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Co-Designing Data Labs at the Public Library: Data Literacy with, for, and by Teens

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Abstract. This poster presents research investigating youth data literacy at the public library. The *Data Literacy with, for, and by Youth* project is framed by principles of participatory design, and asks, *how might an informal STEM learning environment such as the public library, support the development of the skills, knowledge, and dispositions that young people need for them to take charge of their data lives, from data creation to data use – to be, in short, data literate*. The problem of how to approach something as complex as data literacy in the voluntary drop-in setting of informal, after-school sites of learning - the public library being one such place - guides this study. The aim of the project is to design, build, test, and evolve theory and practice around informal data literacy education *alongside youth*, with the goal of building a holistic, humanistic, and youth-oriented model of data literacy which incorporates social-awareness, critical approaches, and "goodness of fit" into STEM learning about data.

Keywords: Data Literacy, Participatory Design, Co-Design, Teens

1 Introduction and Background

Today's young people, more than any previous generation, have a personal stake in their ability to function with data. Future job prospects might hinge on their ability to participate in the new data economy. But equally, young people are themselves the subjects *of* data science, being the most thoroughly measured, tracked, and analyzed generation. To be active citizens and good stewards of their own data, they need to be data literate.

Traditional approaches to data literacy emphasize quantitative reasoning by focusing on numeracy, statistics, and computer programming but data literacy is, more accurately, a complex array of skills, knowledge, and humanistic reasoning to be applied throughout the *data life cycle*. This includes a set of dispositions that facilitate the ability to *critique* data practices, to contextualize data to broader contexts such as platforms, cyberinfrastructure, and society, and to find meaning in data beyond statistical and mathematical arguments. There are many questions as to how public libraries can approach something as complex as data literacy in the voluntary "drop-in" setting of after-school library programs for teens. Engagement may be the key and who but young people themselves should show us what is interesting and meaningful to them.

The authors will present research in youth data literacy at the public library, most recently through their project *Data Literacy with, for, and by Youth*. The study, framed by principles of participatory design, asks, *how might an informal STEM learning environment, such as the public library, support the development of the skills, knowledge, and dispositions that young people need for them to take charge of their data lives, from data creation to data use – to be, in short, data literate*. The problem of how to approach something as complex as data literacy in the voluntary drop-in setting of informal, after-school sites of learning - the public library being one such place - guides this study.

The *Data Literacy with, for, and by Youth* project applies principles of participatory design (Bowler et al, 2021) and does more than look at youth and data. The aim is to design, build, test, and evolve theory and practice around informal data literacy education *alongside youth,* with the goal of building a holistic, humanistic, and youth-oriented model of data literacy which incorporates social-awareness, critical approaches, and "goodness of fit" into STEM learning about data.

1.1 Data Literacy

Data Literacy has traditionally included skills associated with Data Science, such as quantitative reasoning, numeracy, statistical analysis, and computer programming. However, data literacy is more than that: It is a complex array of skills, knowledge, and humanistic reasoning and includes a set of dispositions that facilitate the ability to *critique* data practices and to find meaning in data beyond statistical and mathematical arguments (Finzer, 2013, 5; Deahl, 2014; Tygel, & Kirsch, 2015; Gray, Gerlitz & Bounegru, 2018).

1.2 Participatory Design with Youth

The project draws from the principles, and practices of Participatory Design (PD), which is a methodology that gives the end user an active role in the design process. PD's guiding principle is the promotion of collaborative relationships between users and designers, with the user invited to contribute to the final product as a member of the design team (Yip et al., 2017, p.

5742). One PD method that is particularly relevant to this project is *Cooperative Inquiry (CI),* where children and youth work alongside adults as equal partners in the design of new technology (Druin, 1999, 2002, Guha et al, 2013). We note that PD has been applied to contexts beyond technology design, as, for example, a method associated with emancipatory approaches to teaching and learning (Cahill, Rios-Moore & Threatts, 2008, Halskov & Hansen, 2015).

In addition to the practices to arise from the field of participatory design, this project draws from the child rights movement, recognizing young people's fundamental right to participate in making decisions about the matters that affect their lives (Hart, 1992). This includes participation in the construction of learning experiences that reflect how young people interact with and learn about data. Young people should be viewed as agents of change, and not just assets for research. Participatory design, to varying degrees, adopts this stance.

1.3 Intellectual Merit

The project has the potential to deliver a transformative model for learning about data literacy in informal, community-based STEM environments like the public library.

