Book Club Model for Engaging with Data Science and Ethics*

Using *Weapons of Math Destruction*

Tammy VanDeGrift
Computer Science, Shiley School of Engineering
University of Portland
Portland, OR, USA
vandegri@up.edu

ABSTRACT

This experience report describes a book club model for an undergraduate-level Big Data Analytics course. Course learning outcomes included communicating ethical implications of data and models and working collaboratively with other students in crafting solutions by listening and demonstrating. Students read *Weapons of Math Destruction* by Cathy O'Neil, individually answered reading questions, and collaborated during activities in three class meetings. Students' participation and activity completion rates exceeded 90%, indicating engagement with the book club model. To understand students' experiences with the activities, students' work and survey responses were analyzed. The book club activities expanded students' understanding of bias in data and models, the potential misuse and harm when using and creating software, and how models can target users. In addition to providing activities for a specific book, this paper can serve as a template for using the book club model in any computing course.

CCS CONCEPTS

•Social and professional topics ~Professional topics ~Computing education

KEYWORDS

Data Science, Ethics, Active Learning, Book Club

ACM Reference format:

Tammy VanDeGrift. 2024. Book Club Model for Engaging with Data Science and Ethics. In *Proceedings of 55th ACM Technical Symposium on Computer Science Education (SIGCSE'24). March 20 – 23, 2024, Portland, OR, USA. ACM, New York, NY, USA, 7 pages.* https://doi.org/10.1145/1234567890

1 INTRODUCTION AND RELATED WORK

Educators support student learning with a variety of resources such as textbooks, videos, curriculum materials, in-class activities, assignments, and projects. Book clubs are one of several techniques to engage students in reading comprehension skills as early as K-5 grade levels [23]. Early-grade educators use book clubs to give children reading choices, group learners into similar reading levels, introduce new genres, and engage students in political/social discussions [13,16,17,24]. Book clubs among adults have become more popular, perhaps due to Oprah Winfrey's Book Club [9]. In these more informal book club communities, participants often select books together and organize discussion meetings. As recently as 2015, 57% of surveyed US college graduates participated in a book club [19]. Adults may join book clubs to foster community-building and/or for professional or personal development. For example, a book club helped teachers learn about artificial intelligence [18]. In another book club, female undergraduate students in engineering and computer science used the book club model (book: *Playing Big)* to learn about personal and professional development [12]. During the past five years, several book clubs have discussed *Weapons of Math Destruction* by Cathy O'Neil, including groups associated with bookstores, Mozilla, women in data, and an actuarial society [5,7,20,22,32].

While book clubs may be typical pedagogical practice in undergraduate English, Education, and Political Science courses [3,8,17,29], there are few examples of using book clubs in undergraduate computer science courses. The most prevalent genre of general audience books used in CS courses is science fiction. Goldsmith and Mattei used science fiction summaries to help introduce the skill of writing research article summaries [11]. They expanded the pedagogical approach with a third author Emmanuelle Burton to use science fiction to teach ethics [6]. Summet and Bates also used science fiction for discussing ethics in computer science courses [28]. This paper describes course activities inspired by the book club model. It differs from the science fiction examples since the chosen book, *Weapons of Math Destruction,* is not science fiction and is instead a general audience book describing the author's view of real mathematical models that affect people and society in potentially destructive ways [22].

The motivation for including this particular book and associated activities aligns with program outcomes for computer science students. The ABET Computing Accreditation Commission outcomes include: *3. Communicate effectively in a*

SIGCSE'24, March, 2024, Portland, Oregon USA
 978-1-4503-0000-0/18/06...$15.00
https://doi.org/10.1145/1234567890

variety of professional contexts, and 4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles [1]. The CS2023: ACM/IEEE-CS/AAAI Computer Science Curricula is currently under review and proposes two hours of AI applications and societal impact, three hours for social context, and two hours for equity, diversity, and inclusion [2]. The book club activity described here could satisfy these seven hours in the proposed curriculum. There are many other pedagogical methods for teaching about ethics, society, and technology: case studies, debates, and discussions can also engage students [4,14,21,25,26,27,28].

The book club activities were designed with evidence-based pedagogical practices. First, students individually answered reading comprehension questions to actively reflect on the book [31]. During the class sessions, active and collaborative learning techniques of line-ups, posters, gallery walks, speed networking, and case studies were used [10,30].

