Decoding Design Agendas: An Ethical Design Activity for Middle School Students

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ABSTRACT

If we expect our children to be driving technology design agendas in the future, we must first help them recognize that opinions and beliefs are baked into the technologies that we create and that these opinions may serve some groups of people more than others. In this paper, we discuss an ethical design activity completed by 19 middle school-aged children. The activity encourages students to see technical systems as socio-technical systems, to engage them in stakeholder analysis, and to apply ethical design tools in order to redesign YouTube. Results indicate students are capable of transforming into critical users and ethical designers of technology. They are able to recognize the underlying design agendas for popular technologies such as YouTube, identify stakeholders who shape those design agendas, and apply an array of tools to reimagine technologies in a more inclusive manner.

Author Keywords

Ethical design; Design education; Social media; K12; Recommender systems; STEM education

CCS Concepts

•Human-centered computing → Empirical studies in interaction design; •Applied computing → Interactive learning environments;

INTRODUCTION

In June 2019, the Wall Street Journal published an article titled, “YouTube Weighs Major Changes to Kids’ Content Amid FTC Probe,” which described a series of possible changes YouTube might make in order to better comply with the Children’s Online Privacy Protection Act (COPPA) [6]. The FTC investigation was sparked by complaints that YouTube was illegally collecting data on children under 13 years of age to power their recommendation algorithm, which accounts for more

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IDC’20, June 21–24, 2020, London, United Kingdom

© 2020 ACM. ISBN 978-1-4503-7981-6/20/06...\$15.00

DOI: [10.1145/3392063.3394396](https://doi.org/10.1145/3392063.3394396)

Figure 1. Middle schooler holds her paper prototype for a new version of YouTube.

than 70% of watchtime on the platform [28]. The most popular change for consideration would be hugely detrimental for YouTube’s bottom line: remove all kids’ content from YouTube and move it to a separate app just for kids without any recommendation algorithm [6].

As the social media platform most used by teens, YouTube is a prime example of why children need to have tools to be critical users of technology [3]. While YouTube empowers its users to learn new skills and connect with others, its design is not without flaws. In 2018, the Wall Street Journal investigated YouTube’s recommender system and found that it would suggest increasingly conspiratorial or extreme content to its users in order to try to keep users on the site [20]. The New York Times has published several stories portraying how YouTube’s recommendation algorithm has influenced what young people watch, and consequently, their ideologies [24, 31, 14].

Therefore, children of today need to be prepared to ask questions such as: what information does YouTube know about me? How is it influencing what I watch? Are the videos I watch credible? How are they influencing my beliefs? Beyond YouTube, these questions should also be asked of other social media platforms, voice agents, and especially technologies as ubiquitous as Google Search. Prior research has shown that 39% of children (the plurality) use social media as their main news source, that they view voice agents as smarter than themselves, and that they typically never search past the first

page or even first result when using Google Search [23, 10, 11]. In the same way that we want our children to be trained to ask questions about the content they interact with online, they also need to be trained to question the algorithms which curate that content.

In this work we present a pilot test of a design activity with middle school children. Through a series of exercises, we ask children to identify the stakeholders associated with YouTube, the values those stakeholders may hold, and to paper prototype a new version of YouTube that fits the needs of those stakeholders. The aim of this exercise is to get students to see technology as non-neutral and driven by particular design agendas, and to give students the opportunity to practice driving design agendas of their own. This activity is a part of a larger, open source curriculum designed to teach middle schoolers about the ethics of artificial intelligence. In this paper, we address the ways in which this activity answers the following questions:

1. Are students able to identify the stakeholders and values of a socio-technical system?
2. How do students apply the stakeholder-value pairs to their own designs?
3. How does their knowledge of design agendas impact their own sense of agency around technology?

We also provide design recommendations for future iterations of similar activities.

BACKGROUND

The Need for Ethical Design

According to the U.S. Bureau of Labor Statistics, computing and information technology jobs will be both the fastest-growing and highest-paying jobs over the next decade [22]. To meet this demand, there have been numerous national and international efforts to introduce children to computer science and teach them to code [1, 12]. In particular, it is predicted that by 2022, 58 million new jobs will be related to artificial intelligence specifically [30].

At the same time, public conversation has become more and more critical of the effects technology has had on society. Beyond YouTube, there are growing concerns about algorithmic bias in hiring or credit-scoring algorithms, about the effect social media has on democracy, and an increased number of surveillance technologies [8, 21, 34, 17].

