7. Conclusion

7.1 A Theoretically and Empirically Grounded Framework for Critical Datafication Literacy

The overarching goal of my study was to develop a *holistic framework for critical datafication literacy*, grounded in existing academic critical data literacy concepts, an in-depth theoretical analysis of relevant traditional educational approaches, and empirical findings on online educational resources about data – including the perspectives of their creators and of educators who use such resources. All of these insights have informed and shaped this study's framework for critical datafication literacy and were mobilised for educators in a collaborative knowledge mobilisation project with the NGO Privacy International. Thus, the study contributed to gaps in critical data literacy scholarship and to a need for more practical models on how to implement such literacy into practice. The following paragraphs outline this newly developed literacy framework. Critical datafication literacy, as defined in my 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, and that these processes come with new opportunities but also manifold risks. Importantly, I argue that such understanding does not necessarily require technical knowledge of data or algorithms but rather aims for societal understanding, or "tech intuition". In contrast to many existing literacy concepts, critical datafication literacy, as presented here, goes beyond mere awareness of data collection practices or a focus on media content or a specific medium. Instead of such specific thematic foci, the objects of learning for critical datafication literacy 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 think-ing*. 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 par-ticipation. 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 equips citizens to deal with fast-changing technology landscapes that are developing in unforeseeable ways, as the ability to scrutinise and critically reflect can be applied to new platforms and systems in the future. 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 on data technologies 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 frame-work 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 or not learners even *want* to take any actions should be en-tirely up to the individual. Critical datafication literacy thus strives for "*enlightened*" *users*, who have the option and the means to become "resisting" or even "emancipa-tory" users *if they so desire* (see Milioni and Papa's typology, 2019). The second empha-sis in this goal for critical datafication literacy is placed on "different forms of ac-tion". Advice on actions to take can include steps to better protect one's data, as this can give learners confidence and can help avoid a feeling of 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 ad-vice included in critical datafication literacy approaches 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*.

Finally, the question of how to implement critical datafication literacy remains. A key insight of my study was that there is *no one-size-fits-all approach* to literacy (as already suggested by other scholars, e.g., Carmi et al. 2020), but that literacy ap-

proaches should differ depending on the individual group of learners and contexts of learning. Therefore, I made a conscious decision to differentiate the abstract framework of critical datafication literacy and the practical implementation of this literacy. Instead of providing generic implementation advice and thereby assuming a homogeneous understanding of learners, the educational objectives of critical datafication literacy should rather be adapted to different educational contexts and groups of learners. However, two general recommendations can be made. First, the importance of initially identifying and knowing one's learners and, based on this, *adapting one's approach to these specific learners* cannot be underestimated. Second, it should be stressed that while digital formats constitute suitable, well-established and popular approaches to educating about data, critical datafication literacy *does not need to take place digitally* but can also be fostered by traditional, analogue methods.

7.2 Key Theoretical and Empirical Insights

7.2.1 Insights from the Theoretical Analyses

This new framework for critical datafication literacy was developed out of a close interconnection of theoretical and empirical research in my study. The initial literature review demonstrated the profound transformation of our societies through datafication, the wide-reaching implications of this transformation, and the risks this entails in regard to citizens' privacy, increased surveillance, lacking transparency and public involvement, and bias and discrimination through data technologies. Moreover, studies have identified a "major understanding gap" of citizens regarding how the digital technologies around them work, how they collect and use their data and how they affect their lives (Doteveryone 2018, p. 5; see also Grzymek and Puntschuh 2019; Miller et al. 2020; Yates et al. 2021; Akman 2022). Furthermore, many citizens feel uneasy, concerned or even resigned about the data practices they experience (Bucher 2017; Miller et al. 2018; Worledge and Bamford 2019; Akman 2022). In light of this, many scholars have called for more and better education about datafication (Zuboff 2015; O'Neil 2016; Miller et al. 2018; Müller-Peters 2020), arguing that greater public awareness could open up discussions of new policy solutions for better regulation of data practices (Marwick and Hargittai 2018, p. 14).