Following the introduction, the institution, course, and course materials are described in more detail. Sections 3 and 4 provide information about the reading assignment and in-class activities, so other faculty can adopt or adapt the model. Student and instructor reflections are provided in Sections 5 and 6.

2 EDUCATIONAL CONTEXT

University: The book club model was used at a primarily undergraduate university with a liberal arts core curriculum on the west coast of the USA. Computer science course sections enroll 20 to 30 students, so in-class faculty-student and student-student interaction is valued and small class sizes support discussion.

Course: The book club model was implemented in a Big Data Analytics (BDA) course. BDA is an undergraduate, elective, computer science course. The prerequisites for BDA are the introductory programming course (taught in Java), the data structures course (taught in C), and the statistics/probability course. The BDA course includes an overview of the data science process, statistical methods, linear regression, logistic regression, classification, Bayes, tree-based models, clustering methods, association rules, data visualization, and ethics. The course is segmented into six two-week modules with each module containing lectures, in-class activities (ICA), discussions led by students of research articles that employ the module's modeling techniques, prelabs, labs (in R), and a quiz. During the first three modules, students also had activities related to the *Weapons of Math* Destruction book. Table 1 shows a typical two-week module schedule from the first half of the semester.

In addition to the regular cadence of the six two-week-long modules, students worked in teams of three to five students on a semester-long project to analyze data, create models, and create data visualizations. A second semester-long project was an individual research project about the implications of big data in a domain of the student's choice.

Materials and Students: Students were required to buy or borrow the book *Weapons of Math Destruction* by Cathy O'Neil ($17.00 US) [22]. The other course textbook was freely available online [15]. Both books were used in the Spring 2021 (fully online) and the Spring 2023 (fully in-person) course offerings. The *WMD* reading questions and in-class activities were reviewed and revised between offerings. Students in the online course used shared electronic documents to communicate. The Spring 2023 course was in-person, so the activities were re-designed to take advantage of students being able to collaborate and move physically within the room. The remainder of the paper focuses on the Spring 2023 experience with twenty-three students (8 juniors/15 seniors; 22 CS/1 electrical engineer; 3 women/20 men).

Learning Outcomes: The book club activities were designed to fulfill two student learning outcomes in the course: 1) communicate ethical implications of data and models, and 2) work collaboratively with other students in crafting solutions by listening and demonstrating. Section 5 contains guiding questions to evaluate the activities and students' work as it relates to their thinking about the book, their interpretation of what they read, and their engagement in the in-class activities.

Assessment: The reading assignment and in-class activities contributed to 6% of the overall grade in the course. Because the focus was on student engagement with the readings and the activities (see next two sections), the grading was entirely binary (full points or no points) based on reading questions completion and attendance/participation in the in-class activities. Each unit's reading questions and each unit's in-class activity day contributed 1% to the overall grade in the course.

Table 1: Typical schedule for two-week module; each class session was 55 minutes in length

Monday	Wednesday	Friday
	1. Quiz 2. Lecture/ICA	1. Lecture/ICA
1. *WMD* activities 2. Lecture/ICA	1. Lab day	1. Lab day
1. Student leaders 2. Quiz review	1. Quiz 2. Lecture/ICA	

3 THE READING ASSIGNMENT

Students were provided the following assignment and submitted individual reading responses prior to each unit's discussion day:

Purpose: *This book gives one perspective of mathematical models. While data and models may seem objective, unbiased, and neutral, Cathy O'Neil describes several software tools and mathematical models that have caused harm in some way. Many of these tools had altruistic, efficiency, and/or optimization goals that then changed human behavior or impacted certain groups of people in different ways. As citizens of the digital world and experts in computing, navigating ethical issues related to data, who owns data, disclosure of data collection, data use, and data modeling will be ever-present. This book provides one tour into the world of the good and the bad of mathematical models.*

Themes: *As you read the book, consider the major themes the author presents regarding attributes of these "weapons of math*

destruction". Some examples include "black box" – little transparency, using models for purposes other than for what the data was collected, data as poor proxies for things like trust and fairness, and lack of feedback loops to update and correct models.
***Deadlines:** You should finish certain chapters before each discussion date. Reading questions related to each chapter are posted to Moodle and should be submitted by the deadlines below.*

Discussion Date	**Pages (Chapters)**
Feb 6	Unit 1: 1 – 67 (introduction, chapters 1 – 3)
Feb 20	Unit 2: 68 – 140 (chapters 4 – 7)
Mar 13	Unit 3: 141 – 231 (chapters 8 – end)

4 IN-CLASS ACTIVITIES

Three lecture sessions included 35-to-40 minutes of activities related to the *Weapons of Math Destruction* book.