Many solutions to these problems have been proposed, from technology companies creating jobs centered around ethics to increased auditing of technical systems by researchers to new policy efforts [13, 4, 19, 29, 2]. In addition to these solutions, there have also been many calls to train future designers of technology in ethical design so that they may consider the societal impact of what they build [27]. Most progress has been made at the undergraduate and graduate level, but some efforts have moved toward the K-12 range [25, 16].

While these efforts are often motivated by job statistics in the technology industry, it is important to note that ethical design

skills and the ability to consider a product's impact on society are valuable in other professions as well. Additionally, these skills are helpful for consumers of technology, such as in the YouTube case introduced above, or in the cases where citizens need to weigh in on regulations, as has been the case in the many recent facial recognition bans across the United States [18].

However, a big question looms: what should we be teaching when teaching ethical design?

Ethical Design Principles

Although there have been several approaches to teaching ethical design thus far, there is one common theme throughout the majority of them: designers need to see technical systems as socio-technical systems. That is to say, designers need to recognize the existence of design agendas. The phrase, which originated in the field of system design, is used to highlight the fact that technologies do not operate in vacuums. Rather, they are embedded in social systems, and their success relies on how they are embedded in those social systems. This builds on the idea of Langdon Winner's paper "Do Artifacts Have Politics?" where he shows that a series of New York City bridges, which may seem to simply be the results of equations about masses and loads, are political in that they prevent city buses to travel underneath them, therefore limiting access to poorer neighborhoods in the city [32].

Some early iterations of teaching ethical design have focused on incorporating moral philosophy into the classroom. For example, one course taught students about moral theories such as utilitarianism, deontology, and virtue ethics, and how to identify those lines of reasoning in technology representations in film and media [5]. While these theories are certainly helpful in critically assessing technologies and how they were produced, they do not necessarily provide clear action items for designers of technology to follow while developing a product of their own.

For this, we turn to design tools such as value-sensitive design, participatory design, and design justice, which allow designers to deliberately incorporate values into their designs or engage with those stakeholders who are most affected by design. Participatory design is an increasingly popular method as it attempts to include all possible stakeholders throughout the design process. Design justice seeks to ensure that the stakeholders who are at the greatest risk for harm are centered in the design process [9, 7]. Ideally, this is the protocol brought into the classroom for students to learn, although it is often difficult for logistical reasons. These design processes are helpful in providing actionable tools students can use for identifying design agendas as well as driving their own [26].

One such tool is the ethical matrix. Originally a tool used in bioethics, Cathy O'Neil has written about how it can be used in the context of technology [15]. The ethical matrix is a 2-dimensional table where stakeholders are listed on one axis and the values those stakeholders hold in the system are listed on the other axis. Designers of a new technology can then go row by column and identify where stakeholders' values align and where they conflict. Designers can also identify which

Step 3: Fill out the following ethical matrix from your answers above:

	Money	Education	Fun	Good Content
Youtube (the company)				
Kids				
Parents				
Advertisers				

Step 4: Given the ethical matrix above, identify the goal of your algorithm:

Have fun, & see good content.

Why did you decide on this goal? Explain in a few sentences:

I decided this goal because we want to have fun. We also like good content better than bad content.

Figure 2. An example ethical matrix for YouTube.

conflicts in values might produce the most harm for any of the stakeholders involved. In filling out the matrix, designers are forced to empathize with multiple perspectives of a diverse set of stakeholders and consider how the technology is situated in society. This tool, although in a simplified form, is heavily leveraged in the activity discussed below, and can be seen in Figure 2.

METHODS AND DATA COLLECTION

This study took place during a five-day summer workshop for middle school students on a college campus. During the workshop, students completed activities from the AI + Ethics curriculum as well as other activities such as outdoor time, arts and crafts, and campus tours. Students were divided into two different classrooms by grade level.

Participants

Students entering grades 5-9 in the greater Boston area were recruited for this study. They were split up into two classrooms, one with students in grades 5-7 and the other with students in grades 7-9. A total of 19 students completed all five days of the workshop and completed this activity in approximately four hours over the last two days. Out of these 19 students, 18 of them reported that they “couldn’t live without technology,” while one reported that “it scares me”. The most popular technologies among the students were YouTube and Google Search, with 18 out of 19 students regularly using both. Further details of the participants that completed all 5 days of the study can be found in Table 1.

