Thinking Critically: Classroom Activities to Examine Ethics in Computing

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SYNOPSIS

There are many reasons why it is important for students to think about the ethical implications of computer science and the technology that they use and create. At the beginning of the Covid pandemic all teachers faced the sudden transition to necessary remote learning. The fast pivot to online learning required changes to existing lessons, or even creating totally new ones. Shifting to lessons about ethics proved to be a valuable substitution for lesson plans (LP) that required access to resources no longer available to students from home. Presented here are a series of lessons that could be taught in any modality that were adapted for middle and high school learners during the spring of 2020 for their science and AP CS Principles courses. Although the activities and artifacts that are described for students were originally created for online synchronous sessions, they could easily be adapted for face-to-face, online or hybrid classrooms. The subjects of these lessons focused on the ethical impacts of computing by looking at past, present, and emerging technologies. Specifically, the lessons presented here look at the overall ethical ramifications of artificial intelligence (AI), the disruption experienced through peer-to-peer file sharing, and an overview of cybercrime.

KEYWORDS

Ethical computing, AI, Cybercrime

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1 WHY TEACH ETHICS?

We often experience news stories that center around tech companies and the impacts of technology both real and hypothetical. As of this writing, the trending topics include banning TikTok and the emergence and evolution of ChatGPT. Media coverage for both technologies highlight the importance of students learning about them so they can make their own informed decisions. Studying ethics can help develop critical thinking skills. Typically, there are ethical implications when new technologies are introduced to provide a good or service, but they are often accompanied by a range of outcomes and consequences often not anticipated by their creators.

Computer science (CS) education has been emerging as a discipline that has a place in K-12 education [11]. While we have made progress with making CS education available, we also need to consider teaching about the consequences of technology and the impacts on individuals, groups and particularly marginalized groups [7]. K12CS.org curricular recommendations suggest by the end of grade 5 students should be introduced to the ethical implications from the opportunities provided by computing. Further, by the conclusion of grade 8 students should recognize the trade-offs of an online presence and safety and privacy, and by the end of grade 12 students should be aware of the impacts of the laws both nationally and internationally that govern computing and data privacy[1]. The K12CS.org framework situates the study of the impacts of computing as a core concept that focuses on safety, security, and ethics [1]. Similarly, the work of AI4K12.org, whose mission is national guidelines for AI K-12 education, identifies ethics within societal impact which is one of the core 5 Big Ideas in AI Education [2]. These frameworks, while not standards within themselves, guide and inform the K-12 CS standards at the district, state, and national levels. All identify the importance of instructing students about ethics.

2 INTRODUCTION TO ETHICS IN THE CLASSROOM

Legend has it that a love of Shakespeare led Eugene Schieffelin to release European starlings into Central Park resulting in the introduction of one of the first documented accounts of an invasive species [5]. This tale is one that makes a good segway to introduce the topic of ethics in middle and high school science and computer science classes. To engage students in this topic, teachers can show the class a YouTube video of a starling murmuration and invite them to predict its connection to the classroom. There are many paths that this conversation can follow, but not unlike the murmuration itself, it is a representation of a circuitous path to a discussion of legends, facts from fiction, and finally, the ethical implications of actions, and how they can result in intended or unintended consequences.

The analogy of the starlings also works when we talk about the introduction of a new technology. When we see the arrival of a new technology, and watch the process of adoption that it undergoes, we can only hope that the intent of the creators is to add value to our lives for only positive impacts. Just like the introduction of the starlings, the acclimatization movement in the 19th and 20th centuries was based on economic and cultural motivations. In this case, however, the result was an invasive species continuing to wreak environmental havoc. When introducing ethics an overarching question is have all new technology introductions been for economic or cultural reasons? If it is concluded that all technologies have been implemented with best intentions, there are certainly many parallels of unintended consequences.

Conversations about topics such as these in a classroom setting and can evolve into very thought-provoking discourse among the participants with very minimal prep and planning. However, finding ways of creating equivalent lessons for virtual learners can require extra creativity. It is easy to have theoretical conversations "on the fly" when in person with students when you have the advantage of eye contact and body language. Hybrid and virtual learning, however, require more deliberate planning. The shift to virtual learning in 2020 prompted the modifications of lesson plans to provide students with a context that could engage them to critically examine outcomes and created a scaffold to situate their thinking in outcomes from prior learning. This article shares three of the adapted lesson plans from the traditional classroom setting to the virtual model but could be presented in any modality or even in combination. Lesson plan topics include the following.