Manifold new digital and data literacy concepts have been suggested in recent years. Chapter 2.2 offered a tentative categorisation of these concepts into the overlapping categories of practical-instrumental approaches, those that foster critical reflection through using data, and literacies that promote critical education about datafication. While practical and instrumental data literacy concepts that aim to promote the skills to use and work with data still constitute by far the most common

approach in the literature, critical approaches are increasing. Besides more common concepts that aim for critical reflection *when using* data and those that foster critical perspectives on the *content* of digital media, also academic literacy concepts that aim for broader understanding and critical reflection of the way datafication transforms our society are slowly increasing. These approaches strongly informed the development of the framework for critical datafication literacy in my study, for example by calling to go beyond data usage skills (although the extent to which these practical skills should nevertheless be included in critical education about datafication is not always clear); by highlighting the importance of critical thinking; by arguing that inequalities within the society need to be considered and different audiences need different approaches; and by urging not to shift responsibility to the individuals.

Despite several conceptual suggestions, scholars have argued that a more complete theorisation of critical data literacy is urgently required (Pangrazio and Sefton-Green 2020, p. 208). My study aimed to contribute to this research gap by developing a critical datafication literacy framework that is grounded not only in existing critical data literacy concepts, but also in more traditional education scholarship, and in empirical research findings on one of the earliest approaches to critical data education: online educational resources about datafication. To learn from traditional education scholarship, three educational approaches were selected as most relevant, and were analysed in detail. The first educational field, *education about (digital) media*, was perhaps the most obvious educational field to learn from as it has produced a myriad of literacy concepts that aim for better understanding of media technologies. The term "media literacy" is further subject to similar debates as data literacy, with practice-oriented, instrumental conceptualisations, some that focus mostly on media content, but also other, well-established literacy conceptualisations with a strong focus on critical reflection. A highly relevant insight was that literacy should not only be implemented at the individual, but also at the supra-individual and societal level, and should aim to foster a public discourse. Moreover, strong arguments were made for being sensitive towards diversity and for taking vulnerable groups into consideration.

As a second relevant educational approach, key texts from the field of *(politische) Bildung* were analysed. This popular education concept in the German-speaking world proved to be highly relevant for critical education about datafication. The core goal of this approach – Mündigkeit – was identified as a very suitable goal for critical datafication literacy, as it can be seen as a prerequisite to successfully participating in society and is thus exactly what citizens need in order to participate in datafied societies in an empowered manner. Due to these similarities, there are increasing calls to include education about digital and data technologies and their societal implications and power asymmetries into approaches of politische Bildung. Another relevant insight from this theoretical field was the differentiation between education in the sense of Bildung, aiming for understanding one's position in the world, reflec-

tion and self-determination, in contrast to education in the sense of a 'mere' acquisition of knowledge – a differentiation that, as outlined above, strongly influenced the final conceptualisation of critical datafication literacy. Related to this, politische Bildung's approach of not defining set learning objectives but addressing whatever currently challenges citizens' Mündigkeit and self-determination emerged as another highly relevant approach for critical datafication literacy.

The third educational approach that was analysed provided many valuable insights for the conceptualisation of critical datafication literacy as well. The *Freirean critical pedagogy* is a transformative educational approach that strives to evoke a critical consciousness in its learners, and that has often been applied to data education in the past (e.g., Tygel and Kirsch 2016; Markham 2019; Špiranec et al. 2019; Dasgupta and Hill 2021). Key tenets of critical pedagogy, such as a focus on dialogue and a pedagogy *with* the learner rather than *for* them as well as the use of real-world problems in teaching constitute valuable approaches for educating about a complex topic like datafication. Moreover, in reaching its core goal of a "critical consciousness", critical pedagogy places particular emphasis on critical thinking as a tool for self-determination and civic engagement, striving to encourage learners to transform their limiting realities. This distinctly transformative and emancipatory character through the use of critical thinking and dialogue strongly informed the conceptualisation of critical datafication literacy as an educational approach that aims to empower learners to actively shape their societies rather than feeling hopeless and resigned about the ubiquity and power of big technology firms.