Curriculum

Over the course of the workshop, students were exposed to eight, mostly unplugged, activities that touched upon the topics of AI + Ethics. The curriculum had three goals: to enable students to recognize artificial intelligence in the world around them, to assist them in understanding technically how artificial intelligence works as well as the ethical issues associated with it, and to empower them with tools to ethically design AI systems in the future. The activities assumed no prior knowledge about computer science and began by providing a definition of an algorithm and giving many examples. Students learned that any algorithm - not just artificial intelligence - hold design agendas. For example, students participate in a twist on the classic “write an algorithm to make a peanut butter and jelly sandwich” assignment, where they are asked to write an algorithm to make the best PB&J sandwich, and then discuss the many connotations of the word “best.”

Students then learned about supervised machine learning as an example of an artificial intelligence system. Supervised machine learning was selected as an example of artificial intelligence because of its ubiquity in everyday technologies, such as in e-mail SPAM filters, in content recommendation systems, or in facial recognition. Its ubiquity in children’s everyday lives supports the primary goal of the curriculum, which is to be able to recognize AI in the world around them. Students were introduced to supervised machine learning as a kind of AI system which accepts a dataset, a curated selection of data, and outputs a prediction for a particular situation. Learning about supervised machine learning also enabled students to learn about other ethical issues, such as algorithmic bias.

Demographics	Breakdown	
	Category	#
Grade	Fifth	8
	Sixth	5
	Seventh	6
	Eighth	7
	Ninth	2
Gender	Male	20
	Female	8
Heard of AI before workshop?	Yes	23
	No	5
Role of Technology	Can’t live without it	25
	It scares me	2
Days Participated	Monday	28
	Tuesday	27
	Wednesday	27
	Thursday	22
	Friday	21

Table 1. Participant Demographics

The topics covered throughout the week culminated in a final project in which students were asked to redesign the YouTube recommendation algorithm according to a stakeholder analysis. This paper covers the YouTube Redesign activity, but the entire curriculum is open-source and available at bit.ly/mit-ai-ethics.

YouTube Redesign Activity

In pairs, students were tasked with identifying at least 10 stakeholders invested in YouTube's recommendation algorithm (or other algorithms, such as the comment filtering algorithm or the algorithm which supplies search results) and two values each of those stakeholders may hold in the system. After this brainstorming period, students narrowed their lists down to three stakeholders in addition to YouTube the company. They chose four values that those stakeholders might have. From this smaller list, they drew a 4x4 ethical matrix (such as the one in Figure 2). They then used the ethical matrix as a conversation starter to determine a new goal - a new "opinion" - of the recommendation system. Finally, students were given craft supplies and asked to paper prototype a YouTube interface which better reflected the values of their reimagined platform. To get them started, we showed them examples of Twitter redesigns, such as Gobo, which allows a user to filter content by categories such as author gender, political affiliation, and rudeness level [35]. Each pair sketched out a first draft of their design and shared that draft with another group. After they received feedback on the initial design, student pairs made changes to their projects and created a final version.

Socratic Seminar

On the last day of the workshop, students read a condensed version of the previously mentioned Wall Street Journal article, "YouTube Weighs Major Changes to Kids' Content Amid FTC Probe," which had been published just a week earlier [6]. The article touches upon YouTube's lack of COPPA compliance and the changes that the company is considering in order to make the platform safer for young viewers. We chose this article because it was both timely and relevant to the student's work, specifically the YouTube Redesign Project. After the students read the article, researchers facilitated a class discussion about the article. Students were asked questions about the article such as:

- Can you summarize this article?
- Which stakeholders were mentioned?
- How do you think [stakeholder] might feel about these changes?
- Do you think YouTube kids should be a separate product? Why? Why not?
- Do you think YouTube will lose profit if they decide to make the changes? Is it okay if they lose profit?

These questions were designed to reflect the same process that the students followed during their YouTube Redesign Project: identifying stakeholders and values and using them to inform design decisions. During the conversation, students were encouraged to respond to others' comments and pose their own questions. This discussion was audio recorded and later transcribed.

