

Teenagers and the data economy: understanding their *dreams*, *desires* and *anxieties* with metaphor workbooks

SAMUEL BARNETT
sam_barnett@sfu.ca

WILLIAM ODOM
wodom@sfu.ca

SAMIEN SHAMSHER
samein_shamsher@sfu.ca

School of Interactive Arts & Technology,
Simon Fraser University,
Surrey, British Columbia, Canada

ABSTRACT

Teenagers are in a unique position, having known no other reality than the current exploitative model of the data economy, and are particularly at risk of harm from it. Using a classroom intervention with 31 Grade 9 students, we deployed co-created Metaphor Workbooks as a tool to foster critical and reflexive thinking about their phones and data. Our research advances the HCI community's understanding of teenagers' entanglements with the data economy, by highlighting how they experience it through their critical, reflective, and creative responses. This alludes to ways in which future initiatives could better support teenagers in developing a critical relationship with data. We identify key gaps in their understanding of the data economy and emphasize the need for critical data literacy interventions to address their limited understanding, complex emotional relationships with their phones, and the pervasive influence of technology addiction narratives.

AUTHORS KEYWORDS

Critical Data Literacy; Teenagers; Data Economy; Creative Practice; Metaphors; Personal Data; Surveillance Capitalism;

CSS CONCEPTS

•Human-centered computing~Interaction design•Social and professional topics~User characteristics~Age~Adolescents•Human-centered computing~Human computer interaction (HCI)

CC-BY 
This work is licensed under Creative Commons
Attribution International 4.0.
DIS '25, July 5-9, 2025, Funchal, Portugal
© 2025 Copyright is held by the owner/
author(s).
ACM ISBN 979-8-4007-1485-6/2025/07.
<https://doi.org/10.1145/3715336.3735435>

INTRODUCTION & BACKGROUND

We are tracked and surveilled in our everyday interactions by the digital products and services that populate our lives. Data generated about us shapes us in a myriad of ways — how we see the world (e.g., filter bubbles [5], polarization [71]), how we experience our felt environment (e.g. consuming all of our capacity for attention [19], stimulating emotional responses [30]), the opportunities that are available to us (e.g. whether you are a target for advertisements for university admissions [35] or employment [20]), or the way that society treats us (e.g. predictive policing [25] or redlining [44]). This is the data economy, described by Zuboff as an “economic order based on the dispossession of human experience as a means to the prediction and control of human behavior for others’ profit” [70].

Teenagers are in the unique position, having known no other reality than this current exploitative model of the data economy. They are deeply engaged in constructing their identities, which often involves consuming large amounts of media and exploring how technology and digital services can be used to develop, manage, and express their sense of self, and imagine their future selves [27, 46, 60]. Driven by their developmental need to socialize with peers, teenagers increasingly turn to online platforms to fulfill this requirement; however, these online interactions often fail to meet their social needs [59]. Teenagers are often at the forefront of adopting emergent technologies, where their behaviors and social customs are influenced by these technologies [4, 61], making them susceptible to manipulation through their data [11, 57]. These activities are situated within and mediated by the data economy, and as such, uniquely impacting teenagers through surveillance capitalism and leaving them largely powerless to exert agency over their environment [51].

Understandably, the effects of these processes on teenagers are becoming an increasing concern [21, 48, 51, 57, 62, 64], with some governments and other state actors adopting prohibition-style interventions to try to limit teenagers’ access to technology or social platforms. In Australia, a landmark law set to take effect in 2025 will prohibit teenagers under 16 from holding social media accounts, placing the onus of enforcement on technology companies [23].

While the potential impacts remain uncertain, critics worry this could do more harm than good by isolating at-risk teens from their online communities and diminishing the mobilizing power of youth [23]. New York has adopted a slightly more nuanced approach, where by default, youth under the age of 18 should only experience content on social media from accounts that they follow, in chronological order [13], harkening back to an earlier era of the Internet. Phones, as teenagers’ primary interface with the data economy, are increasingly scrutinized for fostering addictive behaviors that contribute to issues like loneliness and disruptions in daily life and relationships [36]. While legislating technology platforms to prioritize the well-being of teenagers is an important approach, the Office of the Privacy Commissioner of Canada argues that we also need to “empower them with the knowledge and agency to navigate digital platforms and manage their data safely and with autonomy” [48]. This pressing context motivates our research, which seeks to contribute new insights into how teenagers understand themselves and their experiences in relation to the data economy. Additionally, our research responds to calls for further investigation into how best to support teenagers becoming “informed and agentic data citizens” [50].

How do teens understand the roles that personal data and data economy plays in shaping their lives? How do they perceive, interpret, and respond to these mediations? And, how are teenagers’ dreams, desires, values & anxieties entangled with the data economy? In exploring these questions and presenting findings from our ongoing work, we leverage the visually-oriented pictorial format to foreground teenagers’ voices, both through their creative work and reflective writing.

In our research, we draw on emerging work that explores *critical data literacy* as a new way of teaching and engaging high school students with digital data and the data economy. Critical data literacy broadly aims to “prepare people to ask the critical questions of data, such as how it is constituted and collected, who it benefits, and how these process might be reimagined” [52]. The application of critical data literacy in an education context is nascent and emerging. Early findings have shown success in facilitating critical conversations about data, the self as data, and

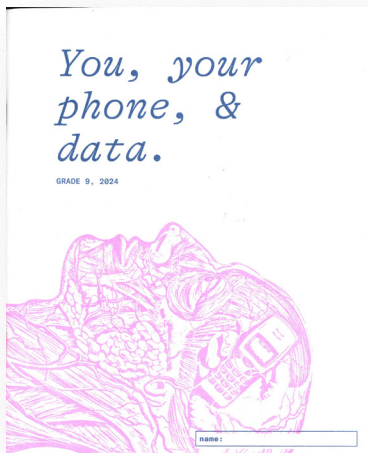
algorithms [3, 51]. In Canada, current resources for teachers seeking to introduce critical data literacy into their classrooms take what could be referred to as a ‘harm reduction approach’ to digital content and platforms [7, 39] which mirror broader trends across a variety of educational contexts [26]. Students are taught how to protect themselves in online spaces from cyberbullying and from the harm that could occur should they post inappropriate or personal content online. There is also an extended focus on identifying biased or fake information through the teaching of simplified forms of journalistic practices including checking sources and reading laterally [38]. While these skills are practical, current resources remain underdeveloped with regards to supporting teenagers’ agency and social identity within the data economy and lack meaningful integration into existing content and curricular goals for teachers.

This pictorial reports on a classroom intervention with 31 Grade 9 students (14–15 years old), spanning five consecutive 70-minute English classes, using the data economy as the context to teach the rhetorical concept of metaphor. This work is part of a multi-year co-design research project at the intersection of co-speculation, teenagers, and the data economy. We are exploring how teenagers can be supported to develop critical awareness and understanding of systems in which they are engaging and acquire more agency to operate within and perhaps challenge these systems. We collaborated extensively with a high school teacher and design researchers, iterating our workshops and activities through two prior summer schools, before ultimately arriving at the final design of the metaphor workbooks used in the classroom intervention.

Our research makes two contributions. First, it advances the HCI communities understanding of teenagers’ entanglements with the data economy, foregrounding how they experience it through their critical, reflective, and creative responses, alluding to the ways in which we could and should support teenagers in developing a critical relationship with data. Second, we offer the Metaphor Workbook as an alternative research outcome [45, 65, 66] (attached as a supplementary material with this publication), which itself is available to be mobilized more broadly.

