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ORIGINAL RESEARCH

Scoping deliberations: scaffolding engagement in planning collective action

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Abstract

Most social challenges fall outside of the authority of any single individual and therefore require collective action—coordinated efforts by many stakeholders to implement solutions. Despite growing interest in teaching students to lead collective action, we lack models for how to teach these skills. Collective action ostensibly involves design: the act of planning to change existing situations into preferred ones. In other domains, instructors commonly scaffold design using an instructional model known as *studio critique* in which students strengthen their plans by exchanging arguments with peers and instructors. This study explores whether studio critique can serve as the basis for an effective instructional model in collective action. Using design-based research methods, we designed and implemented *scoping deliberations*, a new instructional model that augments studio critique with domain-specific templates for planning collective action and repeats weekly to enable iterations. We used process tracing to analyze data from field notes, video, and artifacts to evaluate causal explanations for events observed in this case study. By implementing scoping deliberations in a 10-week undergraduate course, we found that this model appeared effective at scaffolding *engagement* in planning collective action: students articulated and refined their plans by engaging in argumentation and iteration, as expected. However, students struggled to contact the community stakeholders with whom they planned to work. As a result, their plans rested on implausible, untested assertions. These findings advance instructional science by showing that collective action may require new instructional models that help students to test their assertions against feedback from community stakeholders. Practically, scoping deliberations appear most useful for scaffolding thoughtful planning in conditions when students are already collaborating with stakeholders.

Keywords Collective action · Scaffolding · Design · Civics

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Introduction

In recent years, social movements from Black Lives Matter to school strikes for climate action have brought increased attention to the fact that many societal problems require collective action—coordinated efforts by many stakeholders to implement solutions (NAE, 2008; Ostrom, 1990). For example, the mere idea of a carbon tax will not by itself make progress towards solving the climate emergency—proponents must wage campaigns to convince decision makers to implement the tax and other solutions (Jansson, 2013). Effective collective action occurs when people strategically build political power to implement solutions together, such as by working on campaigns in civic organizations, or mobilizing large numbers of supporters to come out to protest (Han, 2014). By engaging in collective action, people have peacefully toppled dictators (Engler & Engler, 2016), changed corporate policies (Singer, 2019), won elections (Hersh, 2020), secured fair pay (McAlevey, 2020), and otherwise exerted democratic control over society. Yet despite its importance, we lack research-based instructional models for teaching collective action. The literature to date focuses predominantly on descriptive and explanatory accounts of activism- and movement-based learning but provides few design principles for engineering formal learning environments for collective action (Kirshner, 2007; Kirshner, 2008; Meléndez, 2021; Pham & Philip, 2021; Takeuchi & Ishihara, 2022; Tivaringe & Kirshner, 2021; Uttamchandani, 2022).

Despite growing interest in teaching collective action (Curnow & Jurow, 2021; Levinson, 2014), we lack models and strategies for understanding and spreading effective pedagogical practices in collective action. In recent years, learning scientists have grown increasingly interested in studying collective action as a context for learning. While this line of research arguably extends much further into the field's history (e.g., Engeström, 2001), it has become increasingly explicit and well-organized in recent years, culminating in a Journal of Learning Sciences special issue devoted to learning in and through collective action (Curnow & Jurow, 2021). The literature consists largely of case studies conducted in contexts that require collective action, such as social movements (Pham & Philip, 2020; Takeuchi & Ishihara, 2020), advocacy organizations (Kirshner, 2008; Uttamchandani, 2020), and interorganizational problem solving (Engeström, 2001).

Prior research has focused on evaluating the learning outcomes of particular programs, rather than model building that would allow us to generalize the lessons learned to design formal learning environments (e.g., Ballard et al., 2016; LeCompte et al., 2020). There is a lack of research on the learning and instructional processes that unfold within existing programs, making it difficult to draw out effective teaching strategies. Instead, researchers have focused on high-level evaluations that treat program design and implementation as a black box. Specifically, researchers have focused on aggregating data from many students to measure students' civic attitudes, self-efficacy, and knowledge (Ballard et al., 2016; LeCompte et al., 2020). This gives our field an opportunity to expand our practical impact by understanding how to design learning environments to facilitate collective action. Despite the growing enthusiasm for teaching collective action, it remains unclear how to do this well. There is a lack of research on the learning and instructional processes that unfold within existing programs, making it difficult to draw out effective teaching strategies. Instead, researchers have focused on high-level evaluations that treat program design and implementation as a black box. Specifically, researchers have focused on aggregating data from many students to measure students' civic attitudes, self-efficacy, and knowledge (Ballard et al., 2016; LeCompte et al., 2020).