Survey

At the beginning of the workshop, students took an online survey to assess their incoming knowledge of AI. The survey included three open ended questions to address their knowledge of the stakeholders in various socio-technical systems:

1. What groups of people are concerned with the outcomes of YouTube's video recommender?
2. What groups of people are concerned with the outcomes of self-driving cars?
3. What groups of people are concerned with the outcomes of Google's search engine?

On the last day of the camp, students completed the same online survey and answered these questions again to understand any changes in their understanding of stakeholders and definition of artificial intelligence.

Reflections

Each day the students were asked to reflect on their experiences and share their thoughts on artificial intelligence. These reflections were handwritten and collected or were done through verbal interviews and audio recorded.

RESULTS

Are students able to identify the stakeholders and values of a socio-technical system?

To begin their YouTube Redesign Project, each student pair was asked to brainstorm 10 stakeholders along with two values that each stakeholder holds. Values were grouped into larger themes. For example, "Good Content" and "Entertainment" were grouped into the "Entertainment" category, and "Privacy" and "Safety" became the "Safety" category. Stakeholder-value pairs from this brainstorm were recorded and summed across all students (Figure 3). The stakeholder-value pairs that guided the students' redesigns were YouTube-Money (9), Kids-Entertainment (7), YouTubers-Money (6), YouTube-Entertainment (6), and YouTubers-Entertainment (6).

How do students apply the stakeholder-value pairs to their own designs?

Next, students were asked to reflect on the stakeholders and value pairs that they identified to come up with a goal for their redesign. These goals and the reasoning for them, as originally written by the students, can be found in Table 2. The most common goals identified were Entertainment (5) and Good Content (4). Seven out of the 11 pairs chose their goals because most stakeholders valued that particular characteristic. One pair chose their goal based on the perceived consequences of that goal (profit). Another pair chose their goal because they perceived it as morally superior to the other values in the table (fun). One pair of students chose their goal because it seemed like a compromise among other values (aware of time spent on the platform). Lastly, one project was not able to come up with a goal or reasoning based on stakeholders.

Figure 3. A heat map of stakeholder-value pairs brainstormed for the YouTube Redesign Project. Darker and larger shapes denote pairs that were used most often.

Case Study 1: Optimizing for Good Content and Time Well Spent

This rising seventh and rising eighth grader decided that YouTube should maximize for “getting what they want and time well spent.” They identified YouTube, YouTubers, viewers, and sponsors as their stakeholders with the values of good content, popular, amount of ads, and money. As previously mentioned, students chose this goal because “If people get what they wanted they would stay on the site longer, but not too long.” Their paper prototype, seen in Figure 4, shows the one feature that they added to YouTube: a time tracker and pop up to let the user know how long they have been on the platform.

Case Study 2: Optimizing for Entertainment

This pair of rising fifth graders decided to optimize their new version of YouTube around entertainment. Students identified YouTube, kids, parents, and advertisers as their stakeholders

Figure 4. An example of “Time Well Spent” YouTube. The students designed a pop up to let the user know how much time they spent watching videos.

Figure 5. An example of “Entertainment” YouTube. The first image shows the home page and the second shows a video page.

along with the values of money, educational, good content, and fun, where most stakeholders were interested in “good content.” The students wrote, “We decided on this goal because having fun is very fundamental but being appropriate is also needed.” When asked how they would achieve this goal, the students wrote, “We would also teach it to give us clean content or videos that don’t have swears. It will have a child safety mode to make sure there are no swears or inappropriate content.” The home page of their design includes a navigation

Goal	Reasoning
Entertainment to be better	More people care about entertainment
Good Content	I think people like it more
Good content and fun	We decided on this goal because having fun is very fundamental. But being appropriate is also needed
Kid friendly and entertainment	They were the most important goals
Entertainment	Because the most stakeholders have the value of entertainment
Our goal is that our recommendation system will help with entertainment and money income	We decided on these two values, because overall, they were the most valued by the most people
Easily accessible, publicity	Out of the selected stakeholders, most say access and publicity are important
Profit	YouTube and YouTubers can use the profit to increase the quality of the site and videos
People get what they want. Also aware of how long they spend on the platform	If people get what they wanted they would stay on the site longer but not too long
To recommend popular videos, with few ads in multiple topics	Popularity is sought after most, ads are not as liked
N/A	Unable to provide justification

Table 2. YouTube Redesign Goals and Reasoning

bar on the left that separates videos for kids and adults (Figure 5). The video page includes features such as a slider that allows users to choose levels of “rudeness” that appear in their videos and a child safety setting.