DESIGN RESEARCH APPROACH

Methodologically this research is grounded in research-through-design [16, 67, 68], and employs a co-speculative collaborative design research approach that prioritizes the perspectives and lived experiences of individuals [9, 63]. Speculative design is a form of design that is intended to create discourse and catalyze conversations on what preferred futures might be, and what they are not, as well as questioning present societal norms and technology [1]. Co-speculation has been demonstrated to be successful in the context of teenagers and the data economy, supporting the articulation of preferred futures, and an increased sense of agency [28, 47, 64]. It is also used as a tool to prompt critical reflections on one's use of technology from research participants [6, 47].



CREATIVE PRACTICE, REFLECTIVE LEARNING & THE CHALLENGES OF WORKING WITH TEENAGERS

Central to this exploration and use of co-speculative methods is the development of tools that utilize creative exploration and output by participants as a means of: surfacing tacit knowledge of the data economy, scaffolding core elements of critical data literacies, and generating reflective thinking-through-making [58] that deepens personal understanding of these issues. The kind of reflective practice that accompanies creative endeavors has been shown to enhance emotional intelligence among individuals [17], leading to an increased self-awareness regarding emotions, moods, and drives, suggesting a reciprocal rela-

tionship between emotional intelligence and reflective practices. This is particularly relevant for teenagers who are in a critical developmental stage where self-awareness is essential for emotional regulation and identity formation.

Moreover, teenagers are complex research participants. Beyond the challenges of recruitment, which often requires establishing trust within diverse communities [2, 15], the research methodology needs to be carefully considered, as teenagers tend to provide monosyllabic or vague responses to interview questions [2]. Working with teenagers in a school setting also presents unique challenges. Their behavior can be significantly affected by the presence of their peers, leading to potential peer pressure and conformity. Further, the teacher-student relationship can impact the power dynamic between researchers and participants, making teenagers more likely to respond in ways they think are expected rather than expressing their true opinions [15]. These potential limitations, arising from conducting research in contexts where teenager's autonomy is constrained, are real and important to acknowledge. Yet, prior work has shown that they can be somewhat mitigated by participatory research approaches that draw on co-speculative and creative practices that empower [56]. Creative expressions have been shown to be an effective way to glean insights into participants understanding of complex digital systems [14, 29]. Storytelling has a demonstrated history in HCI as a tool to understand teenager's entanglements with technology [14] and creative writing has been shown to facilitate emotional processing among young people [53]. The process of articulating feelings through creative outlets aids in a deeper level of self-reflection, allowing teenagers to navigate and communicate their emotional landscapes more effectively.

ROLE OF METAPHORS

We see metaphors as a powerful tool for developing critical literacy of data, and as a medium through which we can begin to understand how teenagers experience their entanglement with the data economy. Lakeoff and Johnson argue that metaphor is more than merely a rhetorical device, but "is one of the most basic mechanisms we have for understanding our experience" [32:212]. They see the conceptual system through which we understand and engage with the world as being inherently metaphorical, and as such "the

way we think, what we experience, and what we do every day is very much a matter of metaphor" [32:4]. Thus, the simple action of making comparisons between two unlike things not only creates social realities but can be a tool to understand everyday experiences and, through imaginative and creative processes, express alternative or unknown experiences and contexts. In light of this, the role of metaphor in shaping prevailing societal narratives about teenagers and their phones is an emerging area of research [33, 42]. While, in the context of our intervention, metaphor supports students in re-examining common experiences and actions—forcing them out of familiar patterns of seeing—to establish the conditions for critical thinking and learning.

CO-CREATING THE CLASSROOM INTERVENTION & METAPHOR WORKBOOK

This research is the result of an on-going multi-year research project that began in 2022 with the creation of a metaphor-based card game that utilized lo-fi personalized data-tracking, and the creation of new technology metaphors to teach high-school students about existing privacy issues within the data-economy. This card-game was developed collaboratively with teens and designers and deployed in 2023 as part of a full-day workshop within an experimental summer school program, jointly run by Simon Fraser University and a public school district in the Greater Vancouver area in British Columbia (BC) Canada, for teenagers in Grades 9 to 11. The feedback and results from this initial workshop were then extended and collaboratively redesigned with a Grade 9/10 High-School English teacher to create a series of modules for a 1-week workshop that critically examined the use of metaphors within the data-economy for a subsequent summer school in 2024.

Drawing on what was learned from these early workshops, we continued to collaborate with the teacher to co-create a classroom intervention spanning five consecutive 70-minute classes centered around the Metaphor Workbook, which we report on in this pictorial. Metaphor emerged through our co-creation process as the core framework of our intervention, as it builds on a trajectory of prior research that mobilizes metaphor (e.g., [10, 43, 55]), and facilitates the instruction of metaphor, which is a curricular requirement. As such, the intervention is designed to integrate into the existing English 9 curriculum, where the

data economy is used as the context through which we teach the concept of metaphor. We employed a variety of creative outputs and scaffolding [49] including visual cues, playful sentence-stem questions, and emotion wheels, combined with direct instruction on the use of metaphor as a rhetorical tool, to generate reflexive creative outputs in a variety of forms.

We designed the Metaphor Workbook to invite engagement in the classroom intervention through its novelty and approachability. The workbooks were intentionally crafted to be radically different—both materially and aesthetically—from the standard classroom materials teenagers typically encounter. We employed playful and evocative phrasing and graphics. We RISO printed them with bright, smudging inks on slightly heavier paper, which provided a tactile quality that encouraged interaction. The typography and graphics were carefully designed to evoke a DIY, photocopied aesthetic, creating a sense of playfulness and imperfection. This approach aimed to make the workbooks approachable and inviting, rather than overly polished or intimidating. The workbooks were deliberately designed to be written in, pasted into, and personalized, ensuring that students felt comfortable modifying them—we wanted them to be appropriated. This design choice was reinforced by the deployment of two forms of collage in our intervention, which has a low barrier to entry and has been shown to facilitate thoughtful, reflective responses in teenagers within HCI contexts [37].

In this research, we use the phone as a proxy for the data economy. Through their phones, teenagers knowingly and unknowingly engage with the data economy, through features such as social media algorithms, personalized recommendations, and targeted advertisements. This collective examination of a single artefact—and its multiplicity of entanglements—borrows elements from Haraway’s “implosion” method [12] and seeks to aid in developing both the literacy and knowledgebase needed to develop meaningful creative outputs for reflection, while subtly embedding research questions related to teens understanding and entanglement with the wider data economy.

Classroom Intervention

On Day 1, teenagers completed a short self-assessment survey on phone usage, leading into small group discus-



sions about dependence. They then worked in these groups to respond to worksheet prompts that began scaffolding critical thinking about how the phone shapes everyday experiences through data.

On Day 2, we introduced similes as a rhetorical concept. Teenagers created similes using animals' attributes to explore their relationship with their phones. They illustrated their similes as shadow chimeras using black animal silhouettes and charcoal.

On Day 3, teenagers wrote reflections on their artistic expression from the previous day, explaining how they represent their relationships with their phones. They also wrote short statements about how they felt carrying this creature in their pocket.

After exploring data's role in recommendation algorithms and ads, we did a scaffolding activity on emotional associations with the phone and the actions that can be taken through it. Students created metaphors that captured an action that they do with their phone with their emotional associations embedded within it. They illustrated these metaphors through collage and wrote short reflective descriptions.

On Days 4 & 5, students finalized their collages and answered the following written reflection questions:

1. In what ways do you control your phone, and in what ways does your phone control you?
2. How do you feel about your relationship with your phone? Is there anything you would change if you had the chance?
3. How do you define the word "data?" How does your phone use data?
4. If you had to offer advice to future generations about cell phones, social media, or data, what would you tell them?
5. Imagine the "Shadow Creature" you created came to life. Compose a short scene perhaps a scary or funny scene! describing what it would say or do.
6. What did you enjoy about this unit? What would you like to add or change?