4.1 Unit 1: Becoming Unsettled and a WMD

The first three chapters introduce the author's relationship with mathematical models, both in academia and industry. As one of the reading questions, students created their own definition of a "weapon of math destruction". During class, the students engaged in two types of activities: line-ups and posters.

- Line-up A: The instructor asked students to physically form one line with the following endpoints: After reading chapters 0 to 3, I did not change my view on mathematical models. After reading chapters 0 to 3, my views on mathematical models changed a lot. The instructor asked students to talk to their neighbor about why their views did or did not change.
- Line-up B: The instructor had students form a new line with the following endpoints: When did you start getting unsettled about the potential to use math models as weapons? Just now, after reading this book OR > 10 years ago. The instructor asked students to talk to their neighbor about which software tools are currently unsettling for them.
- Write post-its: Students wrote information on four post-it notes. On two post-its, students wrote their individual definition of a "weapon of math destruction". On the other two post-its, students wrote down a specific example of a software application / algorithm that uses prediction, modeling, or recommendations. They put the WMD definitions on posters 1 and 2. They put the software applications on posters 3 and 4.
- Group Posters: Students were randomly assigned to four groups. Groups 1 and 2 read the WMD definitions, clustered them into similar definitions, and wrote a single, collective definition. Figure 1 shows Group 1's final poster. Group 3 classified the software applications into "has feedback loop", "has no feedback loop", and "may have a feedback loop". Group 4 arranged post-its of software applications so they formed a spectrum from "least harmful" to "most harmful". The information from their posters are shown in Section 5.
- Gallery Walk (modified): Groups 1 and 3 merged, with the groups applying the WMD definition to see if software applications that fit the definition were positioned in the "has no feedback loop" group. Groups 2 and 4 merged, with the groups applying the WMD definition to see if the software applications on the side of "most harmful" fit the definition.
- Wrap-up: The full class compared the two WMD definitions and reviewed the example applications in the "has no feedback loop" group and the "most harmful" group. Students were invited to share other observations they had from the reading.

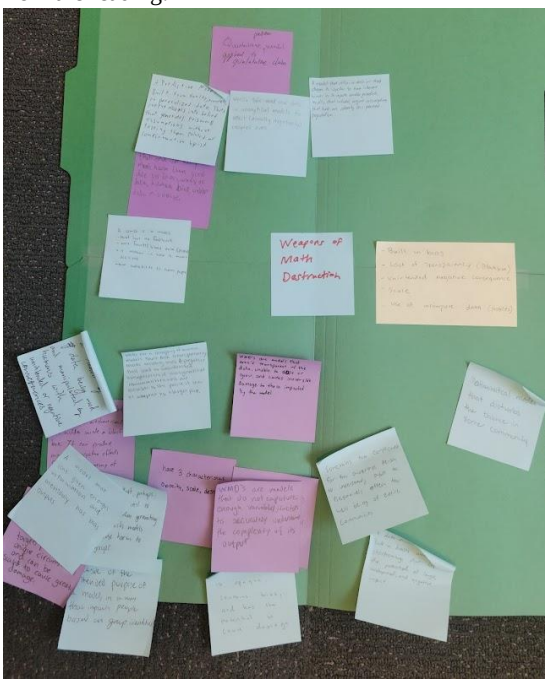

Figure 1: Poster 1: definitions of weapons of math destruction

4.2 Unit 2: Systems that Hurt

Unit 2 focuses on specific software systems that can hurt groups of people. For example, police patrolling, employment scheduling, employee recruiting, and targeted advertising are models of potential destruction. During class, students engaged in two activities: speed networking and group case studies.

