication and highlighted critical, reflective and emancipatory goals for teaching about data. As highlighted above, such perspectives are rare in existing academic critical data literacy concepts, which are predominantly limited to reflecting the practical use of data or fostering digital self-defence skills. However, several parallels to traditional educational approaches such as media literacy, 'Bildung' and critical pedagogy were identified. This highlights how much the academic data literacy field can learn from practitioners, such as the interviewed resource creators, as well as from more established educational fields.

Educators' Topics and Goals for Educating about Data(fication)

The analysis of the educator survey identified many parallels to the creator interviews. This is particularly remarkable as the survey, in contrast to the expert interviews, had not specifically addressed practitioners interested in critical perspectives. Nevertheless, it should be emphasised that the survey addressed a very specific population – educators interested in teaching about digital and data technologies – and did not aim for a representative sample, thus not allowing for any generalisation of findings.

The survey demonstrated that, overall, the participants *felt fairly experienced and well-equipped* to teach about digital technologies and data. However, differences between topics emerged, with surveyed educators feeling considerably more experienced and well-equipped to teach about digital technologies in general (77% felt very or extremely well-equipped and 61% very or extremely experienced) and their societal implications (70% and 61%) than about more technical or complex topics such as data security (52% and 32%) or data and algorithmic systems (42% and 39%). In particular, the participants' 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 educators in this study go beyond instrumental skills in their teaching, and also include more reflective perspectives on technologies' impacts.

The surveyed educators further gave detailed descriptions of the topics and goals of their education about data, thus providing a good idea of the kind of literacy they aim to foster. Many similarities to the creator interviews were identified, for example that a large majority of educators highlighted *understanding and critical reflection* as key goals. In particular, many participants indicated to educate about how digital technologies and data systems work, including their shortcomings such as the "myth of objective knowledge" (participant 209), and about "the social factors shaping technology" (participant 202) or that "societal decisions on technology affect all of us" (participant 122). Moreover, advanced goals were identified, such as fostering the "ability to recognise bias" (participant 289), to "understand how software/ algorithms can discriminate" (participant 202) or promoting "ethical thinking on unforeseeable yet emerging technologies" (participant 282). These sophisticated and critical goals 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, pp.446ff).

The surveyed educators further highlighted various *practical skills* they foster in their teaching. This included basic usage skills of digital technologies, researching skills, content creation (such as “production skills for social media”, participant 319), the use of data and analytics, and the use of technologies for teaching, for example “using ICT in classroom, LMS [Learning Management Systems], analysing general educational data” (participant 186). These practical-instrumental skills stand in contrast to the strong emphasis on critical reflection outlined above, yet this perspective was often indicated by the same educators who distinctly called for critical approaches. This suggests that fostering critical reflection along with, or even through, practical media usage constituted no contradiction for these participants – similar to academic critical data literacy approaches that aim for critical education *through* using data (e.g., Pybus et al. 2015; Gray et al. 2018).

However, the educators in this study also indicated more critical skills, such as fostering digital self-defence or data security and supporting learners in making informed decisions on technology use. One educator summarised this goal under the term “tech intuition”, which they defined as

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 (participant 316).

While several academic critical data literacy concepts aim for empowered and enlightened users that make informed decisions on technology (e.g., D’Ignazio and Bhargava 2015; Pangrazio and Selwyn 2019), the notion of a ‘tech intuition’ is a novel and unusual approach. This ‘tech intuition’ as well as the goal of “ethical thinking on unforeseeable yet emerging technologies” (participant 282) that was already highlighted above constitute particularly relevant approaches for educating about data technologies. These technologies not only constitute ‘black boxes’ whose functional workings are unknown and impossible to uncover, but they also evolve at a fast pace, come with wide-reaching implications, and may change in unforeseeable ways. Thus, aiming for ethical thinking that can be applied to new technologies and an ‘intuitive’ approach to make informed decisions based on social impact – rather than imparting details about specific platforms and systems that will outdate quickly – represent highly valuable solutions. Moreover, these open approaches are reminiscent of the strategy of ‘politische Bildung’ to not define any set learning topics but teach about whatever challenges citizens’ democratic self-determination at the time (Autorengruppe Fachdidaktik 2016). This approach is rare in critical data literacy discourses, yet, one early data literacy publication made a similar suggestion, aiming to foster “adaptive capacities and resilience rather than teaching platforms and technical languages that are bound to become out-dated” (Data Pop Alliance and Internews 2015, p.iv).