RECRUITMENT & ETHICS

This intervention, designed and run in collaboration with an English teacher, aimed to support students to develop critical data literacy, while also facilitating research on teenagers' entanglements with the data. It was conducted in three Grade 9 English classes, with 31 students giving informed consent to be research participants. Within the framework of our ethics approval from Simon Fraser University's Research Ethics Board and the school district, we

were limited to taking field notes and reviewing the student's work.

The catchment area for the public high school where the study took place is highly diverse, with a significant immigrant population—more than half of the population in the school's catchment area are first generation immigrants to Canada and three quarters of the population are visible minorities. Clearly our study population is not representative of all teenagers, yet our participant sample is notably diverse.

ANALYSIS

In this pictorial we analyze a subset of the data collected through the metaphor workbook. Specifically, we focus on the metaphors teenagers created to represent their phone use, the accompanying descriptive narratives, and the collages they constructed to visualize these metaphors (Day 3 and 4). Additionally, we analyze written responses to the first 4 reflective prompts completed at the end of the unit (Day 4 and 5).

Researchers took field notes during each classroom session. Field notes were reviewed immediately following session, and tentative insights were noted in reflective field memos [18]. Analysis of the data produced in the metaphor workbooks was an ongoing process. We conducted a preliminary analysis, searching for emergent, stabilizing, and shifting patterns across our data to draw out underlying themes [40]. The 31 workbooks were reviewed and then coded by two members of the research team, using a hybrid approach involving first deductive and then inductive coding. With inductive coding, we examined the participants' workbook responses without predefined categories, identifying creative products and written responses, and forming themes based on recurring ideas. For deductive coding, we applied predefined categories, such as "perceptions of data" and "perceptions of control" to identify data that fit these existing themes. We held weekly meetings that lasted 2 hours over several weeks to review and discuss themes in our analysis. We also created affinity diagrams to model connections and differences among participants. Ultimately, this process yielded three main themes: attunement to data & the data economy, processes of shame, and positive entanglements with the phone & data.



P28's mythical shadow animal glued over their written responses. Teenager's dissected and combined laser cut animal cutouts to create their own chimeric creatures that represented their relationships with their phones.



P30's mythical shadow animal. P30 made liberal use of charcoal and its traces run through all pages of their workbook.

FINDINGS

THEME 1: ATTUNEMENT TO DATA

Many teens expressed awareness of how their phones collect and generate data about them to personalize ads and recommendations, and some were able to highlight the influence this has on their experiences. This is exemplified in P32's response, which clearly states that "data means information" and that their phone uses data to "give me specialized ads, sell it for money, and recommend me things". P4, on the other hand, explained this through a personal example of how listening to KPOP and searching for it, causes KPOP to be recommended to them in other parts of the internet that they navigate.

In their responses some teenagers indicated these processes as a positive element, appreciating how algorithmically curated feeds would surface new content that they liked. P30 describes this as:

I would define data as having my personal information and tracking me. My phone uses my data by tracking and changing the ads and reels to something I personally like.

Others pointed to the consequences that they experience from the outcomes of the analysis of their data, particularly in terms of making it harder to disengage. One teenager explicitly pointed to the challenge of trying to have agency over the collection of their data: "I control my phone by not accepting cookies, my phone controls me by collecting my data" (P11).

It was also identified how engaging with content, creates a feedback loop that surfaces more of the same, which P1 illustrates the harms of in their metaphor "Anguishing View". This teenagers' experience is emblematic of how social media recommendation algorithms function in relation to their age group and mental health. These algorithms identify and react to age and mental health-related cues, often amplifying the amount of distressing content shown to teenagers exhibiting signs of depression [22].

However, many teens also demonstrated a lack of awareness and understanding the ways in which they are entangled with the data economy through their phones.

When probed explicitly on what data is, at the end of the intervention, a theme of confusion emerged from some teenagers. Students who had otherwise responded creatively and critically throughout the five days, were unable to translate this critical reflexivity into a coherent written statement. However, this limited ability to articulate a definition of data in their writing, was not always an indicator of a lack of understanding as the same teens demonstrated unique, situated knowledge of data through their creative metaphor work. For other teens, however, "data" was primarily understood to be mobile internet, or "wifi on the go" (P13) or "backup wifi" (P5).

The findings from this section begin to suggest a lack of understanding of data due in part to its intangibility, opaqueness, and the passive nature of teenagers' engagement with the data economy.



METAPHOR:

"too much information can make the data spill out of the screen" **P11**



METAPHOR:

Anguishing View

"Every time I scroll something messed up or heart break will always pop up, and when it does I watch it, then shows me more which is painful to see." **P5**

"I define 'data' as mobile internet, like mobile data. I don't really know what it means." **P15**

METAPHOR:

Tired Eyed Scrolling

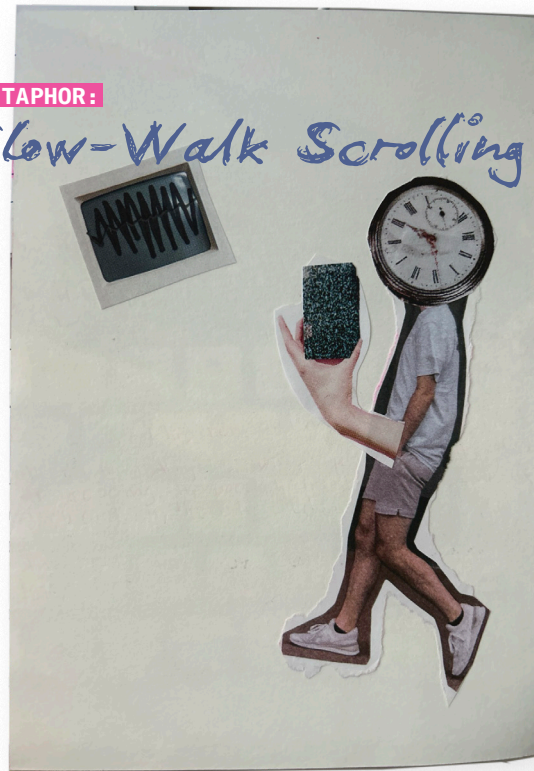
"I am tired at night scrolling." P13



"When I'm scrolling videos, it feels like I'm absorbed into it like a magnet and can't stop scrolling." P5

METAPHOR:

Slow-Walk Scrolling



"I walk really slow when I'm watching on my phone and I slow down because I'm too busy scrolling on reels to pay attention to where I'm walking." P2

THEME 2: PROCESSES OF SHAME

Addiction emerged as a pervasive theme across teenagers' responses, with participants identifying how their phones influenced their emotions and daily activities. While some acknowledged the benefits of their devices, most expressed a sense of being overwhelmed or trapped by their usage patterns. This sense was often described in embodied terms, with students highlighting physical sensations associated with their inability to stop using their phones.

Loss of control

For many students, phone use felt involuntary: "Every single time I continuously scroll it feels like I'm hypnotized and confused" (P14). For others, like P4, the experience was described as occurring against their will: "I sometimes feel like it's making my eyes tired, and I'm forced to watch the videos." This loss of agency extended beyond emotional exhaustion to physical manifestations. One teenager likened their experience to being physically pulled into their device: "It feels like I'm absorbed into it like a magnet and can't stop scrolling" (P5). These descriptions point to the relationship between elements in the apps that teenagers are using which are designed to maximise attention — such as infinite scrolling and algorithmically curated content — and their feelings of entrapment.