- Speed Networking: Each student wrote down themes, questions, concerns, or insights after reading these chapters. The instructor had students form two similar-length lines to engage in speed sharing. After every minute, one line shifted down one position to start a new quick conversation. Figure 2 shows the two lines of students engaging in short conversations.
- Case Studies: Students were randomly assigned to six groups to quickly research a software tool and answer questions. Here are the case study contexts:
    1. Predpol (you are on the city council and they want to use of Predpol for the local police department)
    2. Ziprecruiter (your company wants to use this software to find and hire new employees)
    3. Zoho (your company wants to use this software to do targeting marketing)

4. Sova (your company wants to use this software to find, hire, and assess employees)
5. The Predictive Index (your company wants to use this software to hire and build employee teams)
6. Shiftboard (you are on the board of directors for a large restaurant chain and the company wants to use this software for managing employee shifts)

Each group answered the following questions:

1. What is the purpose of the software solution?
2. What value does the software solution purport to bring and to whom does it bring value?
3. Who may end up being "preyed" upon by using this software solution? (Or who may be disadvantaged if this software system gets used)
4. Who may end up getting advantaged by using this software solution?
5. What questions would you ask as a member of the city council / board of directors / developer at tech company that you would want answered before making a decision to adopt the use of this software?

- Wrap-up: Each group shared their case study answers and wrote one insight they will take away from today's activities.

Figure 2: Speed networking activity

4.3 Unit 3: Injustices, Monitoring, and the Road Ahead

The last set of chapters focuses on systems that monitor and persuade people. In some cases, monitoring may not be transparent, so tracking and privacy become central themes. For example, credit scores, insurance premiums, and healthcare costs are some of the models featured in these chapters. During class, students engaged in two activities: minute papers and posters.

- Minute paper: Each student contributed one idea they will take into the future in a shared electronic document.
- Themes: Students reviewed the shared document and recorded common themes on the whiteboard.
- Posters: Powerpoint slides (mostly blank) were provided as a shared electronic template. Students chose which of the four posters they wanted to join: 1) advice for computer scientists to keep models transparent, have a clear purpose, and not hurt the marginalized, 2) what they can do as citizens to provide guidance about data and models to others, 3) write a code of ethics for data scientists, 4) analyze chatGPT's summary of the book – what it did well and what it missed. After students completed their powerpoint slide, the class did a gallery walk of the posters.

5 STUDENTS' EXPERIENCES

To evaluate students' experiences, the following questions (Q) and data guided the reflection:

Q1: What were completion rates for the reading questions and participation rates of the three in-class sessions? (data: student submissions and attendance/engagement on the three *WMD* days**)**

Students completed the book club activities at a high rate. For the reading questions submissions: 21 of 23 (91.3%) for Unit 1, 21 of 23 (91.3%) for Unit 2, and 22 of 23 (95.7%) for Unit 3. Attendance at the activity sessions was also high: 21 of 23 (91.3%) attended Unit 1, 22 of 23 (95.7%) attended Unit 2, and 22 of 23 (95.7%) attended Unit 3. Not only did students attend class, they engaged fully in the activities. In particular, they did not want to stop working on the Unit 1 posters. Figure 2 shows the students actively engaged in speed networking, sharing their ideas in quick minute-long conversations. The average attendance rate for the course was 90%, so the WMD discussion day attendance was slightly higher. The average lab submission rate was 94.6%, in line with the submission rates of the reading questions.

Q2: What were the students' collective definitions for a WMD and examples of software systems that were most harmful and those that have no feedback loops? (data: Unit 1 posters)

Two of the four student groups worked on posters to produce a definition of a WMD from the definitions provided by their classmates. The two definitions were lists of attributes. Definition 1: -non-transparent, -biased, -negative impact on people on a large scale, -is a mathematical model. Definition 2: -built in bins, lack of transparency (blackbox), -unintended negative consequence, -scale, -use of incomplete data (proxies). Both definitions were similarly formatted as lists. Both included the negative impact on people and the lack of transparency. The third poster group created a spectrum of systems from least harmful to most harmful:

Least harmful

Fantasy football player score projection
Weather forecast
Autocorrect
Spam filtering
Spotify recommendations
Youtube recommendation system
Advertising
Social media content recommendations
Tik tok for you page
Google adsense
Apple maps
How good a teacher is
Value-added model to DC schools
Automated resume reviewer
Resume scanners
Goldman Sachs investments
Military facial recognition system