Many surveyed educators further recognised the problematic nature of individual data protection tactics. A closed question revealed predominantly *disagreement* (56%) with the statement: “It is up to the individuals to protect their data online”, suggesting that the participants were aware of the difficulties of shifting the responsibility of data protection to individuals. This is unusual as the critical data literacy discourse places a strong emphasis on empowering learners to protect their own data. However, these findings correspond with critical research on the “responsibilisation” of individuals (Kazansky 2015, p.189), and with scholars who have recently criticised the “small bandage approach” of data protection advice (Young and Pridmore Forthcoming) in critical data literacy concepts (Carmi et al. 2020; Pangrazio and Sefton-Green 2020).

Finally, some educators in the study 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, and even highlighted that “this type of engagement is political” (participant 209). This finding was confirmed by a closed question in the survey, which found that 86% of the participants agreed with the statement: “It is important to not just raise awareness, but also to mobilise people to take societal/political action”. While such political and emancipatory understanding of literacy as a pathway for societal change strongly correlates with critical pedagogy practice (Freire and Macedo 1987; Wringe 2012; Vossoughi and Gutiérrez 2016), only few critical data literacy approaches focus on unpacking the politics of data, power, interests and ideologies as yet (examples include Pangrazio and Selwyn 2019; Fotopoulou 2020). Some participants further indicated to encourage their learners to use data for good and to “empower themselves with their data” (participant 341), aiming for data sovereignty, or to enable 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 (participant 96).

Discussion

Overall, one of the key empirical findings of this study was that many parallels could be identified between the interviewed creators and the surveyed educators. These parallels emphasised the distinctly critical education about datafication that the practitioners foster through their teaching and their educational resources. This finding is particularly remarkable as the survey, in contrast to the expert interviews, had not specifically addressed practitioners interested in critical perspectives, and previous studies showed that instrumental and technical approaches to data literacy prevail in the education sector (Raffaghelli and Stewart 2020, pp.446ff). Goals such as critical thinking, systemic understanding of datafication’s structural transformations on society, a ‘tech intuition’, or empowering learners to take societal and political action are further rare in existing academic critical data literacy concepts. As argued above, the majority of existing concepts fosters critical reflection through the use of data, and this reflection is often limited to the content of digital media or learners’ own use of data. Where critical reflection goes beyond this, concepts usually aim to foster learners’ skills to protect their own data, and only few existing concepts promote broader societal and (infra)structural perspectives or systemic actions (examples include Pötzsch 2019; Pangrazio and Sefton-Green 2020; Polizzi 2020). Instead, many of the critical, emancipatory and collective goals of practitioners identified in this study showed parallels to established approaches from education scholarship, such as media literacy, ‘(politische) Bildung’, or critical pedagogy. This suggests that some practitioners of critical data education already implement key insights from traditional education scholarship that are not yet common in the majority of academic critical data literacy approaches.