Teenagers also connected the habitual use of their devices to negative outcomes in their everyday lives, particularly how it interfered with their sleep. P16 explained: "Whenever it's late, I go on my phone or stay on my PC, and even when I get tired, I keep scrolling until I fall asleep." This experience mirrors literature which links teenagers' social media usage and device usage with reduced sleep quality [31, 34]. Additionally, the excessive use of devices often disrupts their ability to focus on schoolwork and impacts their grades, as seen in P24's reflection: "This bad habit led me to make mistakes, fail assignments, get a lower grade, asking for extension, and makes you unproductive." Notably, P13's metaphor collage Slow-Walk Scrolling illustrates how they walk slowly, because they're absorbed in watching short-form videos.

Struggle for agency

This theme also emerged when teenagers discussed their desire to self-regulate the usage of their phones. Attempts to claim agency were often framed as acts of personal resistance against design patterns intended to spark or maintain engagement—a desire to not let “your phone control you” (P3). The following two quotes (P21, P22) illustrate the emotionally charged nature of this, and in the case of the latter, the complexity of their relationship with their phone:

I control myself from not using by just knowing that if I use it, it will only hurt me, and my phone can control me only when I wait for a notification.

I feel like the phone is the most important object to me. If I could change, I would try to get me a daily limit for how long I can use it.

P4 provides the following advice for future generations:

I would tell them that whenever they feel forced or stuck on their phone it's better to just shut their phone down immediately and take a break from it. I would also tell them that their phone is just a dead thing. It can't be alive. It's them who have the power to control the phone because they're humans, but it is their choice to let the phone control them and it will lead to addiction, or they don't let the phone control them.

It is important to view this desire for agency in context—the online platforms that teenagers are interfacing with are designed to use data to increase engagement. Teenagers are also more susceptible to manipulation from data-driven systems [57], and their developmental needs for socialization is turning them to these platforms [59]. These findings map to a broader context where recent studies have shown that half of teenagers have attempted to reduce their phone use through various means and been unsuccessful [69]. Only two participants identified that their battle for control is bigger than the device in their hands.

METAPHOR:

Hypnotized scrolling



"every single time I continuously scroll it feels like I'm hypnotized and confused" **P16**

Guilty/Addictive Liking

METAPHOR:



"I would change the way I get addicted to my phone. I let my phone control me with its interactive apps which include doom scrolling." **P17**

"My collage is supposed to show how I surround myself in things I don't like for no particular reason how I put in this much effort for things that anger me. I know I should just stop but I can't." **P15**

P11 expressed a desire for the dark pattern of infinite scrolling to be removed, while P31 clearly identified that this was bigger than their own personal failings: "I wouldn't want to change my relationship with my phone so much as I would rather change the world's relationship with social media".

Guilt & an addiction narrative

For many participants, their practices with their phone were a source of guilt and self-blame. They saw their inability to manage their screen time as a personal failing, often expressing disappointment in themselves for prioritizing social media over more productive activities.

One participant captured this internal conflict succinctly: "I feel guilty and disappointed at myself for just scrolling through social media continuously rather than just doing something productive like studying but I can't stop as it is addicting" (P8). Another highlighted the tension between enjoying social media and the regret that follows: "Sometimes I feel good with my phone. I feel happy, scrolling and laughing across shorts. However, I sometimes feel guilty for being controlled by the very thing I wanted to control. I just wish I were not so addicted. It's like a drug." (P24).

In our findings, we emphasized responses connected to affect and embodied experiences. However, it is noteworthy how frequently teenagers framed phone use in terms of addiction, mirroring societal narratives. Almost all participants described their phone habits negatively, often associating them with addictive behaviors, a trend observed in prior studies that highlight the influence of the addiction narrative in shaping perceptions of device use [33]. For instance, in response to Question 4, "If you had to offer advice to future generations about cell phones, social media, or data, what would you tell them?", many students advised against becoming "addicted." This aligns with a broader cultural discourse that views extensive phone use as inherently problematic [33, 42]. As one teen noted, "Don't use it too much because it is bad for your eyes, and don't let your phone control you" (P3), or another (P30) who gave the advice:

I would tell them to be more positive because many depressed kids go on social media to pass time. I would also tell them to be more careful since there are a lot of predators online.

These responses illustrate how teenagers internalize and reproduce dominant narratives, even when specific harms remain vaguely defined.

In sum, the findings within this theme, highlight how data-driven design features not only shape what teenagers engage with and are exposed to, but also influence their sense of autonomy, socialization, and how they move through and experience the world around them.

"My relationship with my phone is good and just addicting. I would change my battery capacity, because it's very bad."

P21



"I feel guilty and disappointed at myself for just scrolling through social media continuously rather than just doing something productive like studying but I can't stop as it is addicting."

P8

THEME 3: POSITIVE ENTANGLEMENTS WITH THE PHONE & DATA

While much of the discussion centered on the negative aspects of phone use, some teenagers also expressed positive experiences with their devices. These responses highlighted the nuanced role of phones in their lives, pointing to moments of joy, emotional regulation, and a deep sense of attachment often portrayed through personification.

For some participants the sense of joy they experienced while using their devices emerged from the discovery of new content facilitated by recommendation algorithms. While for others, this sense of joy derived from their anticipation and enjoyment of sharing the content they had discovered. This is captured in P3's metaphor, Excited Scrolling at Night, which they describe as:

*I scroll through social media at night before sleep.
Excited to share funny things with friends.*

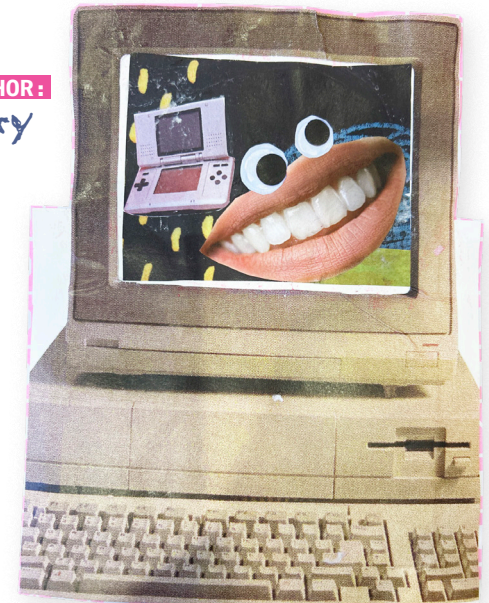
Some teenagers acknowledged the value of algorithmic curation in supporting their emotional well-being. P10 described how personalized content helped them manage negative emotions:

The posts I see online can be what I am interested in. For example, an idol I like, music, and other things I am into. If I keep scrolling and continue finding posts that pique my interest, then I get calm and everything that didn't make my day good gets turned into something calm and peaceful.

Again, while most participants described a negative emotional association with their phone, this was by no means a universal experience. These responses highlight the complexity of teenagers' relationships with their phones, and through them, the data economy.