Most harmful

The fourth poster group classified systems into one of three bins: has feedback loop, may have feedback loop, and no feedback loop. Here are the bins from their poster:

Has Feedback loop:

- Youtube recommendation system
- Tik tok for you page
- Apple maps
- Weather forecasting
- Spotify recommendations
- Google adsense
- Fantasy football player score projection
- Autocorrect
- Spam filtering

May have feedback loop:

- Advertising
- College admissions
- Automated resume reviewer
- Resume scanners

No feedback loop:

- How good a teacher is
- Value-added model for DC schools
- Goldman Sachs investments

Note that some students did not duplicate their software systems on post-it notes as directed, so the lists above are not perfectly congruent across posters 3 and 4. However, we see some similarity in the least harmful part of the spectrum and the systems that have feedback loops.

Q3: What groups did students identify that may be disadvantaged by certain software systems? (data: Unit 2 case studies)

Student teams identified the following groups that may be disadvantaged: Predpol – minorities in high crime rate areas, Shiftboard – employees may get crazy schedules rather than their preferences and strengths, Zoho – users on the Internet, Sova – can customize software so recruitment does not create a diverse pool, so potential employees can be optimized out, Ziprecruiter – people with fewer qualifications will be filtered out, PredictiveIndex – potential employees with soft skills that are hard to quantify. The case studies engaged the students in researching and considering the impacts of adopting a tool.

Q4: What were the themes of students' ideas to take into the future? (data: Unit 3: minute paper)

Each student wrote one idea they will take into the future during the Unit 3 minute paper activity. The author(s) reviewed the "one idea" and the following themes emerged. Note that some "one idea" phrases included more than one theme below, so the total does not equal 22:

- Consider who might be disadvantaged by using a model. (9)
- No data model is objective; be careful of bias. (8)
- Be aware of how I and others may be targeted by software and data collection. (6)
- Models can have unexpected consequences. (1)
- Be an advocate and teach others about models. (1)
- I do not want to work for an hourly wage. (1)

Q5: Did students find the book club activities helpful for learning and assessment? (data: end-of-semester survey)

Students could complete an optional, end-of-semester electronic survey. The research study and survey were approved by the institution's review board. To incentivize participation, survey completers earned 20 extra credit points toward labs (900 points possible on labs). Sixteen of 23 (69.6%) students completed the optional survey. Students were asked to rate course activities (prelabs, labs, data science team project, discussion leaders, small group activities, quizzes, individual research project, course lectures) in terms of contribution to their learning. Students answered: *The <course activity> supported my learning of Big Data Analytics course material.* Students ranked each activity from 1 to 5 (1=not descriptive, 2=minimally, 3=somewhat, 4=mostly, 5=very descriptive). Another question asked about demonstration of learning: *The <course activity> accurately demonstrated my understanding of Big Data Analytics course material*. Averages are shown in Table 2.

Table 2: Average survey ratings for course learning activities (1 was low and 5 was high)

Course Learning Activity	Supported Learning	Accurate Assessment
Prelabs	3.875	4.000
Labs	4.250	4.188
Discussion Leader	2.938	2.938
WMD Activities	3.875	3.750
ICA	3.813	3.688
Quizzes	3.938	4.250
Individual Research Project	3.688	3.875
Team Data Science Project	4.063	4.000
Lectures	4.313	N/A

The WMD activities had an average of 3.875 for supporting learning (zero 1s, one 2, three 3s, nine 4s, and three 5s). The other course activities had averages from 2.938 to 4.313. The activity with the worst score was the discussion leader assignment and the activity with the best score was lectures. In terms of accurate assessment, the WMD activities scored an average of 3.75 (no 1s, two 2s, three 3s, eight 4s, and three 5s). The range of scores of activities demonstrating accurate assessment was 2.938 to 4.25. The worst scoring activity was the discussion leader and the best scoring activity was quizzes. Since the WMD part of the course scored in the middle of all course activities, it seems that students felt the book club helped them learn and demonstrated their understanding of course material. The survey also contained open-ended questions about how reading the book changed their view of models and what book activities they remembered doing in class (survey was administered eight weeks after the Unit 3 activity). All respondents felt that the book changed their view of models to some degree, with some students stating it helped confirm that systems can harm while others stating it really opened their eyes. One student wrote, "*I think it helped me contextualize what we were learning about much better and gave insight into why we need to be careful and think about how we build models*". Another survey response said, "*Everyone's familiar with bias and says its bad, and even before the class we knew that models could be biased. However, being given concrete*

examples of bad models, with their technical flaws and also their real world effects, made the impact of data scientists really obvious, even small decisions they make can have an unexpected impact." Table 3 shows the categories of survey free-text responses regarding which activities they remembered from class (no prompts in the question). Some students wrote about more than one activity, so the total in Table 1 does not sum to 16.