These findings on the goals of resource creators and educators advance previous research and demonstrate how much can be learnt from analysing the practical data education that is already taking place in different contexts. After the empirical research was conducted, these empirical findings were interconnected with theoretical insights from the three analysed educational approaches. Through this interconnection, a *critical datafication framework* was developed that builds on and expands existing critical data literacies through an in-depth theoretical and empirical grounding. The terminology of the framework is informed by Pangrazio and Sefton-Green’s literacy understanding as a concept that always possesses a “learning or pedagogic dimension”, is “usually understood as a process”, and works toward

“ensuring full and complete participation in wider society” (2020, p.217). In light of scholars’ strong calls to avoid ‘one-size-fits-all’ approaches to literacy (e.g., Carmi et al. 2020), a conscious decision was further made to differentiate the abstract framework of critical datafication literacy and the practical implementation of this literacy. Rather than providing generic implementation advice and thereby assuming a homogeneous understanding of learners, the framework presented here constitutes the core, the abstract goals of critical education about datafication, which should then be adapted to different educational contexts and groups of learners when fostering this literacy in practice. For this reason, the singular term ‘literacy’ is used instead of the multiple ‘literacies’ that have been suggested by others (Pangrazio and Selwyn 2019; Fotopoulou 2020; Jansen 2021). A final terminological consideration concerned the term ‘datafication’. This framework fosters critical *datafication* literacy because, in contrast to the more general term ‘data’, this term suggests a reflection of the profound transformation of our societies through data technologies.

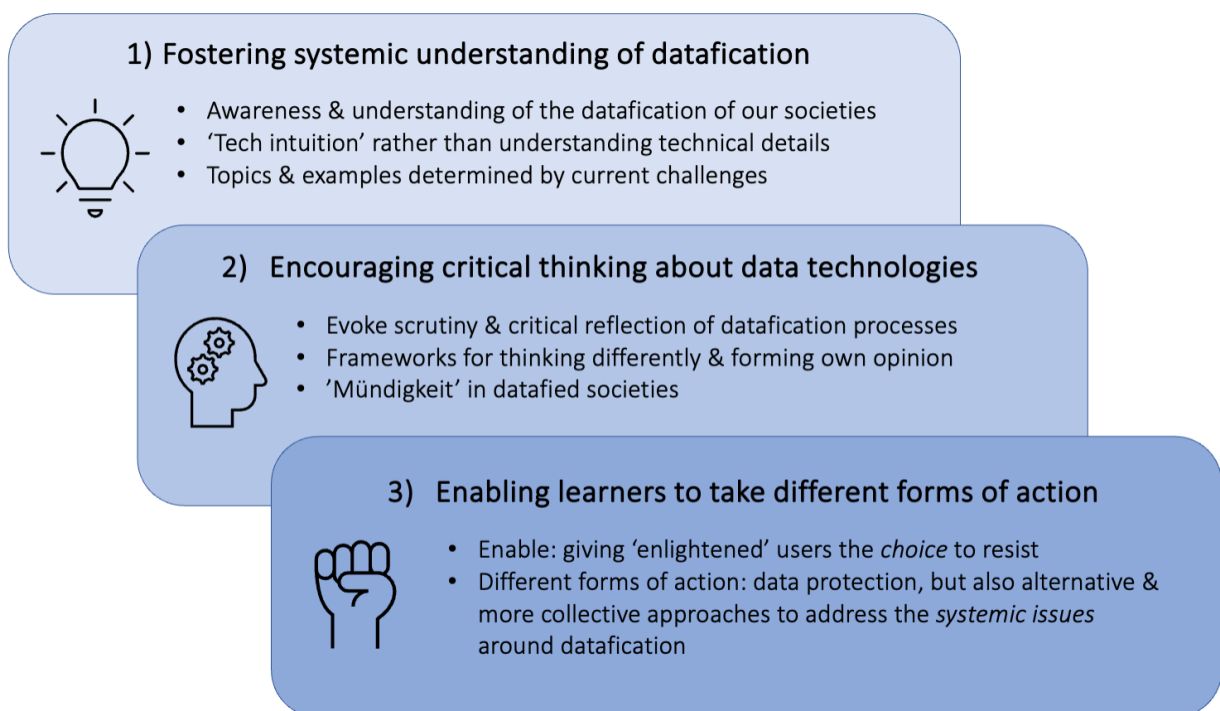


Figure 3: Visualisation of the critical datafication literacy framework and its key goals. Source: Ina Sander.

