

# Exploring Dimensions of AI Democratization through a Need/Supply Case Study

## ICICLE Educational Fellows Project - Executive Summary

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### Abstract

Democratizing AI is a common aim across many projects and organizations working with AI and other emerging technologies. However, there are a variety of definitions for whom and with whom democratization can be focused. As such, general perceptions about the concept can be limited, making engaging with broader audiences, including early-career students, about these topics challenging. This work highlights a case study on AI narratives implemented in a technology ethics course that encourages students to explore the concepts with a real-world example – the effects of a supermarket closing in an isolated community and the ability of AI to alleviate the consequences by serving as a predictive tool. The case study introduced participants to the concepts of democratization, along with the technical components of the case and the potential stakeholders, to gather a consensus on the plan moving forward.

The pursuit of democratizing technology represents a shared objective of responsibility across research and practice - the goal is to have more people involved with using, developing, benefiting, and ensuring the holistic success of emerging technologies. Artificial intelligence (AI) is one field where democratization is often used as a focal point for engagement initiatives. However, conceptualizing who the democratization should represent and include varies significantly. Consequently, prevailing perceptions of this overarching concept may be limited, posing challenges in effectively engaging diverse and future-thinking audiences, including students and other practitioners, in the early stages of their academic and professional trajectories. To this end, this work highlights the process of creating an explainability narrative that can be used to engage people, even those with limited technical understanding, on how technology implementation affects everyday people. The broader work was arranged in three stages: creating the case study using an ICICLE project as an inspired use case, implementing the case in a technology ethics course, and exploring what and how students learned about responsibility and democratization. This summary describes the case study, highlighting the effects of a supermarket closing in an isolated community and the ability of AI to alleviate the consequences by serving as a predictive tool, role-playing components, and planned future publications.

## 1 Summary

As an ICICLE Educational Fellow, I engaged in the following activities to complete my fellowship goals:

- I participated in the *ICICLE Kick-Off Meeting* at Indiana University (June 21 and 22, 2023) and the *ICICLE All Hands Meeting* at Ohio State University (November 2 and 3, 2023).
- I attended meetings with the ICICLE Food Systems working group over the summer and fall of 2023. I separately interviewed several members of the working group. I met directly with Dr. Ayaz Hyder and Dr. Eric Fosler-Lussier regarding the development of the *Kroger Grocery Store Closure Simulator Dashboard*.
- I engaged with my ICICLE Contact, Neelima Savardekar, in biweekly meetings throughout the fellowship, brainstorming ideas, providing progress updates, and planning for the next steps.
- I engaged with other Educational Fellows during the summer kick-off meeting and in biweekly meetings afterward, providing feedback and collaborating on the broader understanding of the project guidelines.
- I created the case study titled "Modelling a Community's Grocery Needs/Supply with Algorithms" and revised it through several iterations of initial testing with the target participant demographic.
- I implemented the case study as the source material for a role-play activity in fall 2023 with 70 undergraduate students in 2 sections of a *Technology and Society* Course. The role-plays were conducted as 30-45 minute semi-structured conversations between 5-7 student participants, and students completed assignments to gauge pre- and post-knowledge.
- I am in the process of publishing the case study to be widely and publicly available. I am also in the process of disseminating the findings of the work.

The following research dissemination/publication is in progress:

- The case study will be published and available through an open-access website. The Online Ethics Center is the first choice to make the case available: <https://onlineethics.org/>.
- A conference poster on implementing this work has been accepted to the Association for Computing Machinery's Special Interest Group on Computer Science Education (ACM SIGSCE) 2024 Technical Symposium. The work will be part of the Graduate Student Research Competition.
- A longer journal publication is being explored, with potential venues including the Journal for Responsible Innovation.

## 2 Introduction

In the ever-evolving landscape of technology, ensuring that the broadest range of people has access to and can work with the technology is an enduring goal. Having the skills to make the most of, the resources to make use of, and the support to build upon are fundamental components to ensuring technology has the potential to benefit all. As educators, the commitment to enriching the learning experience for students goes beyond the confines of traditional brick-and-mortar classrooms. It extends into online learning, active engagement, and providing students with multiple options for engaging with the knowledge. It broadly represents preparing the next generation of leaders and thinkers to foster this mindset and envision accessible technology. Finding ways to communicate across disciplinary levels and technical skills is a challenge that needs to be addressed sooner rather than later.