7.2.2   Novel Findings on Online Resources as One Way to Educate Citizens about Datafication

My study aimed to learn from practitioners of critical data education to better understand the long-standing yet under-researched field of online educational resources about datafication. Novel findings on these resources, the goals of practitioners, and practical strategies for fostering critical data education were identified. Particularly the findings on practitioners' goals strongly informed the development of the critical datafication literacy framework, showing many parallels to key insights from traditional education scholarship and demonstrating similar controversies as highlighted in the literature.

Goals of Critical Data Literacy Practitioners

A first key goal that was identified was that the creators and educators aimed to *raise awareness and understanding* of how digital technologies function, including their shortcomings. Similar to the goals of (politische) Bildung, many aimed for critical and reflective, or even "systemic", understanding of how datafication transforms our societies on a structural level, rather than passing specific knowledge. However,

this perspective can be difficult to foster in reality due to learners' limited and instrumental understandings of digital technologies. Related to this, another key goal of the study participants was to promote *critical thinking* about data technologies and to support learners in *forming their own opinion*, for example by demonstrating how data systems already affect people in their everyday lives. Practitioners argued that this can increase learners' agency and empower them and might even help in dealing with fast-changing technology landscapes.

A strong emphasis was further placed on *encouraging learners to become active*. The majority of interviewed creators and surveyed educators wanted to enable people to take action, and similar prompts were found in two-thirds of the examined online resources. These are encouraging findings, as constructive next steps are thought to help avoid learners' resignation when learning about datafication and its risks. Moreover, informed participation in today's datafied societies and citizens' ability to make enlightened choices were repeatedly highlighted as crucial goals – thus seemingly calling for Mündigkeit as defined above, although without using this terminology. Yet, some participants viewed a changed behaviour as an unrealistic goal. Conflicting findings were further found on the question of whether critical education about data should foster people's *data usage skills* as well. Particularly the surveyed educators indicated similarly divergent perspectives on this as identified in academic critical data literacy discourses (see chapter 2.2): some aimed for critical education *through* using data while others saw practical data use as a hindrance or even a risk for critical reflection.

Another key finding was that *data protection advice constituted somewhat of a dilemma*. On the one hand, data protection skills were by far the most common form of practical advice across all stages of the research. The participants highlighted that "digital self-defence" can empower learners, foster their confidence and protect from resignation. On the other hand, many also stated that systemic solutions are needed and that individual approaches are unable to solve the issues around datafication, thus reiterating academic criticisms of a "small bandage approach" (Young and Pridmore Forthcoming). Moreover, many participants agreed that responsibility for data protection should not be shifted to individuals. Yet, the majority of analysed resources provided only individual data protection advice, and some educators indicated that the protection of one's data is up to the individual. Thus, finding a balance between empowering learners through digital self-defence while not making them feel responsible to solve systematic issues around datafication remains difficult.

Besides the popular data protection advice, several participants called to go *beyond skills* and to encourage learners to take *alternative and collective paths of action*. In particular, promoting political and societal action with learners was a common alternative approach. Moreover, some participants wanted to provide learners with a data language to enable them to better take part in public debates and to make their

voices heard or wanted to encourage people to imagine different data futures. The objectives of reaching people's "networks of literacy" (Carmi et al. 2020) and starting a "chain reaction" of critical thought (Markham 2019) were further identified in the empirical findings. Overall, the goal of supporting learners in actively shaping the digital society was identified repeatedly and in various forms, suggesting that many participants saw a *potential for change* in literacy education.

Online Critical Data Literacy Resources and Other Contexts of Teaching about Data

The study further led to novel insights on the under-researched field of online critical data literacy resources and the contexts in which critical data education is already fostered. Although topics around data are rarely included in curricula yet, the findings demonstrated that critical data education is *already taking place in various formal and informal education contexts.* Nevertheless, a clear need for a systematic education strategy for critical data literacy and updated curricula was identified. The study further highlighted that a *wide range of diverse online educational resources* about datafication already exist. Key findings on these resources were their various national backgrounds, their diverse creation contexts, and the many different design formats they applied. Moreover, some resources offered different sections for specific target groups or were provided in many languages. Another novel finding was that a large number of resources offered teaching and training material for educators. This suggests that critical research and increasing mainstream interest in topics around datafication is slowly 'trickling down', leading to a greater supply of teaching material on such topics. A comparison of findings on the resources with the surveyed educators' needs and wishes further showed that many of the examined resources already correspond with what the educators called for and saw as useful.