Critical datafication literacy, as defined in this study, promotes education about datafication by pursuing three key goals: 1) fostering systemic understanding of datafication; 2) encouraging critical thinking; and 3) enabling learners to take different forms of action. To achieve the first key goal – *systemic understanding of datafication* – learners should be supported in becoming aware of the datafication processes around them, understanding the basic workings – including shortcomings – of data systems, and realising how these systems already affect their lives and our societies, coming with new opportunities but also manifold risks. Importantly, such understanding does not necessarily require technical knowledge of data or algorithms but rather aims for societal understanding, or ‘tech intuition’. Critical datafication literacy thus goes beyond mere awareness of data collection practices or a focus on media content or a specific medium. Instead, the objects of learning for such education should be determined by current developments around datafied systems and the risks and challenges, for example to citizen’s democratic self-determination, that these systems entail.

As a second key goal, critical datafication literacy aims to *encourage critical thinking*. Rather than placing an emphasis on the passing of specific knowledge about data technologies, which will likely outdate within a short time period, critical datafication literacy aims to provide learners with frameworks to *think differently* about technology, striving to evoke scrutiny and critical reflection of datafication processes. Encouraging people to think critically further empowers them to form their own opinion on an issue, which in turn allows for a more informed societal participation. Thus, one could say that critical datafication literacy ultimately aims for '*Mündigkeit*' in datafied societies: the ability to grapple with modern society, politics and economy that are increasingly affected and transformed by data technologies in an informed and self-determined manner. In addition, critical thinking can be applied to new technologies and thus equips citizens to deal with fast-changing technology landscapes that are developing in unforeseeable ways. Ideally, empowering *some* citizens to critically reflect on data practices might even lead to a '*chain reaction*' of critical thought, in which learners pass on their new perspective as they speak to friends, family members and colleagues (for example suggested by Markham 2019).

As a third key goal, critical datafication literacy as conceptualised in this framework aims to *enable learners to take different forms of action*. The first emphasis here lies on 'enable'. In line with the goal of empowering learners to form their own opinion, the question of whether learners even *want* to take any actions should be entirely up to the individual. Critical datafication literacy thus strives for '*enlightened*' users, who have the option and the means to become 'resisting' or even 'emancipatory' users *if they so desire* (building on Milioni and Papa's user typology, 2019). The second emphasis is placed on 'different forms of action'. Advice on actions to take can include steps to better protect one's data, as this can give learners confidence and can help avoid resignation. However, the pitfalls of this type of advice should be recognised and addressed: it should be made clear that the challenges around datafication are *systemic issues*, which cannot be solved by individual actions, and individuals should not be made to feel as if this is their responsibility. For this reason, critical datafication literacy places a particular emphasis on going *beyond* individual data protection advice. Thus, constructive advice should encourage societal and other forms of *collective action* as well, for example by enabling citizens to make their voices heard. Overall, critical datafication literacy aims to prompt learners to *imagine different data futures* and to empower them to work towards such better data futures – attempting to realise literacy's *potential for change*.

Conclusion

The overarching goal of the study was to develop the previously outlined framework for critical datafication literacy. This framework builds on existing academic critical data literacy concepts, and is grounded in an in-depth theoretical analysis of relevant traditional educational approaches and empirical findings on the perspectives of creators of online critical data literacy resources and of educators who use such resources. By suggesting this framework, this study contributes to a research gap on in-depth theorisations of critical data literacy (Pangrazio and Sefton-Green 2020, p.208). The current data literacy discourse is strongly dominated by practical-instrumental data literacy concepts, and existing critical approaches often focus on a reflection of the content of digital media, learners' own use of data, and the promotion of individual data protection skills. In light of the wide-reaching implications of datafication on society, more critical data literacy approaches that foster broader societal and systemic understanding and collective action are needed. In addition, only few studies on critical data literacy have as yet thoroughly reviewed and analysed existing conceptual suggestions to

(critical) data literacy (e.g., Gray et al. 2018; Pangrazio and Selwyn 2019; Pötzsch 2019), and even fewer have connected critical data literacy approaches to more established educational concepts such as 'Bildung' or critical pedagogy that the new and emerging critical data literacy field could learn from (e.g., Tygel and Kirsch 2016; Gapski et al. 2017; Markham 2019).