- `Topic 1`: Copyright & File Sharing, when is it ok?
- `Topic 2`: Cybercrime or Not? – Evaluating crimes
- `Topic 3`: AI and Society – Debating our future

Presented here are narrative versions of lesson plans to accommodate article space limitations. Where appropriate, there are pedagogical suggestions as well as the incorporation of recommendations for choice and agency in accordance with the Universal Design for Learning framework [3]. Versions of the following lessons were adapted for middle school science and AP CS Principles course sections.

3 LP #1: COPYRIGHT & FILE SHARING, WHEN IS IT OK?

This lesson centers around the history of peer-to-peer (P2P) file sharing and the disruptions that it created upon its arrival. In addition, this lesson recalls the starling discussion as we evaluate intended versus unintended consequences. While the development of P2P was designed and implemented as a breakthrough in file sharing and networking capabilities, what became available and how it impacted several industries was explosive. P2P file architecture breakthroughs led to new industries and the streaming services we use today. However, when introduced it disrupted many powerful industries such as movies (MPAA) and music (RIAA) [9]. The subject of this lesson is the legal battle faced by one of the first P2P companies, Napster. We study copyright, fair use, and the story of what happened when two teens took on a major industry. Students evaluate about consequences of a technology culminating in a mock trial.

3.1 Learning Objectives

- I can describe the technology of P2P file sharing.
- I can analyze the effects that P2P had on the music industry, individual users as listeners, and artists.
- I can compose an essay (testimony) in support of the concerns of individual users, artists and recording executives.
- I can participate in a mock trial to analyze the case.

3.2 Vocabulary & Background

Before the engagement of a mock trial can occur, learners need prior knowledge of the language and proceedings in a court of law. Before they can meaningfully engage in the process they first need to be grounded in the terminology. Some concepts and vocabulary needed include:

- Copyright
- Fair Use
- Peer-to-Peer file sharing
- Nonprofit vs profit business model
- Digital Rights Management
- Plaintiff
- Defendant

For background, students can review information on copyright and fair use that is available from the U.S. government.

Two important concepts key to understanding copyright are that music belongs to the artists that create it, and fair use is generally intended for purposes like education. For example, fair use is the reason why a teacher can play a song or show a movie in class without having to pay the artists for using it. Another key point is for students to distinguish the difference between a for profit versus a not-for-profit venture. Typically, an example like the Humane Society is approachable for all students. The Humane Society raises funds to help animals and does not engage in any profit sharing from their work. Compare this to a company like *Google* which makes a search engine available for free, but in return, can show advertisements, gets paid by advertisers and obtains information from the user by way of the data entered into the search terms. Also highlight the distinction between a plaintiff and a defendant in a legal case.

3.3 Engaging Activity to Launch the Lesson

There is always a lot of excitement about the Superbowl and the commercials that debut in those expensive slots during the game. In 2004, Pepsi had an advertisement that was rather tongue-in-cheek. Students can watch the commercial (available on YouTube) and have a follow-up discussion about the commercial that addresses a few of the references happening in the commercial including; *who is the girl? why is Greenday singing that particular song? and why were downloads of songs being given away by Apple a big deal?* Students may need background explanations that prior to the arrival of services such as Spotify, the ways to hear music were through listening to a radio for free, or purchasing (first records, later tapes of varying formats and CDs). Being able to listen to any music that you wanted whenever you wanted was not something that you could do in 2004 without purchasing a physical copy of it. Apple launched the iTunes music store, and what was unique about it was that you could purchase one song for about a dollar rather than having to purchase an entire album at a much higher price. Be prepared that K-12 learners may not have any comprehension of listening options prior to streaming and cloud-based services.

3.4 What is P2P

A peer-to-peer network allows communication between computers without the need for a server. In P2P architecture there is no central server meeting processing requests, the computers interact with each other without that central point of contact of a server overseeing them. This breakthrough, intended to lighten the load on servers, results in when one peer makes a request, it is possible that multiple peers have a copy of that requested object.