1.4 Broader Impacts

Understandings derived in this study have the potential to inform the public's ability to make decisions about data at school, at work, and across everyday life, as well as providing a model of best practices in the field of informal STEM learning.

2 Methods and Activities to Date

Due to COVID-19 restrictions, the study was conducted online, using a range of digital tools such as Zoom, online games and quizzes, and collaborative environments such as Google Jam Board. During Winter and Spring 2021, ten online design sessions (called Data Labs in this project) were conducted via the Zoom platform, with the principal investigators working alongside teens and librarians from our community partner Brooklyn Public Library and two schools in New York City. Four Data Labs were stand-alone – each session with a different group of teens. Six Data Labs were part of a series, collaborating with the same teens over a six-week period. In total, 41 people participated in the design sessions, including 30 teens, 4 librarians, & 5 graduate students from Pratt Institute. (Figure 1 illustrates a Zoom session with students from a middle school in New York City, Winter 2021)

Fig. 1. A Data Lab in Zoom. Winter 2021

The Data Lab sessions were designed to prompt instances of critical data literacy, co-design, and engagement with teen participants. Early sessions introduced the project to the teen participants, gauged their understanding of the data life cycle, and engaged them in thinking about data literacy concepts within their own life experiences and interests. For example, if a participant was an athlete, they were asked to think about data related to their athletic achievements, who collects it, where it is stored and who has access to it. In the series of six Data Labs with the same teens, the "middle" sessions focused on deepening teens' knowledge of data literacy concepts (e.g., data privacy, surveillance) and enabling them to design instructional sessions on data literacy for other teens. Communication platforms (e.g., Google Jam Board, Miro) that teens could use in their instruction were also introduced during these sessions. In the final sessions in the series of six Data Labs,

teen participants presented their instructional program to other teens, and had a chance to reflect on their project. (Figure 2 illustrates the "flow" of the sessions).

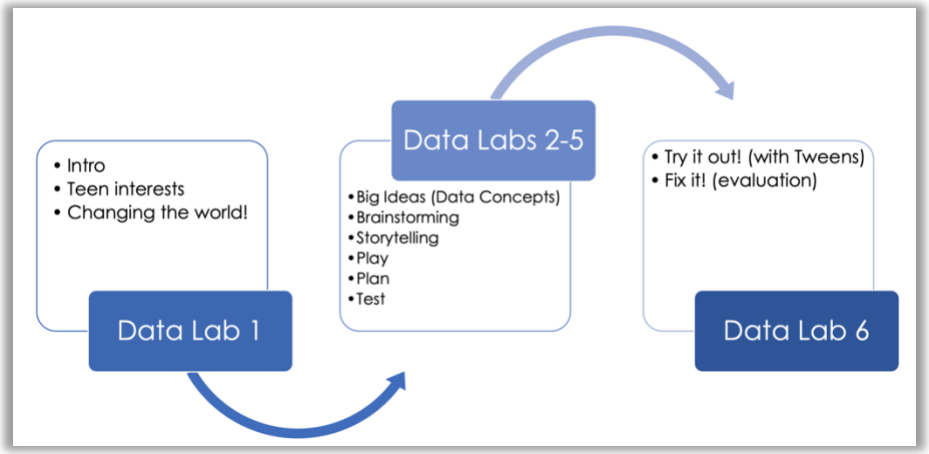

Fig. 2. The series of six Data Labs with Teens. Spring 2021

3 Preliminary Findings

Data analysis of the first series of design sessions (called Data Labs) has begun and is ongoing. Qualitative data includes transcripts of verbal interactions, chat transcripts, and products created by the design team. Analysis is framed by three themes driving the project: 1) *co-design with youth*, 2) *critical data literacy* and 3) *engagement with data* (interest and motivation), referencing Nowell et al.'s framework for conducting a trustworthy thematic analysis.

The six Data Labs incorporated numerous data activities, including games, storytelling, videos, and brainstorming using online collaborative tools - always with an eye toward what would be fun, encourage co-design, and facilitate critique of data. A survey of the teens preferred activities indicated that they especially enjoyed brainstorming using "sticky notes" in Google Jam Board. Their least favorite activity was watching videos about data concepts.