Table 3: Activities that students remembered (free-text, not multiple select)

WMD In-Class Activity	Number of Students
Wall line-up (Unit 1)	6
Post-it posters (Unit 1)	6
Speed networking (Unit 2)	5
Case studies (Unit 2)	2
Powerpoint posters (Unit 3)	3
None	2

6 INSTRUCTOR'S EXPERIENCES

These activities allowed for students to engage in both personal and collaborative reflection. The instructor felt these were three of the most active class sessions in terms of the volume and depth of group conversations. Students were vocal about not wanting the Unit 1 and Unit 2 activities to end. For the instructor, this was a sign that the activities were engaging students and more time could be allocated in future offerings. This section provides advice for other instructors.

Tip 1: Preparation is a key component of the book club model. The instructor read several books related to big data and ethics and selected one they thought would interest students. Preparing the reading questions is also important. The instructor wrote one to three questions per chapter. The full text of the reading questions can be found at [33]. Some reading questions asked about the book author's perspective, some asked about the student's perspective/experience, and some asked about the reading itself. Here are examples of each type of reading question:

- Cathy O'Neil describes her background in mathematics (professor, financial industry, Internet company). At what point do you think she started becoming unsettled about data-driven mathematical models?
- Have you personally experienced targeted advertising that used your personal information? If so, what was the application and what type of data do you think was used to make the model?
- Some attributes are hard to measure with data. We then use data as proxies for these attributes, such as fairness, trust, and equity. What other attributes did you read about in this chapter that would be difficult to define using data?

Students' submissions showed they took the reading questions seriously, answering in full sentences and sharing personal encounters with data and systems, indicating faculty-student trust.

Tip 2: Plan "active" activities related to the book. The instructor taught this course online in Spring 2021 and in-person in Spring 2023. They wanted to lean into taking advantage of being physically in the same room, so collaborating and movement were intentionally designed into the activities. Each session had "active" movement activities. Unit 1 had students line up, which forced physical movement in the room. Note that if one or more students has a physical disability, the "line-up" activities may need to be modified. Unit 2 had speed networking, which forced physical movement as well. Unit 3 was less movement-oriented, but students moved to the whiteboard to write themes and moved to the table to join their preferred poster topic. 14 of 16 students could describe at least one WMD activity eight to 12 weeks after doing them (see Table 3), and the instructor thinks physical movement may have helped with their memory. All three days also included collaborative work on posters or case studies, which may have also aided their memory of the activities.

Tip 3: In a large class or in classrooms with fixed seating, make adjustments for grouping and movement. In larger classes, the instructor may wish to divide the class into smaller groups of 20, with each group of 20 forming lines and doing speed networking. The case studies and poster topics can be duplicated, so multiple groups work on the same topics. If moving between fixed seats is a challenge, have students work with classmates seated near them instead of randomly assigning groups.

Tip 4: Personal and group accountability are key components. In order for all students to be prepared for the activities, the reading questions were assigned as individual work due before the activity day. After students co-created a poster or case study, they either shared it with another group or shared it with the whole class. With a "reporting out" component, students were encouraged to make progress on group tasks. It also solidified the communication outcome for the course, in addition to giving students multiple modalities to showcase their learning.

7 CONCLUSION

Overall, using a general-audience book for an undergraduate computing course was an engaging learning tool for students. This was also an engaging method for the faculty member to review books other than textbooks and software documentation for potential course materials. This book club model could be adapted to many CS courses, since there are many popular press books related to different facets of technology and society. If a semester includes 45 hours of class time, students are expected to work 90 hours outside class. This book club model takes about two hours of class time and eight hours of reading time for a total of 10 hours. Given the author(s)' experience, it was definitely worth 10 of the 135 hours of students' time for the learning that took place. If time is even more limited in a course, shorter readings or other types of general-audience media with one discussion session may be a valuable addition to a course. Both students and the instructor learned more about data, models, ethics, and each other.