3.5 The story of Napster

One of the first software applications to make use of P2P was Napster. Napster allowed users to share copies of files without direct ownership. According to a Google search, at one point Napster reached 80 million users. P2P allowed the sharing of one legal copy of a media file (predominantly songs) to many users, and there were potentially 80 million people that could access the one copy. Once they could access the file, users could download near perfect file copies, in this case music files, for free. Prior to this, users would have to purchase copies of CDs or vinyl albums to have high quality files for their music. Napster gave users access to downloading copies of files that were of high quality at no cost. Not surprisingly, this disruption to the potential profits for artists, and the industries that supported them was immense. Have students watch this 12+ minute New York Times documentary about Napster on YouTube [13]. Similarly, as an alternative the class could research the case in Sweden of civil prosecution of The Pirate Bay trial.

3.6 The Mock Trial

Now that students have been introduced to the story and legal battles of Napster, have students take on roles and present a mock trial in which you invite another teacher or administrator at your school to be the judge. If you are not familiar with mock trials, the following linked resources will provide details:

- Mock Trial Activity Guide
- Teaching Civics Mini Mock Trial Manual
- American Bar Association Plans

Roles for students can be assigned in various ways depending on class size. If you have more than one class, you can even have one class be prosecutors and the other section be defense. You can assign roles by adjusting the number of witnesses and lawyers for each side. For example, there were many individuals who were sued by the RIAA, and there were many artists that were involved to create more parts as needed. The characters to be assigned besides the judge and jury members if you opt to have a jury trial include Shawn Fanning, Sean Parker, Jerry Leiber, Ali Aydar, Annie Leith, and others sued by the RIAA. On the Plaintiffs side you could have the roles of A&M Records executives, Geffen Records, and lawyers for the Plaintiff. Additional roles might even include Metallica or Puff Daddy, Tower Records store owner, and Tower Records executives. In keeping with UDL guidelines, it can be beneficial for students to pick out the roles they wish to play or even which side of the case they wish to argue. While there are no artifacts for this assignment assigned to all, there are opportunities to create evidence exhibits (posters, printouts, drawings) and costumes as well as researching and writing speeches or testimony for witnesses.

This creative endeavor has opportunities for assessment and student voice and choice.

Once roles are assigned, each side will need time to research and plan their part in the trial. Encourage students to think about the ethical implications of their cases as they are performing their research and writing the Opening and Closing Statements for the trial. In terms of assessment, students can be given a rubric before the lesson begins and examples of what can be assessed is varied, but there are clear opportunities for collaboration with peers. The students can be encouraged to reflect on their journey in the trial with a daily diary or completed exit ticket of what they worked on in class during the preparation phase. Exit prompts can include things such as I worked well with my partners today, I learned (blank) about the case today, or I prepared (blank) for the case today.

After the trial has been enacted, invite students to reflect on the "winners" and "losers" in this case. Did their conclusions match those of the real trial? Ultimately, we want them to experience this case of unintended consequences resulting in major disruption to an entire industry. Be sure to help make connections to the disruptions that were caused to the industry, how the industry chose to fight the disruption, and evaluate their own conclusions about if it was successful because they have the advantage of living in the future after the battle played out in the courts.

4 LP #2: CYBERCRIME OR NOT? - EVALUATING THE SEVERITY OF A CRIME.

This lesson centers around the many and varied forms of computer crime. Students develop two artifacts, one for the extensive vocabulary of terms and one for a shared presentation as sense making for a subset of topics of their choosing. In addition, they can be asked to provide rankings of the crimes in terms of magnitudes of violations and ethical violations. A doc version of this 5E lesson plan for this activity can be found in Lesson Template Ethics & Crimes.

4.1 Learning Objectives

- I can identify and classify various terms related to computer crime.
- I can evaluate the ethical implications of different cybercrimes.
- I can create an artifact/presentation that explain the terms to novices.