The study further identified different *challenges* when it comes to creating and using online educational resources about data. Divergent findings were identified on educators' satisfaction with their access to educational resources: some were overwhelmed by too many options, whereas others felt unable to find the resources they need. In terms of creating educational resources, *funding* was identified as a particularly difficult hurdle. Many interviewed creators had received project-based funding, which supported only short-term projects and did not allow for longer-term maintenance or updates of the resource. Partly for this reason, the *sustainability* of online resources emerged as another obstacle. With fast-changing technology landscapes, both the resources' content and their technical structure tend to outdate quickly. The findings identified different approaches to this challenge but did not reveal an ideal solution for this problem. The participants clearly called for more permanent funding, and one participant suggested that these resources should be seen as "unupdateable" and be systematically archived instead. Finally, the *evalu-*

ation of online critical data literacy resources was identified as another challenge. The creators highlighted that it is difficult to measure a resource's reach and usage while at the same time ensuring the users' privacy. Moreover, they outlined that evaluating success is a methodological challenge, as it is unclear how "learning success" of critical data literacy resources could even be measured.

Strategies for Practically Implementing Critical Data Literacy

A final set of findings provided new insights on practical strategies for teaching about datafication. A first key finding across all stages of the research was that there is *no one-size-fits-all-approach* to critical data literacy, but that target-group specific resources and teaching are crucial. Resources should, for example, be adapted to the narrative that their target audience holds about data, or try and find their "hook" – what societal or personal issues do these learners care about? However, this was not generally implemented by the examined resources, as most addressed broad groups, such as the general public. Only a third of the examined resources clearly addressed more specific target groups.

Another key finding was that most participants called for *easily accessible, interactive and involving formats* for critical data literacy resources. Interactive formats were overwhelmingly regarded as popular and well-working to engage learners, and they were identified in half of the examined resources in my study. Resources should further be easily accessible both in their content – for example by addressing complex topics in small steps – and in their format, aiming for maximum technological accessibility. Moreover, it was suggested that involving learners personally could help in addressing people's "issue fatigue", for example through connecting to people's personal experiences with data; including real-life stories and examples; or addressing real-life dilemmas around data systems. In all of these cases, the importance of considering representation and making sure the intended audience can identify with the material was emphasised.

Finally, the findings highlighted a controversy around the question of *how fun and light or shocking and scary* a learning resource about data should be. The majority of participants recommended colourful and fun resources, which are approachable, playful and entertaining, and they emphasised that learners should enjoy the experience. Furthermore, appealing visualisations were recommended for engaging people emotionally and fostering understanding of complex issues. Moreover, creative and tangible visualisations, such as the "data octopus" or "data monster" that were identified in the resource analysis, were recommended over stereotypical illustrations of data, such as zeros and ones. Many participants were convinced of such fun, light and entertaining approaches, and warned that overly pessimistic approaches may lead to resignation with the learners. Yet, this perspective was not unanimous, and some participants argued that fear can be helpful as it gets people's attention; that the right approach depends on the individual; or that shocking learners can be

beneficial since, as one participant put it, people can get to a story of hope through a story of fear. Thus, the question of how fun and light versus shocking and scary critical data literacy resources should be could not be settled entirely in my study, and the connections between positive or negative emotions and learning about data require more research in the future.

7.3 Contributions of the Study, Limitations and Future Research

Goals and Approach of the Study

Overall, the empirical and the theoretical research in my study provided many novel insights for the development of the critical datafication literacy framework, on the diverse contexts in which critical data education already takes place, and on online critical data literacy resources: what they can look like and aim for; who created them and with what goals and strategies in mind; and how they are being received and what can be learnt from educators. Thus, the three goals set out at the beginning of the study were reached: 1) an *in-depth theoretical framework for critical datafication literacy* was developed; 2) *critical data literacy practices* in the form of online educational resources about data were investigated; and 3) the new knowledge produced in the study was *mobilised for practitioners* together with the NGO Privacy International. A detailed report of how the latter goal was reached can be found in appendix IX.