Case Study 3: Optimizing for Entertainment and Profit

This pair, including a rising fifth grader and a sixth grader, decided to optimize their new version of YouTube around both entertainment and profit. Students identified YouTube, viewers, YouTubers, and advertisers as their stakeholders along with the values of entertainment, money, popularity, and safety, where most stakeholders were interested in entertainment and profit. They explained the rationale behind the goal: “Popularity is sought out after most, ads are not as liked.” These students focused on features that brought more income to YouTube, including filters for types of ads (leading to a more enjoyable ad experience by the user) as well as an option to donate directly to YouTube or YouTubers (Figure 6).

Figure 6. An example of "Entertainment and Profit" YouTube. The bottom left corner of this page invites the user to donate to YouTube or a specific YouTuber.

Additional Project Features

While we did not highlight all of the projects, there are key trends to point out. The top five feature categories across all projects were: a feature related to ads, a child lock, a safe content feature, filters for certain video categories, and a feature for giving feedback. The most common feature was one related to ads, such as a button to turn off ads or a filter to make ads more relevant. Eight out of 11 projects included a feature related to ads. Six out of the 11 projects added a child lock feature to their prototype to keep children away from unsafe content. Similarly, four pairs designed a feature to make video content safer (i.e., no violence or swear words). Four projects contained content filters so that the user could have more control over the content they were recommended. Three pairs had a feature such as a survey or comment box so that YouTube could use direct feedback from users to make design decisions instead of having an algorithm predict based on the users' passive behaviors. It is worth mentioning that some projects had several features in each category, especially with regards to displaying safe or appropriate content, such as in Case Study 2.

How does their knowledge of design agendas impact how they perceive AI and the AI systems that they use?

Each open ended answer was analyzed for the number of unique stakeholders identified. The average number of stakeholders from each class was calculated and compared from the beginning of the week to the end of the week using a Wilcoxon Signed Rank Test. The average number of stakeholders identified for YouTube Recommender System was higher at the end of the week ($M=3.0$, $SD=2.56$) than the beginning of the week ($M=1.21$, $SD=1.44$), with $p=0.015$. Stakeholder identification for Google Search also was higher at the end of the week ($M=1.84$, $SD=1.38$) versus the beginning of the week ($M=1.05$, $SD=1.75$), with $p=0.032$. There was no major difference between stakeholders identified for a self-driving car (Figure 7).

Figure 7. Students were able to identify more stakeholders of Google Search and YouTube after the workshop than before the workshop.

DISCUSSION

Recognizing Design Agendas

The process of redesigning YouTube was meaningful for the students in that it allowed them to critically assess current design agendas at play and to drive their own design agendas for a technology they care about. At the beginning of the activity, students were asked what they thought the purpose of YouTube's recommendation algorithm was. Students initially responded by saying that the goal of the system was to "give you what you want" and "entertain" the user. However, after a few moments of class discussion about stakeholders in the platform, students came to the conclusion that the goal of the system was to keep the user online as long as possible so that they could ultimately generate more ad revenue. Through the process of creating an ethical matrix, students were given the opportunity to (1) reflect on which stakeholders' values are prioritized and how those values are translated into the platform's design, and (2) encouraged to identify new stakeholders and values in order to reimagine the system.

The Socratic seminar discussion showed the students' ability to identify stakeholders and explain their pairing of stakeholders to particular values. When they were asked who the most important stakeholders were in the FTC's investigation of YouTube, they identified several stakeholders similar to the ones that they addressed in their redesign projects. Children, parents, and Google were seen as the prominent stakeholders, and children were seen as the most vulnerable group out of the three. One student described why this was the case:

"Because it's a lot about the safety of kids and what they watch because kids get easily influenced. So when [kids] see something's happening around them, they obviously think, 'oh, they're more experienced we should copy whatever they're doing.' So, it could be really bad that's why they take a long time to make sure everything's cautious

and there's no bad content that could get released into the world of children."

Another identified parents as a key stakeholder, because they were adults that had the children's best interests in mind:

"I think parents are also a really important stakeholder because first of all kids do get influenced a lot, but still, parents are the ones who know what's appropriate and not appropriate, kids don't really know. So parents are kind of the ones that are more cautious and worried about the app being safe or not."