4.2 Vocabulary

General terms at the outset of the lesson include:

- cybercrime
- hacking or hacker
- white hat vs black hat hacking

Lead students to all of the vocabulary associated with cybercrime. The International Chiefs of Police have compiled an extensive glossary linked here or in the Auxiliary References below. Have students work individually or together in teams to review the vocabulary and begin to brainstorm ways to organize a subset of the terms. Part of the objective is to look at the terms and organize them as well as to identify patterns.

4.3 Engaging Activity to Launch the Lesson

Hackers and hacking is an activity that captivates the imagination of many students. It is easy to do a fast search and find a list of teenage hackers and their exploits. Indeed, it is not uncommon for teens to find ways around network security to bypass internet filters in their schools. For this engagement start with a story of a cybercrime that your students would find interesting. Two possible examples, Kevin Mitnick or Brett Johnson, are highly recommended because in both cases, they started as bad guy hackers but now use their skills productively. A good resource to pick from is the FBI resource for major cases. You can tell the story, or invite students to review this case for themselves. Alternatively, invite students to look up and share about famous hacks or hackers that they find interesting.

4.4 Examining Relationships of Terms

Return students to the glossary referenced in the vocabulary section. Working individually or in teams have them create an artifact that combines and organizes the terms in some fashion. For many, this vocabulary will be new, and you need to provide an exercise to scaffold the learning of the terms. Encourage students to find relationships among the terms and organize them in some hierarchy or categories to allow sense making for them. You can choose terms to assign, and then give students choices for additional terms or categories that they find interesting. Furthermore, you can provide learners with choices of the kind of artifact that they will create including flow charts, mind maps, spreadsheets, or infographics. Ultimately, the unit assessment will occur by using a previously distributed generic grading rubric to evaluate the artifacts. Artifact creation will encourage students to analyze, evaluate and assess the vocabulary and combine them in some way that is meaningful. The number of terms required can be determined by grade level, for example 15 terms for a middle school class or 50 in high school.

Once students master the initial vocabulary terms, they can begin to think about the actual crimes represented. As a next phase, have learners focus on ethical impacts as they evaluate a crime. You could select a law enforcement scale, misdemeanor vs severe crime against humanity and various

values in between. Whenever possible, provide examples like a flowchart or infographic if students are not familiar or have not had experience with these types of documents. This assignment can be done in a group or individually but encourage groups for "dividing and conquering" to highlight collaboration effort, like law enforcement officials would use for crime investigations.

4.5 Creation of Artifacts

Now that students have organized the vocabulary, they are asked to create an artifact to explain about a particular type of cybercrime that they have learned about. This will require that they further investigate the vocabulary that they have chosen to gain a deeper understanding. For the artifacts, students have options of what can be created including the creation of an informational poster, a "wanted" poster, a website, a blog post, a short video (such as a PSA) not to exceed one minute. Whatever media is selected it must be able to be shared electronically, with the goal to explain the terms chosen to highlight in a way a novice could understand them and to evaluate the ethical impact of the crimes they have chosen.

4.6 Evaluation and Presentation of Artifacts

Create a showcase or gallery walk for students to share the work they have created during the elaboration. In a virtual environment, students can share in various breakout rooms that are open for people to join. This can be done in "halves", so all students get the opportunity to review the work of their peers. Invite attendees to leave comments in the chat that can be used to evaluate how the topics are presented and if they have any questions from what they have seen. It is recommended providing students with a generic rubric at the launch of the assignment that can be used for assessment regardless of artifact choice. Create a rubric for the common elements such as completed on time, number of terms completed, overall artistic impression, spelling and vocabulary, and creativity.

5 LP #3: AI AND SOCIETY - DEBATING OUR FUTURE

The initial online version of this lesson was through students working in breakout groups and sharing a slide deck via a shared screen at the conclusion. Although the narrative is for synchronous, online sessions, they could also be implemented in a classroom. However, face-to-face classrooms would have the advantage of allowing students to create something instead of or in addition to slides. In person options could be expanded depending on access to tech to hand drawn posters, presentations on a white board or even artifacts created such as the results of a chatGPT inquiry.

5.1 Learning Objectives:

- I can evaluate statements made about AI.
- I can analyze the pros & cons/costs & benefits of a statement made about AI.
- I can support my personal beliefs about specific AI issues.