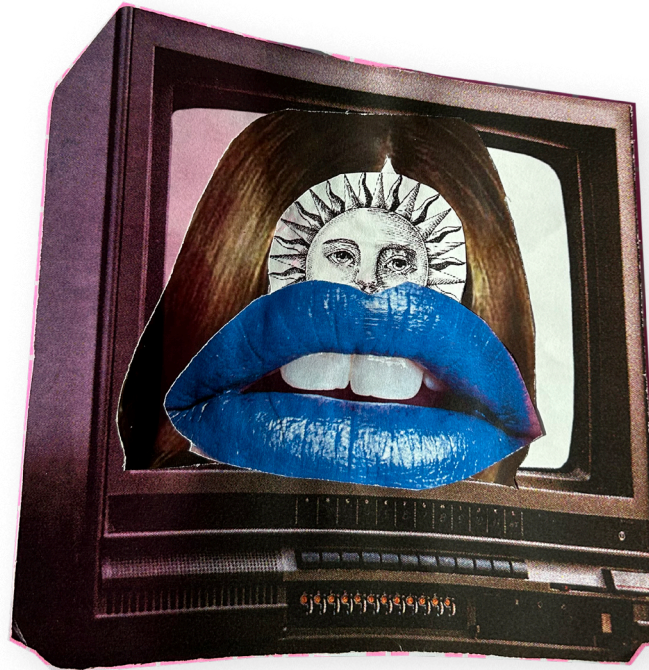
Joyful Discovery

METAPHOR:



*"When I am using social media,
I like to find interesting things
and I always make fun or joyful
discoveries."*

P26



METAPHOR:

*I admire my phone like
a baby with candy*

P6

Personification

Teenagers also expressed a notable dependence on their phones, often framing this reliance in positive terms through the attribution of human-like qualities, which emphasized the depth of their emotional attachment. This connection is encapsulated in P15's reflection: "It feels like we're co-dependent, but we also rely on each other." P6 reinforced this sentiment with a playful metaphor, comparing their admiration for their phone to "a baby with candy," highlighting the joy and their attachment to it. Similarly, P10 described their phone as "a little puppy following me around," illustrating its constant presence and how it is perceived as a companion. These reflections underscore how phones are deeply integrated into both the functional and emotional aspects of teenagers' daily lives.

METAPHOR: Peacefully Liking



P10

"My relationship with my phone is like having a sibling. My phone likes to be stubborn from time to time and I cannot do anything about it but complain."

P17

DISCUSSION

RESOLVING TEENAGERS' LIMITED UNDERSTANDING OF THE DATA ECONOMY

Our findings reveal a disparity in teenagers' understanding of the data economy. While some participants demonstrated an awareness of how their data shapes their experiences—such as through personalized recommendations and targeted ads—many struggled to articulate or grasp the mechanisms behind these processes or even indicate a sensitivity to data at all. For instance, some equated "data" solely with mobile internet or Wi-Fi, highlighting a significant gap in foundational knowledge about how their interactions with digital platforms—mediated by their phones—exists within the broader context of the data economy.

This limited understanding manifested in distinct two ways. For some teenagers, a sense of hopelessness emerged where they were unable to change their behaviours associated with their phones. These teens broadly considered this as a personal failing, without associating their struggles with the data driven design features and algorithms that were keeping them engaged. Alternatively, a naivety about the nature of the phone as a conduit to external forces led them to mythologize their phones, considering them as companions with which they were emotionally intertwined. This personification was evident in responses where participants described their phones as co-dependent partners, pets, or objects of admiration.

These findings point to a need for interventions that demystify the phone and the influence that data and algorithms have on their experience. For example, emerging initiatives and digital applications visualizing the multitude of third parties that 'follow' a user's digital movements through the Internet (e.g., [24]) could be leveraged to offer increased transiency to teenagers. There is also an opportunity for researchers to operationalize and extend existing concepts in HCI research that support critical understandings of the data economy in future work. A clear example of this would be Pierce's generative concepts of Digital

Leakage, Hole-and-Corner applications, and Foot-in-the-door devices, that interrogate the creepiness and social acceptability of technologies [54], and are rich metaphors ripe to be explored through creative practice. While highly relevant to teenagers, these concepts and interventions did not emerge with them in mind. They will require more than translation; they will require direct dialogue and co-design engagement with teenagers to develop resources that mobilize these concepts.

There is also a clear and critical need to continue the trajectory of research [3, 51] into how to support the development of critical data literacy among teenagers in classrooms.

THE INFLUENCE OF THE ADDICTION NARRATIVE

The almost universal references to phone addiction amongst the participants, whether self-identified, or attributed to the behavior of others, highlight the pervasiveness of the narrative of phone addiction. This narrative, as Lanette et al. argue [33], is driven by sensationalist media negatively framing teenagers' use of their phones (see also [42]), which contributes to feelings of shame and guilt, and promotes impractical solutions such as total abstinence. Our findings show that teenagers frequently expressed guilt over their usage habits and they proposed self-regulation strategies that placed the burden of control solely on themselves without considering the influence of systemic factors. These responses reflect a societal framing of device use as a personal failing, diverting attention from the systemic design features and dark patterns—like infinite scrolling and algorithmic recommendations—that foster compulsive behaviors. This underscores the need to develop counter-narratives that shift the focus from individual blame to broader structural influences, which would empower teenagers to critically evaluate the external forces shaping their interactions with technology.

Future research and practice initiatives in this space would benefit from looking into language and perspectives which take a holistic, somatic, or systems-based approach to understanding addiction. For example, in a trauma-

informed perspective, individuals are asked to reframe common moralistic patterns of language such as 'problem behaviors', 'disorders' and 'symptoms' to ideas of responses and adaptations which foster a greater sense of agency for those seeking treatment. Thus, through this trauma-informed lens, questions shift from "what is wrong with this person?" to "what is happening or happened to this person?" which itself can be extended out to questions of institutional or systemic abuse [72]. The HCI community has already begun operationalizing trauma-informed perspectives [8], which suggests opportunities to bring this critical reframing—and catalysts for counter-narratives—into the context of negating the influence of the phone addiction narrative with teenagers.

The ways in which teenagers experience, internalize, and respond to narratives about their phone use and the data economy are likely shaped by regional media, cultural attitudes, and levels of regulatory oversight. Contexts with stringent, top-down legislation, such as Australia's forthcoming restrictions on teenage social media use [23], or British Columbia's phone ban in schools [41], may create different pressures and anxieties when compared to more open societies with limited oversight or governance of the data economy. This suggests the critical need for multiple individual and multi-sited comparative research projects by the HCI community to help us better understand the experiences of teenagers living in different geo-socio-economic-political contexts.

This research also highlights the need to approach interventions with teenagers, as a vulnerable population, with nuance and empathy to avoid exacerbating feelings of guilt and instead fostering a critical engagement with technology.

ON THE DESIGN OF METAPHOR WORKBOOKS

We found the Metaphor Workbooks to be highly effective in using creative practice for supporting critical, reflective thinking in relation to the data economy among teenagers in classroom environments. The qualities of RISO printing and DIY design aesthetic invited teenagers to make

them their own. One student received a workbook that was bound incorrectly, with pages out of order and some upside down. They refused to swap it for a normal booklet, instead wanting to keep it as uniquely theirs. Another student glued their collage over their written responses (see page 3), making the choice for themselves regarding what work would be reviewed and what would be hidden. The students' responses in these booklets were generative and in places demonstrated critical reflexive engagement. This approach successfully navigated some of the challenges of working with teenagers as research participants, particularly in the contexts where they have constrained autonomy such as the classroom. We also see opportunities for the Metaphor Workbooks to be adapted to more informal environments, such as workshops, study groups, youth groups, and camps.

CONCLUSION & FUTURE WORK

This research advances the HCI community's understanding of how teenagers perceive and experience their contemporary entanglement with the data economy. We highlight critical gaps in their awareness of data and the implications of these gaps, alongside the pervasive negative influence of addiction narratives.