In working towards each of these goals, the study took a *holistic approach*, continuously *interconnecting theory and practice*. The development of the critical datafication literacy framework was grounded in academic critical data literacy concepts, traditional education scholarship, and in the study's empirical findings on online educational resources and on the practices of creating and using these resources. The study's theoretical and empirical findings further continuously informed each other, with the theory guiding the selection of examined resources and the questions asked in the research, and the empirical findings shaping the further development of the preliminary literacy framework presented in chapter 3.4. Moreover, significant parallels between educational practice and academic literature were identified. In some cases, it seemed like the practitioners of critical data literacy were several steps ahead of the academic research, already implementing many insights from media literacy, Bildung and critical pedagogy, which are not usually taken into consideration by current academic critical data literacy concepts. This reemphasises the original idea behind my study: that much can be learnt from more established educational fields, but also from practitioners of critical data education.

The final stage of the study, the knowledge mobilisation project with Privacy International, took the interconnection of theoretical and practical knowledge particularly seriously. Knowledge exchange took place in several stages throughout the research, with the NGO acting as an advisor and providing useful feedback on differ-

ent methodological decisions. However, in the final knowledge mobilisation project, the NGO's decade-long practical experience in raising awareness and educating the public about risks surrounding digital technologies proved particularly beneficial. In close collaboration, we examined parallels and divergences between the NGO's experiences and my study's empirical findings on practitioners' year-long experiences in fostering critical understanding of data technologies. This led to many novel insights on best practices for fostering critical data education. To mobilise these findings and support educators, we developed the "Teaching about Data" resource (Privacy International et al. 2022). This website aims to provide educators with information and access to resources for fostering critical datafication literacy in practice (see appendix IX for more details) – thus addressing the need for more practical models on how to practically implement critical education about datafication (see below).

Contributions to Gaps in Academic Knowledge

All three stages of the study contributed valuable new insights to gaps in knowledge and in academic research. As outlined before, a more complete theorisation of critical data literacy is urgently required (Pangrazio and Sefton-Green 2020, p. 208). 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), 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. 2017b; Markham 2019). By developing the theoretical and empirically grounded critical datafication literacy framework, my study addresses these gaps in research and strengthens critical and reflexive approaches to data literacy. These perspectives still constitute an 'underdog' position in academic literacy conceptualisations and in educational practice, research projects, policy interventions and curricula. Yet, critical and systemic understanding of the way datafication affects citizens and society overall is indispensable for an informed citizenry in increasingly datafied societies.

The practices of critical data education constitute another under-researched area. Online educational resources about data are one of the longest-standing and most established approaches to critical data education and provide innovative, creative, diverse and often entertaining approaches to raising critical understanding of data. Nevertheless, these resources have only been examined in very few studies so far (e.g., Milioni and Papa 2019; Sander 2020c; Alegre 2021), and little is known about the many resources that already exist and the ways in which they educate about data. My study addressed this gap in knowledge by providing an extensive – albeit not representative – overview of existing resources and an analysis of their key characteristics; by examining their creators' goals and strategies; and by inves-

tigating how such resources are being received and used by educators and what can be learnt from educators' practices of teaching about data.

Another knowledge gap surrounding critical data literacy that has been highlighted by previous studies is the "absence of practical models" on how to implement critical data literacy into practice (Pangrazio and Sefton-Green 2020, p. 215). This is needed because the translation of abstract objectives of an academic literacy concept into "a practical model that can be operationalised by educators is challenging" (ibid., p. 211). My study aimed to address this knowledge gap by examining practices of critical data literacy practitioners – specifically in relation to online educational resources – and mobilising these findings in the form of a learning resource that provides educators with practical suggestions on why and how to educate about datafication, and how to find, use and create online educational resources for this (see appendix IX).