5.2 Engaging Activity to Prepare for the Lesson

For this lesson, the background information was presented as a flipped lesson. Before any classroom discussion of the topic, the students were asked to watch an episode of Frontline [10] that had previously aired a few months prior and were given specific sections of the video to watch. The episode was two hours in length which exceeded the amount of time the school allowed for a homework assignment, so they were assigned to watch the first hour. The Frontline program titled *In the Age of AI* is available on YouTube. Produced by PBS, the episode is described as: *"A documentary exploring how artificial intelligence is changing life as we know it — from jobs to privacy to a growing rivalry between the U.S. and China. Frontline investigates the promise and perils of AI and automation, tracing a new industrial revolution that will reshape and disrupt our world, and allow the emergence of a surveillance society."* It could have been because the students were bored while in lock-down during the pandemic, but most reported watching the entire episode because they found it so interesting.

After the video was assigned, students were instructed to arrive to a synchronous online session ready to discuss the content. They were not required to turn in any notes, but assessment could be part of the lesson. Similarly, since the video is now on YouTube (at the time the lesson was created it was only available on PBS) you could embed quiz questions via an app such as Edpuzzle or Playposit and assign through a class post to track the individual progress and performance.

5.3 Exploration and Engaging in the Lesson

When students arrived at class, we began with an opening activity to check on how they were doing. During this lesson, the prompt was "What was the best part of your day yesterday?" Anecdotally, a fair number responded that watching the assigned video had been a highlight.

While we don't have a crystal ball, there are educated guesses we can make about how AI will affect us in the future. For example, we can say with some confidence that someday AI will be driving our trucks and cars. AI is already replacing humans in jobs like assembly lines where

machines do not get injured or need to take breaks. We have now entered a time where AI is beginning to replace more highly skilled positions. A great way to introduce the possibility of AI taking jobs is to show an example of articles written for a sports page of a newspaper - which of course is another whole conversation about the disappearance of physical newspapers as a media source. We now have AI that can write recaps of games that are indistinguishable from those written by humans [6].

While the USA has been a leader in technology for the last several decades, the program points out that China is poised to be the world leader in AI[8]. Students were randomly assigned and distributed to five breakout rooms corresponding to 5 quotations listed below. In their groups they utilized a shared Google Slide deck and created three slides. Slide one was an explanation of their assigned quote to show their comprehension of how it was used in the program. On slide two they identified the pro aspects of the quote, and the third slide for the con aspects. The students worked in their breakout rooms on the three slides for twenty-five minutes. At the end of the time, they all reported back for a share out. Students stayed with the same groups and were again sent to the breakout and asked to evaluate the five individuals who were quoted in the questions, and they were asked to think about and analyze the presentation that the groups had given. They were then asked to select the quote/person they found to be the most surprising and to share the evidence that would support their decision. This activity was given approximately twenty minutes, at the end of which they again shared the opinions of the five groups.

5.3.1 Frontline Breakout Discussion Quotes and Instructions. For your assigned quote, please create three slides. On slide 1 explain how the quote was used in the program and what you believe the author intended it to mean. On slide 2 identify the "Pros" and on slide 3 the "Cons" of the statement. Please give concrete examples to support your beliefs.

- `Quote 1`: Kai-Fu Lee stated, “AI is a technology that can be used for good and for evil."
- `Quote 2`: Jeff Bezos of Amazon stated, “technology is always two-sided.”
- `Quote 3`: "AI is a lot like electricity, everyone is going to use it" - Brad Smith.
- `Quote 4`: Robert McNamee stated, “we gave tech a place in our lives that it had not earned.”
- `Quote 5`: Shoshana Zuboff stated,“we can take cues in the online environment to change real world behavior.”