With this in mind, the ***Intelligent CI with Computational Learning in the Environment (ICICLE) National AI Institute*** is working towards building intelligent cyberinfrastructure that can be deployed simply by end users across domains. ICICLE's Mission Statement is:

*As a national infrastructure that enables artificial intelligence at the flick of a switch, ICICLE will transform today's AI landscape from a narrow set of privileged disciplines to one where democratized AI empowers domains broadly through integrated plug-and-play AI. Converging under one virtual roof, ICICLE will foster interdisciplinary communities, advance foundational AI and CI, and transform application domains. Through its innovative approach to training and technology transfer, ICICLE will grow an AI-enabled workforce and incubate innovative companies with sustained diversity and inclusion at all levels. Ultimately, ICICLE will enable a transparent and trustworthy national infrastructure for an AI-enabled future to address pressing societal problems and enable decision-making for national priorities [1].*

This report highlights my (*Ashish Hingle*) efforts as an ICICLE Educational Fellow in exploring AI narratives of democratization [2] with students. The scope of the work included meeting with ICICLE researchers and associates, creating a case study inspired by an ICICLE use case, and implementing the case study as the source material for a role-play activity. This report describes each of these elements and planned future work.

The work aims to create learning materials that can be shared with students or other people interested in learning about the cross-disciplinary work that technology engages in, specifically when it can potentially change the daily lives of everyday people. A comprehensive understanding of the societal consequences is essential in a world increasingly driven by technology, but even an awareness is a start in the right direction. Thinking forward, students must grapple with technological advancements' ethical, cultural, and political ramifications and explore who emerging technology should be democratized for, as they will likely be building these innovations.

The entire case study, role descriptions, and other role-play-ready items will be publicly available. Instructors are encouraged to use the case study in the classroom to engage students using this implementation as a real-world inspired use case. The case study can also be used beyond the classroom - wherever narratives and storytelling are essential engagement tools.

### 3 The Case Study

#### 3.1 *Modelling a Community's Grocery Needs/Supply with Algorithms*

This case study seeks to provide participants with insights into the intricacies of developing technological solutions to mitigate societal challenges. Within this study, the overarching societal issue pertains to the possible disruptions in supply chains, which subsequently impact the availability of food and essential grocery items within a community. These disruptions stem from many factors, encompassing the evolving landscape of small towns in the United States, characterized by declining populations in non-metropolitan regions, elevated poverty rates, the opioid crisis, and slender profit margins. Furthermore, unforeseen events, exemplified by the COVID-19 pandemic, contribute to the multifaceted nature of these disruptions.

Food insecurity is especially problematic for smaller communities in the US. In this case study, community members are exploring an algorithm-based technology solution to ensure 1) food security persists even after a grocery store closure and 2) food organization processes are streamlined locally. The community is encouraged to get involved in adopting this technology, as there are few alternatives for solving food insecurity. Technology developers and implementers are heavily invested in involving the local community as they believe in democratizing the technology - they want to ensure that their technological solution is easy to use, to gain equitable value, and to balance the risks and harms of the technology [2]. When implemented within a course, this case study can model how public-focused technology for community needs should be developed.

#### 3.2 Summary of the Case

Below is a summary of the narrative from the case:

*Diana, an IT manager, moved from Washington, DC, to Morganville, West Virginia, during the COVID-19 pandemic, appreciating the financial benefits and family proximity but facing limited grocery options. Learning that Ace Market, crucial for 60% of residents, would close due to high supply chain costs, Diana and the community worried about adverse effects on health and well-being. Researching solutions, Diana found success stories of small towns starting community-owned grocery co-ops.*

*Motivated by the potential benefits, Diana, leveraging her tech industry experience, envisioned a technology-driven co-op named GoldenGraph. She proposed using an agent-based model to simulate the town and a mobile app for communication. Residents could express preferences, and the co-op would order groceries accordingly. Pickup locations across Morganville on specific days would reduce costs.*

*Diana recognized the challenges – high establishment costs, low consumer buying power – but believed success was possible with community and government support. Despite grocery co-ops being notoriously difficult to run, she registered GoldenGraph as a non-profit organization, planning a launch in six months. Her vision involved algorithmically modeling the town, engaging residents through a mobile app, and partnering with local farmers to ensure efficiency and cost-effectiveness. With her tech expertise, Diana aimed to address Morganville's grocery supply challenges, providing a potential lifeline for residents facing the closure of their primary grocery source.*

*The full case study will be made publicly available.*

## 4 Implementing the Case Study using Role-Plays

Case studies are a pedagogical tool used across domains to engage students with a multifaceted view of phenomena and systems at play [3, 4, 5]. The case study can be used in various ways - introduced as reading materials for students or used more actively through an activity. This case was implemented in the latter through a role-play activity for this work, which is a shared pedagogical approach [6, 7]. Role-plays are group activities designed for peer collaboration among students, engaging in critical decision-making dialogues, and exploring diverse perspectives within a given scenario [8, 9, 10].