Our work also contributes the Metaphor Workbooks as a resource for cultivating critical and reflective thinking about the data economy with teenagers. In our future work, we plan to continue iterating the Metaphor Workbook designs as we adapt them to work with diverse youth populations and educational contexts, including rural and homeschool settings. The Metaphor Workbooks also exemplify how creative practices such as metaphor can be generatively operationalized in data-oriented high school interventions. We see strong opportunities, beyond the realm of metaphor, to continue co-designing, with teenagers and teachers, creative practices employed to develop critical data literacies. More broadly, our research takes a critical step toward building educational and pedagogical resources that can be deployed by teachers and educators in schools or community contexts to empower teenagers with greater agency in the data economy.

ACKNOWLEDGEMENTS

We thank teacher Matt DeSimone, for their generous collaboration, insight, and commitment—this work would not have been possible without their support or care for their students.

This research is supported by the *Natural Sciences and Engineering Research Council of Canada* (NSERC), the *Social Sciences and Humanities Research Council of Canada* (SSHRC), the *Canada Foundation for Innovation* (CFI) and the *Mellon Foundation's Data Fluencies Project*.

REFERENCES

- [1] James Auger. 2013. Speculative design: crafting the speculation. *Digital Creativity* 24, 1 (March 2013), 11–35. <https://doi.org/10.1080/14626268.2013.767276>
- [2] Raewyn Bassett, Brenda L. Beagan, Svetlana Ristovski-Slijepcevic, and Gwen E. Chapman. 2008. Tough Teens: The Methodological Challenges of Interviewing Teenagers as Research Participants. *Journal of Adolescent Research* 23, 2 (March 2008), 119–131. <https://doi.org/10.1177/0743558407310733>
- [3] Karl-Emil Kjær Bilstrup, Magnus Høholt Kaspersen, Mille Skovhus Lunding, Marie-Monique Schaper, Maarten Van Mechelen, Mariana Aki Tamashiro, Rachel Charlotte Smith, Ole Sejer Iversen, and Marianne Graves Petersen. 2022. Supporting Critical Data Literacy in K-9 Education: Three Principles for Enriching Pupils' Relationship to Data. In *Interaction Design and Children*, June 27, 2022. ACM, Braga Portugal, 225–236. <https://doi.org/10.1145/3501712.3530783>
- [4] Danah Boyd. 2007. Why Youth (Heart) Social Network Sites: The Role of Networked Publics in Teenage Social Life. Retrieved October 13, 2023 from <https://papers.ssrn.com/abstract=1518924>
- [5] Engin Bozdag and Jeroen Van Den Hoven. 2015. Breaking the filter bubble: democracy and design. *Ethics Inf Technol* 17, 4 (December 2015), 249–265. <https://doi.org/10.1007/s10676-015-9380-y>
- [6] Nico Brand, William Odom, and Samuel Barnett. 2023. Envisioning and Understanding Orientations to Introspective AI: Exploring a Design Space with Meta.Aware. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*, April 19, 2023. ACM, Hamburg Germany, 1–18. <https://doi.org/10.1145/3544548.3581336>
- [7] British Colombia Ministry of Education and Child Care. 2015. BC's Digital Literacy Framework. Retrieved from <https://www2.gov.bc.ca/assets/gov/education/kindergarten-to-grade-12/teach/teaching-tools/digital-literacy-framework.pdf>
- [8] Janet X. Chen, Allison McDonald, Yixin Zou, Emily Tseng, Kevin A Roundy, Acar Tamersoy, Florian Schaub, Thomas Ristenpart, and Nicola Dell. 2022. Trauma-Informed Computing: Towards Safer Technology Experiences for All. In *CHI Conference on Human Factors in Computing Systems*, April 29, 2022. ACM, New Orleans LA USA, 1–20. <https://doi.org/10.1145/3491102.3517475>
- [9] Audrey Desjardins, Cayla Key, Heidi R. Biggs, and Kelsey Aschenbeck. 2019. Bespoke Booklets: A Method for Situated Co-Speculation. In *Proceedings of the 2019 on Designing Interactive Systems Conference*, June 18, 2019. ACM, San Diego CA USA, 697–709. <https://doi.org/10.1145/3322276.3322311>
- [10] Laura Devendorf and Daniela K. Rosner. 2017. Beyond Hybrids: Metaphors and Margins in Design. In *Proceedings of the 2017 Conference on Designing Interactive Systems (DIS '17)*, June 10, 2017. Association for Computing Machinery, New York, NY, USA, 995–1000. <https://doi.org/10.1145/3064663.3064705>
- [11] Patrícia Dias, Lídia Marôpo, Catarina Delgado, Maria Do Rosário Rodrigues, João Torres, and Eduarda Ferreira. 2022. “I'm not sure how they make money”: How tweens and teenagers perceive the business of social media, influencers and brands. (June 2022). <https://doi.org/10.5281/ZENODO.6702887>
- [12] Joseph Dumit. 2014. Writing the Implosion: Teaching the World One Thing at a Time. *Cultural Anthropology* 29, 2 (May 2014), 344–362. <https://doi.org/10.14506/ca29.2.09>
- [13] Lauren Feiner. 2024. New York bans 'addictive feeds' for teens. *The Verge*. Retrieved January 16, 2025 from <https://www.theverge.com/2024/6/20/24182396/new-york-governor-social-media-law-parental-consent-algorithms>
- [14] Daniel Fitton, Beth T. Bell, Linda Little, Matthew Horton, Janet C. Read, Michelle Rouse, and Nicola Toth. 2016. Working with Teenagers in HCI Research: A Reflection on Techniques Used in the Taking on the Teenagers Project. In *Perspectives on HCI Research with Teenagers*, Linda Little, Daniel Fitton, Beth T. Bell and Nicola Toth (eds.). Springer International Publishing, Cham, 237–267. https://doi.org/10.1007/978-3-319-33450-9_10
- [15] Daniel Fitton, Janet C C. Read, and Matthew Horton. 2013. The challenge of working with teens as participants in interaction design. In *CHI '13 Extended Abstracts on Human Factors in Computing Systems*, April 27, 2013. ACM, Paris France, 205–210. <https://doi.org/10.1145/2468356.2468394>
- [16] William Gaver. 2012. What should we expect from research through design? In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, May 05, 2012. ACM, Austin Texas USA, 937–946. <https://doi.org/10.1145/2207676.2208538>
- [17] Gobinder Singh Gill. 2014. The Nature of Reflective Practice and Emotional Intelligence in Tutorial Settings. *JEL* 3, 1 (February 2014), p86. <https://doi.org/10.5539/jel.v3n1p86>
- [18] Barney Glaser and Anselm Strauss. 2017. *Discovery of Grounded Theory: Strategies for Qualitative Research*. Routledge, New York. <https://doi.org/10.4324/9780203793206>
- [19] Jonathan Haidt. 2024. *The anxious generation: how the great rewiring of childhood is causing an epidemic of mental illness*. Penguin Press, New York.