ACKNOWLEDGMENTS

We thank the students who answered the optional survey about the book club model. This work was supported by a Kern Entrepreneurial Engineering Network grant and a Shiley grant.

REFERENCES

[1] ABET. 2023. Criteria for Accrediting Computing Programs, 2023-2024. Last accessed July 31, 2023. https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-computing-programs-2023-2024/.

[2] ACM, IEEE, CS/AIII. CS2023: ACM/IEEE-CS/AAAI Computer Science Curricula. Last accessed July 31, 2023. https://csed.acm.org/.

[3] Ann H. Addington. 2001. Talking about Literature in University Book Club and Seminar Settings. *Research in the Teaching of English*. 36:2, 212–248.

[4] Solon Barocas and Danah Boyd. 2017. Computing Ethics: Engaging the Ethics of Data Science in Practice. *Communications of the ACM,* 60:11, 23-25. DOI: https://dl.acm.org/doi/pdf/10.1145/3144172.

[5] Irene Bratsis. 2020. Weapons of Math Destruction: Book Club. Last accessed: August 2, 2023. URL: https://medium.com/analytics-vidhya/weapons-of-math-destruction-book-club-64ba3d642739.

[6] Emanuelle Burton, Judy Goldsmith, and Nicholas Mattei. How to Teach Computer Ethics through Science Fiction. *Communications of the ACM*, 81:8, 54-64. DOI:https://doi.org/10.1145/3154485.

[7] Casualty Actuarial Society. 2020. Discussion of the Book *Weapons of Math Destruction* by Cathy O'Neil. CAS Annual Meeting. Last accessed: August 2, 2023. URL: https://www.casact.org/sites/default/files/presentation/cs29-weaponsofmathdestruction-fileid-261727.pdf.

[8] Christopher A. Cooper. 2019. Not Just for Oprah Anymore: Incorporating Book Clubs into Political Science Classes, *Journal of Political Science Education*, 15:3, 365-376, DOI: 10.1080/15512169.2018.1473783.

[9] Cecilia Konchar Farr. 2005. *Reading Oprah: How Oprah's Book Club Changed the Way American Reads*. State University of New York Press, Albany, NY.

[10] Scott Freeman, Sarah L. Eddy, Miles McDonough, and Mary P. Wenderoth. 2014. Active learning increases student performance in science, engineering, and mathematics. In *Proceedings of the National Academy of Sciences (PNAS)*, 111:23, 8410-8415. DOI:https://doi.org/10.1073/pnas.1319030111.

[11] Judy Goldsmith and Nicholas Mattei. 2014. Fiction as an Introduction to Computer Science Research. *ACM Transactions on Computing Education,* 14:1, 1-14. DOI:https://doi.org/10.1145/2576873.

[12] Shelly Gulati. 2021. A Book Club Model to Promote Personal and Professional Development Activities for Female Engineering and Computer Science Students. In *Proceedings of the American Society for Engineering Education Annual Conference*. https://peer.asee.org/36553. DOI:10.18260/1-2—36553.

[13] Mary F. Heller. 2006. Telling Stories and Talking Facts: First Graders' Engagement's in a Nonfiction Book Club. *The Reading Teacher*, 60:4, 458–369.

[14] Lily Hu. 2018. Justice Beyond Utility in Artificial Intelligence. In *Proceedings of the 2018 AAAI/ACM Conference on AI, Ethics, and Society,* December, 368-369. DOI: https://doi.org/10.1145/3278721.3278798.

[15] Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani. 2021. *An Introduction to Statistical Learning with Applications in R* (2nd ed.). Springer. https://www.statlearning.com/.

[16] Robin Jocius and Samantha Shealy. 2017. Critical Book Clubs: Reimagining Literature Reading and Response. *The Reading Teacher*, November 2017. DOI:https://doi.org/10.1002/trtr.1655.

[17] Ailing Kong and Ellen Fitch. 2002. Using Book Club to Engage Culturally and Linguistically Diverse Learners in Reading, Writing, and Talking About Books. *The Reading Teacher*, 56:4, 352–362.