One student pointed out that Google the company was the biggest stakeholder, because they had a financial interest in YouTube's success:

"I think Google would be like one of the major ones because one thing, it's making lots of money on YouTube."

The Socratic seminar was an opportunity for students to apply the tools that they learned through the redesign project to a real situation in the technology industry. By both identifying and empathizing with various stakeholders, students were able to think critically about what YouTube ought to do, such as keeping the autoplay feature or separating out content of its young viewers. One student chose the safety of children as a top priority:

"Yes [I think that YouTube Kids should be a separate product] because then even if YouTube doesn't make as much money as they used to, it's still important that kids don't watch grown-up stuff."

These discussions helped them move from passive users to conscientious consumers of YouTube. They were able to conjecture what specific design decisions YouTube might make, and how those decisions might benefit stakeholders such as YouTube, children, and parents. This helped them develop their own opinions regarding the proposed changes to YouTube.

Another student echoed this opinion but was more concerned about the financial effects this design would have on YouTube:

"I think they kind of should be the same thing because if someone, if they did separate, and someone decided they wanted to post a video on YouTube Kids and they weren't getting as many views as they wanted because there's not enough users or as many users on YouTube Kids, they don't have the choice, it's not never going to be on YouTube."

Regardless of their stance, students consistently referred to various stakeholder-value pairs when justifying their opinions.

Driving Design Agendas

The ethical matrix tool was also used to determine priorities and goals for new designs. Through the YouTube Redesign Project, students created ethical matrices to map out whom they wanted to consider in their designs. Not only did they identify similar stakeholders in their redesign projects as the FTC article, but they chose stakeholders and values that are

commonly referenced in YouTube policy [33]. This may also be due to the fact that we required students to include YouTube the company as one of their major stakeholders, which made them think of the other key stakeholders in YouTube's business model.

The matrix served as a tool to refer to as they created new goals for YouTube. We found that the goals that they chose were heavily informed by the matrices. Most often, students used their ethical matrices to pick what was valued by the most amount of stakeholders and made that the goal of their system. For example, one pair decided to optimize for entertainment "*Because the most stakeholders have the value of entertainment.*"

Students that took this most-stakeholders approach were more likely to have more than one goal. If there was a tie for the value that was most supported, students often tried to optimize for both values. In Case Study 3, we highlight a group that chose to optimize for both entertainment and profit. In this case study, we found that students designed more features that increased profit rather than entertainment. Students who chose more than one goal were not as likely to design features equally for both goals.

The remaining students applied different ethical approaches, such as thinking about the future consequences that some values afforded. One example of this was the pair of students who decided to optimize for profit: "*YouTube and YouTubers can use the profit to increase the quality of the site and videos.*" These students included multiple features in their paper prototype related to advertisements and watchtime, such as allowing ads on shorter videos, requiring an autoplay feature, and allowing users to give feedback on individual ads.

Overall, "entertainment" was most commonly selected as the main goal. When looking at the most common stakeholder-value pairs, we see that entertainment was a goal that was valued by most stakeholders. The students in Case Study 2 were one of the pairs that decided to optimize their redesign for entertainment. The features that they used to meet this goal were very safety oriented. For example, they created a slider feature for level of rudeness and jumpscare, and added a safety lock for kids. This group separated out the kids and adult channels, which is the same feature that YouTube was proposing in the Wall Street Journal article that we read. It was empowering for students to see that the design decisions they talked about in class were sometimes the same ones that YouTube debated.

We saw similar features were developed across projects in both classrooms. The most common type of feature was one that was related to advertisements. Though most groups chose to create an ad feature, the features differed in their purposes. For example, some groups chose to limit ads in order to improve the entertainment experience of the user. Two groups had profit as their goal. One group chose to make advertisements longer while the other gave users the opportunity to pick the ad experiences they preferred. For example, one group asked users upfront what brands or topics they were interested in. One pair whose goal was entertainment found a middle ground

between these features. They offered a subscription service without ads in order to make watching videos more enjoyable while preserving YouTube's profit model.

Through this process, students were able to (1) consider what their own design agenda should be and (2) practice designing features on the platform to serve these agendas.