Limitations of the Study

Despite addressing these gaps in knowledge and research and producing many new insights, my study nevertheless came with limitations. A key limitation was that the study's findings are *not representative*. Although every stage of the empirical research aimed for a sample that is as wide and diverse as possible, the findings still – as is usually the case for qualitative research – cannot be generalised beyond the specific samples of resources, creators and educators examined in the study. Moreover, the study only examined resources that are *available online* (with only few intended for print-out or in-person use), although the surveyed educators emphasised that analogue resources are also useful in educating about digital and data technologies. Thus, it is unknown whether the study's findings on goals and strategies for critically educating about data would be similar if examining analogue educational resources or the practices and exercises used by educators in the classroom. More research on these areas of critical data education is urgently needed.

Related to this, the study has a *specific question focus*, aiming to learn about the goals and strategies of the resources, creators and educators in order to develop the framework for critical datafication literacy, and to be able to provide practical suggestions for the implementation of this framework for educators. By taking this perspective, other lines of questions that may have led to interesting insights had to be omitted. For example, it would have also been fascinating to learn more about how critical data literacy resource creators decide on the topics, examples and stories they use to illustrate the wide and complex topic area of datafication, or about the experiences educators may have with resignation and a feeling of powerlessness in their learners.

Finally, my study did not examine the actual learning outcome of any resources or education about data, but only the *intentions* of creators and educators. Thus, nothing can be said about how well the strategies that were identified work, and

if the goals for learners are being reached. This is a significant limitation of my study, as it allows no conclusions on the 'success' and the learning outcome of the educational approaches identified. For example, while the participants of my study overwhelmingly recommended interactive and fun resources, other scholars have warned that, particularly for young kids, gamified online tools with similarities to social media might be too thrilling and fun to evoke critical reflection (Pangrazio and Selwyn 2020). Ambiguities such as this should be further investigated in future research.

Ideas and Needs for Future Critical Data Literacy Research

Based on these limitations and the study's findings, several ideas, inspirations and needs for future research have emerged. Related to the previous paragraph, one major area that crucially needs more research is the question of the learning outcome of critical data literacy resources: do these approaches in fact achieve their goals in terms of understanding, critical reflection, and ability for action? Which strategies that the creators and educators outlined affect the learning outcome most positively? And how can this literacy and the learning outcome of critical data literacy efforts be measured? These questions were touched upon by my small prior study that examined how online critical data literacy resources affected university students' privacy attitudes and behaviour (Sander 2020a), but they urgently need to be researched more systematically and on a much larger scale.

Another area that desperately needs more research are critical data literacy practices beyond online resources. For example, traditional material such as books or worksheets could be analysed in terms of what type of data education is supported and how critical datafication literacy could better be promoted through these formats. Equally, learning more about educators' practices in the classroom when educating about data would be highly interesting. Furthermore, less formal educational approaches such as museum exhibitions, theatre plays, board games, role plays or even data activism projects constitute inspiring formats that are already used to educate about data as well, but that are not yet thoroughly researched.

Moreover, both the creators and the educators that participated in my study called for a more systematic approach to critical data education and for changes in curricula to include these topics. In order to achieve such a more systemic education strategy, however, we first need more research on what works well in fostering critical understanding of datafication. This study's findings provide valuable first insights on goals and practical strategies for critical data literacy along with detailed findings on online educational resources about data, but they focus on only *one way* of educating about datafication and are not representative. Thus, more, and more systematic research on different approaches to promoting critical datafication literacy in various educational settings is needed as a basis for policy interventions and updated curricula. As other scholars have highlighted, simply tasking educators

with the responsibility to address the systemic challenges around datafication is misdirected as also legislators and regulatory authorities need to act (Livingstone et al. 2022, p. 197).

Overall, it can be said that critical data literacy constitutes a young research field, which still has more questions than it has answers, but which will only gain in importance and relevance over the coming years. This study hopes to open up a more in-depth academic as well as practice-oriented discourse about what kind of critical data education we need, and how we can critically educate about the ways in which datafication processes are affecting our societies, economy, politics, and our personal lives and social relations. It provides a theoretical conceptualisation for such critical datafication literacy together with empirical findings that it is hoped are useful for future academic research, and for practitioners who are already taking on the difficult task of promoting critical understanding of datafication in their educational work.