- [20] Karen Hao. 2021. Facebook's ad algorithms are still excluding women from seeing jobs. MIT Technology Review. Retrieved October 1, 2024 from <https://www.technologyreview.com/2021/04/09/1022217/facebook-ad-algorithm-sex-discrimination/>
- [21] Eszter Hargittai. 2010. Digital Na(t)ives? Variation in Internet Skills and Uses among Members of the "Net Generation". *Sociological Inquiry* 80, 1 (February 2010), 92–113. <https://doi.org/10.1111/j.1475-682X.2009.00317.x>
- [22] Martin Hilbert, Drew P. Cingel, Jingwen Zhang, Samantha L. Vigil, Jane Shawcroft, Haoning Xue, Arti Thakur, and Zubair Shafiq. 2024. #BigTech @Minors: Social Media Algorithms Personalize Minors' Content After a Single Session, but Not for Their Protection. *SSRN Journal* (2024). <https://doi.org/10.2139/ssrn.4674573>
- [23] Yvette Holt. 2025. Does the social media ban for children go too far, or not far enough? Southern Cross University. Retrieved January 13, 2025 from <https://www.scu.edu.au/news/2024/does-the-social-media-ban-for-children-go-too-far-or-not-far-enough/>
- [24] Xuehui Hu and Nishanth Sastry. 2020. What a Tangled Web We Weave: Understanding the Interconnectedness of the Third Party Cookie Ecosystem. In *12th ACM Conference on Web Science*, July 06, 2020. ACM, Southampton United Kingdom, 76–85. <https://doi.org/10.1145/3394231.3397897>
- [25] Tzu-Wei Hung and Chun-Ping Yen. 2020. On the person-based predictive policing of AI. *Ethics Inf Technol* (June 2020). <https://doi.org/10.1007/s10676-020-09539-x>
- [26] Liisa Ilomäki, Minna Lakkala, Veera Kallunki, Darren Mundy, Marc Romero, Teresa Romeu, and Anastasia Gouseti. 2023. Critical digital literacies at school level: A systematic review. *Review of Education* 11, 3 (December 2023), e3425. <https://doi.org/10.1002/rev3.3425>
- [27] Mizuko Itô, Sonja Baumer, Matteo Bittanti, and Judd Antin (Eds.). 2010. *Hanging out, messing around, and geeking out: kids living and learning with new media*. MIT Press, Cambridge, Mass. London.
- [28] Gary Kafer. 2023. Speculating surveillant futures past – a case study of the south side speculations project. *Media Practice & Education* 24, 2 (July 2023), 199–215. <https://doi.org/10.1080/25741136.2023.2207869>
- [29] Ruogu Kang, Laura Dabbish, Nathaniel Fruchter, and Sara Kiesler. 2015. "My Data Just Goes Everywhere." *User Mental Models of the Internet and Implications for Privacy and Security*. 2015. 39–52. Retrieved January 20, 2025 from <https://www.usenix.org/conference/soups2015/proceedings/presentation/kang>
- [30] Bogna Konior. 2020. *The Dark Forest Theory of the Internet*. Flugschriften, Pittsburgh. Retrieved from <https://flugschriften.com/wp-content/uploads/2020/07/flugschriften-6-bog-na-konior-the-dark-forest-theory-of-the-internet-v.2.pdf>
- [31] Florence Lafontaine-Poissant, Justin J. Lang, Britt McKinnon, Isabelle Simard, Karen C. Roberts, Suzy L Wong, Jean-Philippe Chaput, Ian Janssen, Meyran Boniel-Nissim, and Geneviève Gariépy. 2024. Social media use and sleep health among adolescents in Canada. *Health Promot Chronic Dis Prev Can* 44, 7/8 (August 2024), 338–346. <https://doi.org/10.24095/hpcdp.44.7/8.05>
- [32] George Lakoff and Mark Johnson. 2003. *Metaphors We Live By*. University of Chicago Press, Chicago, IL. Retrieved January 16, 2025 from <https://press.uchicago.edu/ucp/books/book/chicago/M/bo3637992.html>
- [33] Simone Lanette, Phoebe K. Chua, Gillian Hayes, and Melissa Mazmanian. 2018. How Much is "Too Much"? The Role of a Smartphone Addiction Narrative in Individuals' Experience of Use. *Proc. ACM Hum.-Comput. Interact.* 2, CSCW (November 2018), 101:1-101:22. <https://doi.org/10.1145/3274370>
- [34] Sakari Lemola, Nadine Perkinson-Gloor, Serge Brand, Julia F. Dewald-Kaufmann, and Alexander Grob. 2015. Adolescents' Electronic Media Use at Night, Sleep Disturbance, and Depressive Symptoms in the Smartphone Age. *J Youth Adolescence* 44, 2 (February 2015), 405–418. <https://doi.org/10.1007/s10964-014-0176-x>
- [35] Douglas MacMillan and Nick Anderson. Student tracking, secret scores: How college admissions offices rank prospects before they apply. *Washington Post*. Retrieved January 12, 2022 from <https://www.washingtonpost.com/business/2019/10/14/colleges-quietly-rank-prospective-students-based-their-personal-data/>
- [36] Sabita Mahapatra. 2019. Smartphone addiction and associated consequences: role of loneliness and self-regulation. *Behaviour & Information Technology* 38, 8 (August 2019), 833–844. <https://doi.org/10.1080/0144929X.2018.1560499>
- [37] Dana McKay, Sally Jo Cunningham, and Kirsten Thomson. 2006. Exploring the user experience through collage. In *Proceedings of the 6th ACM SIGCHI New Zealand chapter's international conference on Computer-human interaction design centered HCI - CHINZ '06*, 2006. ACM Press, Christchurch, New Zealand, 109–115. <https://doi.org/10.1145/1152760.1152774>
- [38] Media Smarts: Canada's Center for Digital Media Literacy. 2018. Grades 7-12 Digital Literacy Training Workshop. Digital Literacy Training Program for Canadian Educators. Retrieved April 22, 2025 from <https://mediasmarts.ca/sites/mediasmarts/files/tutorials/digital-literacy-training/7-12/>
- [39] Media Smarts: Canada's Center for Digital Media Literacy. Digital Literacy 101. Retrieved April 22, 2025 from <https://mediasmarts.ca/teacher-resources/digital-literacy-101>
- [40] Matthew B. Miles and A. Michael Huberman. 1994. *Qualitative data analysis: An expanded sourcebook*, 2nd ed. Sage Publications, Inc, Thousand Oaks, CA, US.
- [41] Ministry of Education and Child Care. Cell phone restrictions in schools. Government of British Columbia. Retrieved January 21, 2025 from <https://www2.gov.bc.ca/gov/content/education-training/k-12/cellphones-in-schools>