Empowering Future Designers

After the workshop and the YouTube redesign activity, we found that students could identify more stakeholders than they could at the beginning of the week. Specifically, there was an increase in the number of stakeholders identified for YouTube and Google Search. It is likely that the YouTube Redesign Project led students to think more deeply about YouTube stakeholders specifically. However, students were able to identify more stakeholders of Google Search as well. This may be due to the fact that almost all students use Google Search regularly and therefore have extensive knowledge about how it is used. There was not the same increase for self driving cars, which may be due to the fact that the students have limited experience and knowledge of them.

Students were able to understand the design agendas of technologies they were familiar with. YouTube was a great starting point to get students to understand the concept of a socio-technical system. Future curriculum design should use popular technologies as a bridge for students to apply ethical design to their own projects or creations. Not only was this exercise meaningful to students in teaching them about design agendas, but many students also voiced interest in being involved in future design processes and learning more about technology in general. Many students expressed interest in presenting their ideas regarding their YouTube redesign to various stakeholders. In a reflection after the activity, one student wrote:

"I hope that our YouTube designs are actually considered in YouTube's future plans."

Another student reflected a desire for their voice to be heard in the design process:

"I hope that I get to work to help with the redesign on YouTube at Google."

After the exercise, students also showed interest in learning more technical concepts to complement their design skills. Students originally came in with a wide range of exposure to technical concepts as well as practical experience with coding, and to some, the workshop was intimidating. However, at the end of the workshop, several students asked if there were other similar workshops they could enroll in with programming components. In their reflection, one student said they were thinking about:

"How I'm going to make the AI?"

Another wrote:

"I feel satisfied, yet hungry for more."

We believe this indicates that ethical design experiences can inspire students to pursue interests in technology ethics, technology policy, and computer science.

STUDY LIMITATIONS AND FUTURE WORK

The first limitation of this work is the small sample size and the setting in which the study took place. This study was atypical in that students self-selected into participation (as discussed in the “Selection and Participation of Children” section below). The study took place during summer break, during a summer camp, and thus the attitudes toward the class were different than in a typical classroom. We also had students in and out of the classroom during the week, which made continuity difficult and resulted in a decrease in data points. Due to the nature of self-selection, we also faced a large gender imbalance which is unfortunate due to the emphasis in the curriculum on the need for diverse opinions.

Furthermore, students were also broken up into two classrooms by age in order to understand how capabilities differed by grade level. A low sample size between classrooms made it difficult to understand differences by age. A follow-up study that addresses differences in grade levels would be beneficial for deciding the optimal time for engaging with this curriculum.

Another limitation of the study was the tool itself. The ethical matrix allowed students to think about who might benefit from a socio-technical system, but the adaptation of the matrix that we used did not address who might be harmed. Though the ethical matrix moved the students’ thinking forward, future studies and workshops might address these nuances in ethical decision making. This includes understanding both who will benefit or be harmed by the system.

Despite these limitations, we feel that this work is a step forward in incorporating ethical design in the classroom. It also highlighted some of the big topics that students care about. Some of the most prominent features that came out of the YouTube Redesign were focused around advertising. We found that our students had experiences with and interest in the profit models of companies that create their favorite platforms. Future work might leverage this interest to create new lesson plans or studies to further understand their perceptions of their own data and advertising. Furthermore, the structure of this activity, and especially the ethical matrix, could be used regarding other technology and platforms beyond YouTube.

Future studies may move from discussing and exploring these topics to thinking about levers of change. Students wanted to advocate for their views, and wanted their voices to be heard. At the end of the week, one student asked us,

“Will YouTube pay attention to our ideas?”

We hope that the number and quality of activities that allow students to question the perspective, role, and influence of technology will increase over time and that future technologists will consider themselves to be socio-technical designers.

ACKNOWLEDGMENTS

The authors would like to thank Maeve Ronan, Danny Plouffe, Carolyn Song, and Ilana Pelzman-Kern for teaching and mentoring our students and for their feedback on the curriculum. Thank you to Empow Studios for recruiting. Lastly, thank you to the MIT Media Lab Consortia for funding this work.

SELECTION AND PARTICIPATION OF CHILDREN

We recruited students entering grades 5-9 in the Boston area through a local for-profit STEM Education program as part of their summer workshop series. They were recruited through flyers and online postings by Empow Studios. Parents gave written informed consent and students gave signed assent prior to the study. All students were exposed to the same curriculum over the course of five days. The protocol was approved by the MIT Committee on the Use of Humans as Experiment Subjects (COUHES).

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