[18] Irene Lee, Helen Zhang, Kate Moore, Xiaofei Zhou, Beatriz Perret, Yihong Cheng, Ruiying Zheng, and Grace Pu. 2022. AI Book Club: An Innovative Professional Development Model for AI Education. In *Proceedings of the 53rd ACM Technical Symposium on Computer Science Education.* 202-208. DOI: https://doi.org/10.1145/3478431.3499318.

[19] Davina Morgan-Witts. 2015. Book Clubs in the USA. *Strategic Library,* 13-15, http://www.libraryspot.net/LPN/1015/SL_Oct15_2.pdf.

[20] Mozilla Foundation. 2019. Book Club 12/19: Weapons of Math Destruction. Last Accessed: August 2, 2023. URL: https://blog.mozilla.org/foundation-archive/mozilla-science/book-club-december/.

[21] Jose Luiz Nunes, Gabriel D. J. Barbosa, Clarisse Sieckenius de Souza, Helio Lopes, Simone D. J. Barbosa. 2022. Using model cards for ethical reflection: a qualitative exploration. In *Proceedings of the 21st Brazilian Symposium on Human Factors in Computing Systems*, 1-11. DOI:https://doi.org/10.1145/3554364.3559117.

[22] Cathy O'Neil. 2017. *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy.* Penguin Books, Harlow, England.

[23] Taffy E. Raphael, Susan Florio-Ruane, and MariAnne George. 2001. Book Club "Plus": A Conceptual Framework to Organize Literary Instruction. *Language Arts*, (November 2001), 159-168, DOI: https://www.jstor.org/stable/41483219.

[24] Taffy E. Raphael, Susan I. McMahon. 1994. Book Club: An Alternative Framework for Reading Instruction. *The Reading Teacher,* 48:2, 102-116. https://www.jstor.org/stable/20201379.

[25] Ben Rydal Shapiro, Emma Lovegall, Amanda Meng, Jason Borenstein, and Ellen Zegura. 2021. Using Role-Play to Scale the Integration of Ethics Across the Computer Science Curriculum. In *Proceedings of the 52nd ACM Technical Symposium on Computer Science Education*, 1034-1040. DOI: https://doi.org/10.1145/3408877.3432525.

[26] Ben Rydal Shapiro, Amanda Meng, Cody O'Donnell, Charlotte Lou, Edwin Zhao, Bianca Dankwa, and Andrew Hostetler. Re-Shape: A Method to Teach Data Ethics for Data Science Education. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems,* 1-13. DOI: https://doi.org/10.1145/3313831.3376251.

[27] Jessi J. Smith, Blakeley H. Payne, Shamika Klassen, Dylan Thomas Doyle, and Casey Fiesler. Incorporating Ethics in Computing Courses: Barriers, Support, and Perspectives from Educators. In *Proceedings of the 54th ACM Technical Symposium on Computer Science Education,* 367-373. DOI: https://doi.org/10.1145/3545945.3569855.

[28] Valerie H. Summet and Rebecca A. Bates. 2020. Science Fiction as an Entry Point for Ethical Frameworks in Engineering and Computer Science Education. In *Proceedings of the American Society for Engineering Education Annual Conference.* https://peer.asee.org/35180. DOI: 10.18260/1-2—35180.

[29] Lesley J. Sylvan. Bringing Book Club to Class: Engaging College Students in Reading Content-specific Books Written for Popular Audiences. *College Teaching*, 66:4, 225-234. DOI: https://doi.org/10.1080/87567555.2018.1518892.

[30] The Teacher Toolkit. 2023. All Tools. Last Accessed: August 2, 2023. URL: https://www.theteachertoolkit.com/index.php/tool/all-tools.

[31] TeacherVision. 2019. Questions Before, During, and After Reading. Last accessed: July 31, 2023. https://www.teachervision.com/reading-comprehension/questions-during-after-reading.

[32] Third Place Books. 2018. Reading Through It – Weapons of Math Destruction. Last Accessed: August 2, 2023. URL: https://www.thirdplacebooks.com/event/reading-through-it-weapons-math-destruction.

[33] Tammy VanDeGrift. 2023. Peer-Reviewed Papers. Last Accessed: October 16, 2023. URL: https://sites.up.edu/vandegri/papers/.