The roles are each developed to allow students to gain unique perspectives from potential stakeholders in the case [11]. The roles are designed with the push and pull of people representing the community in mind - the perspectives and values that each role holds may ultimately be at odds with each other. Still, through discussion, a group consensus that is helpful for everyone can be reached, and students explore the core principles of the case by engaging in the discussion [12, 13]. Especially with the idea of *democratizing AI*, a broader discussion exists about the responsibility that needs to play out within the groups [2].

### 4.1 Our Implementation in a Technology and Society Course

We implemented the case study and role-play in fall 2023. Two sections of a *Technology and Society* course at a large university in the Southeastern United States were selected as students from a breadth of technology-focused degrees took the course. Seventy (70) undergraduate students enrolled in the course and participated in the role-play activity using the developed case study. Students were from the majors of information technology, data analytics, cybersecurity, computer science, and engineering. Permission from the Institutional Review Board (IRB) was requested and approved before data collection.

More details about the implementation can be found in the SIGSCE 2024 submission, which is expected to be available in mid-2024.

### 4.2 Summary of the Case Roles

The roles for the case were designed to allow for conversation and engaged discussion between participants who may agree or disagree with how technology should be used in the case. Below are short descriptions for each role:

- *Albert Simmons, President of Morganville Independent Farmers Incorporated (WIFI), a military veteran, envisions GoldenGraph as an opportunity for local farmers to reach consumers efficiently and believes community-led development is crucial for maximum benefits.*
- *Danielle Foccart, a Computational Scientist specializing in agent-based models, emphasizes the need for community-specific evaluations in building technology solutions. She supports the idea of a community-serving agent-based model if done carefully and with consideration of community values.*
- *Veronica Cale, an HCI Professor, advocates for human-centered design and participatory research. While cautious about the front-end development of the proposed system, she raises concerns about the limitations and potential negative impacts of chatbot implementations.*
- *Maxwell Lord, a City Official, is cautious about making public data available and highlights systematic issues in data collection. He questions the democratization of technology, emphasizing the need for skills and expressing concerns about the commercial use against local farmers.*
- *Arani Desai, Regional Manager at Queen Foods, with extensive management experience, is intrigued by the agent-based model but questions the level of trust in its outputs. Arani is concerned about the potential panic caused by the information and sees both pros and cons in the tool's multi-use potential.*
- *Catalina Flores, an AI Sustainability Analyst born in Morganville, emphasizes the importance of long-term support for the model's success. Drawing on her background in psychology and cybersecurity, Catalina wants to prevent the deployment of a solution that becomes a problem after initial funding is used up.*

*The full role descriptions will be made publicly available.*

## 5 Future Work and Recommendations

The following items are in progress:

- The full case study will be published in a repository for continued access and potential use.
- This work will be presented at the 2024 Association for Computing Machinery's Special Interest Group on Computer Science Education (ACM SIGSCE) Technical Symposium.

### 5.1 Recommendation to ICICLE Team

From the perspective of an Educational Fellow, researcher, and instructor interested in how we can have discussions about nuanced topics like democratizing AI and broader technology, I believe the techniques employed here can be scaled up once the correct venue and audience are found. This work engaged 70 students, but most had never heard about what democratizing AI could be. The aspects of the activity (the case, the role-play, and the supplementary information on how these technologies work) came together, allowing students to understand better why engaging with these systems is such a complicated task. In thinking about ICICLE's mission, I believe this approach aligns and allows for the work that the broader ICICLE team is doing to reach a wider audience.

In spirit, my work has been about finding a middle ground between simplicity and complexity where learning for our students occurs. If we describe AI technology too simply, our students will only have a very shallow understanding, and if we go into too much detail, we will confuse them. This work focuses on balancing knowledge with the skills and experience we expect our students to have. I would highly recommend a similar approach be employed in disseminating other work from ICICLE - democratizing AI does not mean a one-size-fits-all approach, and we must make that distinction.

Regarding the case study and role-plays specifically, I recommend using them (individually or together) as demonstrable ways to answer the question of "why is this important?" - especially to everyday people. The case was written to be understood by people who do not have complex technical experiences with AI, and engaging them is fundamental. Use the cases on social media or other ways to get people thinking about why these discussions about intelligent cyberinfrastructure are essential. Use the role-playing guidelines as interactive activities in courses or as thought exercises. These resources make it easier to talk about what ICICLE is doing and are perfect for engaging groups far removed from the development process. These techniques could be used in library settings for adult learners and others that target K12 students; there is much room to work with these techniques.

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