This study's interconnection of theoretical and empirical research proved highly productive. The empirical research was informed by the theoretical insights, which in turn advanced the development of the critical datafication literacy framework. Moreover, many parallels were identified between the goals of practitioners and the approaches from critical education theory – media literacy, the German concept of '(politische) Bildung' and Paulo Freire's critical pedagogy. The creators and educators indicated a strong focus on critical thinking, suggested to foster systemic understanding of datafication's structural transformations on society, promote a 'tech intuition', and aimed to empower learners to take societal and political action. This suggests that some practitioners already implement insights from traditional educational approaches that are only rarely considered in current critical data literacy concepts. These parallels further reaffirm the original idea behind this study: that much can be learnt from more established educational fields, but also from those who practice critical data education on a daily basis. Besides the novel findings on practitioners' *goals* that were presented in this paper, the study further examined the *strategies* that resource creators and educators applied when fostering critical education about data(fication), and the challenges they encounter, with findings currently being prepared for publication. However, this study was limited in its focus on online educational resources. Further research on analogue resources and on the practices and exercises applied by educators in the classroom is needed. Moreover, only the *intentions* of creators and educators were investigated, and no conclusions can be drawn on whether the goals for learners are being reached.

Nevertheless, the study led to many new insights for policy, practice and academic research. The suggested critical datafication literacy framework not only contributes to recent academic discourses on (critical) data literacy but could also inform future policies on data education. While current data literacy curricula predominantly focus on instrumental usage skills, this study emphasised the importance of critical and systemic understandings and calls on policymakers to include such reflective perspectives when updating curricula. Moreover, the study contributes to an "absence of practical models" on how to implement critical data literacy into practice (Pangrazio and Sefton-Green 2020, p.215). In a knowledge mobilisation project together with the NGO Privacy International, key findings on the critical datafication literacy framework and the strategies of the practitioners were mobilised for educators in the form of an online resource. The goal of this guide to teaching about datafication is to provide educators with understanding, critical perspectives, and educational material for fostering critical datafication literacy in practice.⁴ The resource is already used by educators from various fields, and a German translation has been published⁵. Future studies could build on this by closely working together with educators to, for example, co-create a lesson plan based on this resource, or to examine challenges in practically fostering critical datafication literacy in the classroom. However, it should be emphasised that responsibility cannot lie solely with educators, nor with media makers, activists, or researchers. Rather, a systematic education

⁴ The resource "Teaching about data" is available at: <https://privacyinternational.org/learning-resources/teaching-about-data-resource-educators>.

⁵ The German version of the resource can be found at: <https://unblackthebox.org/materialien-ergebnisse/kritische-datenbildung/>.

strategy for critical education about datafication is needed, and legislators and regulatory authorities need to act.

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Appendix

Appendix I: Expert interview sample

Resource Name and URL	Creator / Interviewee
Anna. Das vernetzte Leben https://www.annasleben.de/	Ludwig Reicherstorfer
Automating NYC https://automating.nyc/	Akina Younge, Deepra Yusuf, (Elyse Voegeli), Jon Truong
Center for Humane Technology https://www.humanetech.com/	David Jay
Clear Your Tracks https://www.clearyourtracks.org/	Ed Parkes
Datak – A game about personal data https://www.datak.ch/	Julien Schekter
Do Not Track https://donottrack-doc.com/en/	Brett Gaylor
Lehrmittel Big Data https://www.mfk.ch/bigdata/	Carmen Siegenthaler
Lernparcours Big Data http://bigdata.jfc.info/lernparcours.html	Esther Lordieck
Me and My Shadow https://myshadow.org/	Fieke Jansen
My Data and Privacy Online https://www.lse.ac.uk/my-privacy-uk	Mariya Stoilova