At the start of the next synchronous class online, the students were asked to reflect on the program they watched and the associated activity that they had participated in during the previous class. They were very positive in their comments. For many, it had been the first time they had gotten to interact as a small group since leaving the classroom. This small group social interaction was something that they were missing and that they were craving so they indicated that they really appreciated the opportunity to work together. In general, prior to the pandemic, the AP CSP course utilized a lot of collaborative work including pair programming so this was a way to simulate that interaction in the virtual space. Today, for face-to-face classes this exercise could still be undertaken. The video watching could still happen in a flipped-format and assigned as homework. The ensuing discussions relative to the quotes could still be achieved in a classroom. Over time this lesson may or may not age well because it is directly linked to the viewing of a particular video. However, this same format could be applied to other AI topics. We could modify the lesson so that students work in groups and evaluate quotes that have been made by various figures about chatGPT. Similarly, we could talk about the results of AI being influenced by data sets. For a deeper dive into the ethics of AI and impacts, students could debate the scenarios found on the experiment page from Moral Machine where AI has crowd sourced data making ethical decisions that directly impact humans [4].

6 RECOMMENDATIONS - PUTTING IT ALL TOGETHER

Sections three through five have presented lesson narratives for engaging middle and high school students about the ethics of technology. These lessons provide opportunities for educators to point out the ethical impacts of technology highlighting intended and unintended consequences. For example, sharing music files through the disruption of P2P provides easier access but eventually leads to the demise of record stores to purchase music. Just like our starlings, a desire to share artistic property resulted in unintended consequences.

All these lessons can be adjusted for time in any modality. The lessons could be presented in computer science classes, or in collaboration with other disciplines. In the case of the mock trial, the content lends itself to a collaboration with another class such as a history or civics class that would have additional objectives that could be met through a collaborative multidisciplinary approach [12]. The trial could take a class period to create, or longer depending on how accurate a portrayal of a trial is attempted. The lessons could be taught individually or as a unit and could be presented in any order or sequence. What connects these lessons together is that they build upon what can happen as resulting consequences from the introduction of new technologies. While we hope new technology will enhance our lives and be used for good, there are no guarantees. Students need to develop the skills

to think critically about the ethical impacts of technology and these lessons can support that goal.

7 MATERIALS

Supporting documents that are available to be downloaded, as well as the referenced URL's from this article are enumerated in the Auxiliary Materials. Additionally, a document linked here (bit.ly/3MyaViD) containing the links is available for download, and could be periodically updated by the author.

8 AUXILIARY MATERIALS

All URL's referenced throughout the document are including within the following numbered list with a brief description of the content.

(1) https://www.youtube.com/watch?v=V4f_1_r80RY - YouTube video of a starling murmuration.
(2) https://www.copyright.gov/what-is-copyright/ - Basic facts and explanation about U.S. copyright law from the U.S. government copyright office.
(3) https://www.youtube.com/watch?v=rcToyN2_cSs - Pepsi commercial that aired during the Superbowl - expensive time to air a commercial for the purpose of supporting the legal downloading of music from one of the cases pursued by the RIAA.
(4) https://www.youtube.com/watch?v=CKrdsGdLVQ8 - New York Times short documentary movie (12 minutes) about Napster that explains the whole situation.
(5) https://classroomlaw.org/wp-content/uploads/2019/03/Mock-Trial-in-the-Classroom-Activity-Guide.pdf - Mock Trial Activity Guide free download available from the Classroom Law Project.
(6) https://teachingcivics.org/wordpress/wp-content/uploads/2013/06/Mini-Mock-Trial-Manual-Instructions-2014.pdf - Mini Mock Trial Manual Instructions from the Learning Law and Democracy Foundation. Contains detailed teacher instructions in how to perform a mock trial in the classroom.
(7) https://www.americanbar.org/groups/public_education/resources/lesson-plans/middle-school/due-process/mock-trial-plan/ - Online lesson plan and steps from the American Bar Association about staging mock trials.
(8) https://bit.ly/477E3oY - Lesson Plan template for Lesson #2 in the 5E format with UDL guidelines included.
(9) https://www.iacpcybercenter.org/resources-2/glossary/ - Extensive glossary of terms provided by the International Association of Chiefs of Police
(10) https://www.fbi.gov/investigate/cyber/major-cases - FBI resource for cybercrime information.
(11) https://www.youtube.com/watch?v=5dZ_lvDgevk - Frontline episode of *In the Age of AI* video on YouTube.
(12) https://www.moralmachine.net/ - Moral Machine project site and information.
(13) https://bit.ly/3MyaViD - Link to Google Doc containing all links referenced in the article.

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