- [42] Mersina Mujagić and Alma Pehlivanović. 2023. Metaphorical framing of children's digital media addiction in media discourse. *PS* 12, 13 (September 2023), 175–191. <https://doi.org/10.52580/issn.2232-8556.2023.12.13.175>
- [43] Dave Murray-Rust, Iohanna Nicenboim, and Dan Lockton. 2022. Metaphors for designers working with AI. *DRS Biennial Conference Series* (June 2022). Retrieved from <https://dl.designresearchsociety.org/drs-conference-papers/drs2022/researchpapers/237>
- [44] Anthony Nardone, Joey Chiang, and Jason Corburn. 2020. Historic Redlining and Urban Health Today in U.S. Cities. *Environmental Justice* 13, 4 (August 2020), 109–119. <https://doi.org/10.1089/env.2020.0011>
- [45] William Odom, Samuel Barnett, Nico Brand, Minyoung Yoo, Henry Lin, and Jordan White. 2024. Negotiating Conceptual and Practical Frictions in Making the Capra Short Film: Extending a Research through Design Artifact with Video. In *Proceedings of the 2024 ACM Designing Interactive Systems Conference (DIS '24)*, July 01, 2024. Association for Computing Machinery, New York, NY, USA, 2866–2881. <https://doi.org/10.1145/3643834.3660739>
- [46] William Odom, John Zimmerman, and Jodi Forlizzi. 2011. Teenagers and their virtual possessions: design opportunities and issues. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, May 07, 2011. ACM, Vancouver BC Canada, 1491–1500. <https://doi.org/10.1145/1978942.1979161>
- [47] William Odom, John Zimmerman, and Jodi Forlizzi. 2016. Engaging Teens in Dialogue on Potential Technological Futures with User Enactments. In *Perspectives on HCI Research with Teenagers*, Linda Little, Daniel Fitton, Beth T. Bell and Nicola Toth (eds.). Springer International Publishing, Cham, 151–178. https://doi.org/10.1007/978-3-319-33450-9_7
- [48] Office of the Privacy Commissioner of Canada. 2023. Putting best interests of young people at the forefront of privacy and access to personal information. Retrieved September 28, 2024 from https://www.priv.gc.ca/en/about-the-opc/what-we-do/provincial-and-territorial-collaboration/joint-resolutions-with-provinces-and-territories/res_231005_01/
- [49] Wanda J Orlikowski. 2006. Material knowing: the scaffolding of human knowledgeability. *European Journal of Information Systems* 15, 5 (October 2006), 460–466. <https://doi.org/10.1057/palgrave.ejis.3000639>
- [50] Luci Pangrazio and Neil Selwyn. 2018. “It’s Not Like It’s Life or Death or Whatever”: Young People’s Understandings of Social Media Data. *Social Media + Society* 4, 3 (July 2018), 2056305118787808. <https://doi.org/10.1177/2056305118787808>
- [51] Luci Pangrazio and Neil Selwyn. 2021. Towards a school-based ‘critical data education.’ *Pedagogy, Culture & Society* 29, 3 (May 2021), 431–448. <https://doi.org/10.1080/14681366.2020.1747527>
- [52] Luci Pangrazio and Neil Selwyn. 2023. *Critical data literacies: rethinking data and everyday life*. The MIT Press, Cambridge, Massachusetts London, England.
- [53] Emily Peach. 2023. *Creative Mental Health Literacy Practices: A Qualitative Study Exploring How Students Use Literacy to Promote Wellbeing and Manage Mental Health Conditions While at University*. *IJERPH* 20, 15 (July 2023), 6475. <https://doi.org/10.3390/ijerph20156475>
- [54] James Pierce. 2019. Smart Home Security Cameras and Shifting Lines of Creepiness: A Design-Led Inquiry. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (CHI '19)*, May 02, 2019. Association for Computing Machinery, New York, NY, USA, 1–14. <https://doi.org/10.1145/3290605.3300275>
- [55] James Pierce and Carl DiSalvo. 2018. Addressing Network Anxieties with Alternative Design Metaphors. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1–13. Retrieved February 9, 2022 from <https://doi.org/10.1145/3173574.3174123>
- [56] Janet C. Read and Matthew Horton. 2016. Future Directions for Quality TeenCI Research. In *Perspectives on HCI Research with Teenagers*, Linda Little, Daniel Fitton, Beth T. Bell and Nicola Toth (eds.). Springer International Publishing, Cham, 269–278. https://doi.org/10.1007/978-3-319-33450-9_11
- [57] Lorena Sanchez Chamorro, Carine Lallemand, and Colin M. Gray. 2024. “My Mother Told Me These Things are Always Fake” - Understanding Teenagers’ Experiences with Manipulative Designs. In *Designing Interactive Systems Conference*, July 2024. ACM, IT University of Copenhagen Denmark, 1469–1482. <https://doi.org/10.1145/3643834.3660704>
- [58] Donald A. Schön. 2017. *The Reflective Practitioner: How Professionals Think in Action*. Routledge, London. <https://doi.org/10.4324/9781315237473>
- [59] Jennifer D. Shapka. 2019. Adolescent technology engagement: It is more complicated than a lack of self-control. *Human Behavior and Emerging Technologies* 1, 2 (2019), 103–110. <https://doi.org/10.1002/hbe2.144>
- [60] Jeanne R. Steele and Jane D. Brown. 1995. Adolescent room culture: Studying media in the context of everyday life. *J Youth Adolescence* 24, 5 (October 1995), 551–576. <https://doi.org/10.1007/BF01537056>
- [61] Alex S. Taylor and Richard Harper. 2002. Age-old practices in the “new world”: a study of gift-giving between teenage mobile phone users. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '02)*, April 20, 2002. Association for Computing Machinery, New York, NY, USA, 439–446. <https://doi.org/10.1145/503376.503455>
- [62] Henriikka Vartiainen, Lotta Pellas, Juho Kahila, Teemu Valtonen, and Matti Tedre. 2024. Pre-service teachers’ insights on data agency. *New Media & Society* 26, 4 (April 2024), 1871–1890. <https://doi.org/10.1177/14614448221079626>

- [63] Ron Wakkary, Doenja Oogjes, and Armi Behzad. 2022. Two Years or More of Co-speculation: Polylogues of Philosophers, Designers, and a Tilting Bowl. *ACM Trans. Comput.-Hum. Interact.* 29, 5 (October 2022), 1–44. <https://doi.org/10.1145/3514235>
- [64] Matthew Wizinsky. 2019. South Side Speculations: Designing Public Histories & Public Futures on Chicago’s South Side. In *Proceedings of the International Association of Societies of Design Research Conference*, Manchester, United Kingdom, 2019. Manchester. Retrieved September 30, 2024 from https://www.academia.edu/download/62217054/Wizinsky_SouthSideSpeculations_IASDR201920200227-115903-17sbylc.pdf
- [65] Minyoung Yoo, Arne Berger, Joseph Lindley, David Philip Green, Yana Boeva, Iohanna Nicenboim, and William Odom. 2023. Beyond Academic Publication: Alternative Outcomes of HCI Research. In *Companion Publication of the 2023 ACM Designing Interactive Systems Conference (DIS ’23 Companion)*, July 10, 2023. Association for Computing Machinery, New York, NY, USA, 114–116. <https://doi.org/10.1145/3563703.3591458>
- [66] MinYoung Yoo, Lauren Knight, William Odom, and Arne Berger. 2022. Storywork & Reciprocity: On the Design of an Audio Documentary that Extends HCI Research back to Participants. In *Proceedings of the 2022 ACM Designing Interactive Systems Conference (DIS ’22)*, June 13, 2022. Association for Computing Machinery, New York, NY, USA, 1345–1357. <https://doi.org/10.1145/3532106.3533539>
- [67] John Zimmerman and Jodi Forlizzi. 2014. Research Through Design in HCI. In *Ways of Knowing in HCI*, Judith S. Olson and Wendy A. Kellogg (eds.). Springer, New York, NY, 167–189. https://doi.org/10.1007/978-1-4939-0378-8_8
- [68] John Zimmerman, Jodi Forlizzi, and Shelley Evenson. 2007. Research through design as a method for interaction design research in HCI. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI ’07)*, April 29, 2007. Association for Computing Machinery, New York, NY, USA, 493–502. <https://doi.org/10.1145/1240624.1240704>
- [69] Laura Zimmermann and Jeeva Somasundaram. 2024. Maladaptive Smartphone Usage. In *Maladaptive Consumer Behavior*, Ingrid M. Martin and David W. Stewart (eds.). Springer Nature Switzerland, Cham, 103–127. https://doi.org/10.1007/978-3-031-60199-6_5
- [70] Shoshana Zuboff. 2019. “We Make Them Dance”: Surveillance Capitalism, the Rise of Instrumentarian Power, and the Threat to Human Rights. In *Human Rights in the Age of Platforms*, Rikke Frank Jørgensen (ed.). The MIT Press. <https://doi.org/10.7551/mitpress/11304.001.0001>
- [71] Shoshana Zuboff. 2022. Surveillance Capitalism or Democracy? The Death Match of Institutional Orders and the Politics of Knowledge in Our Information Civilization. *Organization Theory* 3, 3 (July 2022), 26317877221129290. <https://doi.org/10.1177/26317877221129290>
- [72] 2001. *Using trauma theory to design service systems*. Jossey-Bass/Wiley, Hoboken, NJ, US.