Even though teens indicated interest in the activities, we found that both *co-design with youth* and *engagement with data* were nevertheless constrained by the online environment. For example, chat was the preferred form of discourse, rather than verbal conversation, with many of the teens usually turning off their cameras during Zoom sessions. These distancing techniques may have affected the level of social cohesion and trust, which is a key element to after-school, informal learning. Since the next iteration of the project will also be online due to continued COVID-restrictions, additional team building strategies will be needed to build rapport in the online environment. Nevertheless, teens in the Data Labs enjoyed game-like activities and interactions that facilitated personal expression. Given that most teens at this time were spending their school hours in online classes, we speculate that they were keen to avoid activities that seemed like online school.

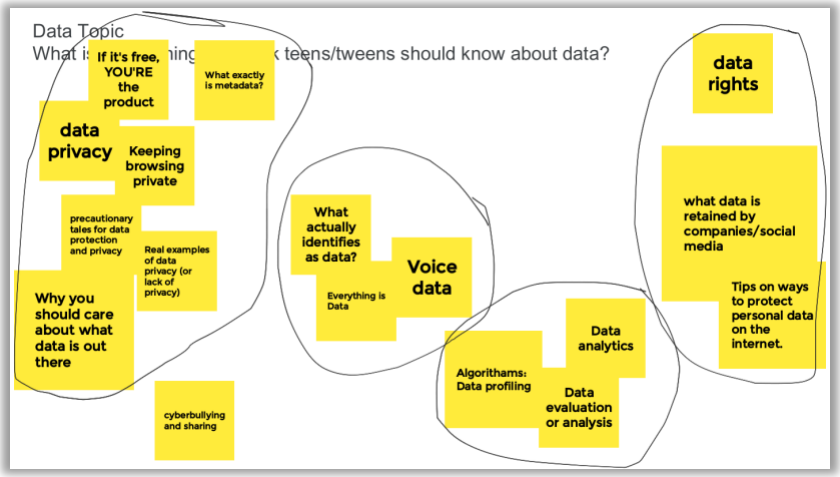

Fig. 3. Activity in Jam Board: "What is the number one thing that teens should know about data?". Spring 2021

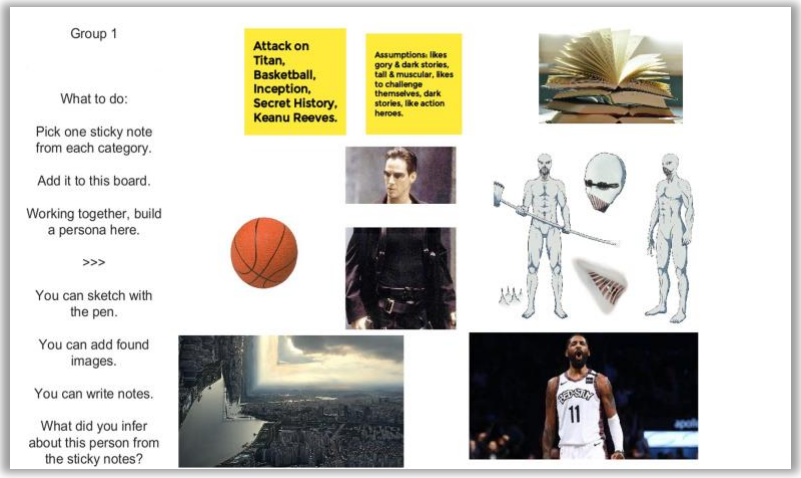

Fig. 4. Activity in Jam Board: Algorithmic assumptions made through data. Spring 2021

In terms of *critical data literacy*, there was evidence of an ability to critique data in the chat conversations that arose during data activities, pointing to the importance of the back and forth of discourse – written or verbal – within the context of design. We found that, not surprisingly, there was general awareness of the data gathering associated with social media platforms and teens had concerns about their own data privacy (including even the youngest participants in the project who were aged 12 and 13). When we dug deeper into concepts like data surveillance, some were surprised at the pervasiveness and magnitude of data tracking, which led some teens to critique this data practice:

> "It is crazy how everything can be data, like even from the moment you were born, you can be used for data for categories that relates to baby, they might use you as a newborn to find out how you compare to other babies as an example" (Teen, age 14)

4 Next Steps

In the first series of Data Labs, teens made a valuable contribution to our understanding of their awareness of data and what, in their view, would appeal to other teens in data literacy programs at the library. Their participation has helped us plan online activities for the next stage of the research. In the next iteration of the project (Fall 2021) we will continue to use online spaces for the design sessions, due to continuing COVID-19 restrictions. We will be refining practice guidelines in support of data literacy at the library and will continue to work toward a conceptual model of co-design with youth in support of engagements with data in informal learning environments.

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