To understand how we might spread successful programs beyond a handful of experimental contexts, researchers need to open the black box and develop empirically based instructional models for teaching collective action (cf. DeBarger et al., 2013). This is how instructional scientists already approach research in other learning domains such as math and science, with great success (e.g., Abdu & Schwarz, 2020; Malkiewich & Chase, 2019). But the field of instructional science has not yet attempted to build a theory of instruction in collective action.

In this article, we aim to expand the scope of instructional science by proposing an initial model for teaching collective action. Our findings highlight how unique learning challenges in collective action domains require new kinds of instructional models. Specifically, students are likely to plan collective action based on untested, implausible assertions unless they have opportunities to test those assertions against feedback from community stakeholders. This process is unfortunately not supported by most existing instructional models, which focus overwhelmingly on what happens within insular environments like classrooms. It is also manifestly absent from many programs that purport to teach impactful civic action.

Theories of change: the core cognitive task in collective action

Civic actors'[1] ability to lead effective collective action depends in part on their ability to construct realistic *theories of change*[2]—theoretical models of how their individual actions can advance broader social change in a specific situation. Most of the writing about collective action across domains—including community organizing (Alinsky, 1971), entrepreneurship (Bland & Osterwalder, 2019), social movements (Engler & Engler, 2016), party politics (Hersh, 2020), social work (Jansson, 2013), issue-driven activism (Singer, 2019), management (Pfeffer, 1992), and science (Latour, 1987)—aims to convince readers that they need to consider various strategies and constraints in their theories of change. For example, Hersh, (2020) calls for citizens to consider strategies and constraints involved in using political parties to make change. Likewise, Singer (2019) calls for civic actors to consider strategies and constraints involved in directly influencing powerful decision-makers within corporations and institutions. While they focus on different domains, both authors argue that civic actors must understand who has the power to solve their problem, and how they can be influenced to take action. These are the core issues in a theory of change.

The underlying premise across all of this research and instruction is that constructing a realistic theory of change is the core cognitive task in collective action. While civic actors may also draw from a broad repertoire of tactical skills, such as ad campaigns (Singer, 2019), crowdfunding (Gerber & Hui, 2013), or nonviolent resistance (Engler & Engler, 2016), the theory of change is of central importance because it helps people decide which

[1] Here, we mean anyone engaging with public problems—not just legal citizens.

[2] Note, we are discussing theories of change and not change theory, which is an academic body of knowledge exploring general theories of social and organizational change (Reinholz & Andrews, 2020). Theories of change are project-specific and can be strengthened by reference to principles from change theory. We gave the students a light introduction to change theory through the reading assignments and lectures for this course. However, the focus of this study was teaching students to construct situation-specific theories of change, rather than the general domain knowledge of change theory.

tactics to use, why, and when. To construct realistic theories of change, civic actors must reason about:

1. *The change civic actors want to make*: What is the problem? Who is affected? What are its root causes? What would make it better? (e.g., Bardach & Patashnik, 2016; Jansson, 2013; Ostrom, 1990; Patton & Sawicki, 1993; Singer, 2019);
2. *The collective action that is needed*: Who has the power or resources to make a difference? What do they need to do? How will their actions lead to change? (e.g., Engler & Engler, 2016; Hersh, 2020; Jansson, 2013; Osterwalder & Pigneur, 2010; Ostrom, 1990; Singer, 2019); and.
3. *How civic actors can foster collective action*: Whom should actions target? What are their needs? What would influence them to act? Will that require help from others? How would they get that help? (e.g., Alinsky, 1971; Blank & Dorf, 2012; Hersh, 2020; Latour, 1987; Osterwalder et al., 2014; Singer, 2019; Weick, 1984).

This is a demanding task that requires civic actors to seek, interpret, and integrate information from many sources and domains. Experts in collective action are quick to point out that many practitioners struggle to complete this task effectively (McAlevey, 2020; Singer, 2019), indicating that it may take years of successful experience to develop expertise in constructing theories of change. Therefore, we ask: How might we help learners to gain such experience?

Collective action as a design task

Learning scientists have made far more progress developing instructional models for design than for collective action. This presents an opportunity, because collective action arguably requires design skills, as collective action problems, like design problems, are highly ill-structured and require that understandings of the problem and solution space be constantly updated together (Dorst & Cross, 2001; Jonassen, 2000). Furthermore, the task of constructing theories of change can be framed as a design task. This becomes clear when we consider definitions of design offered by leading design theorists, such as: "Everyone designs who devises courses of action aimed at changing existing situations into preferred ones" (Simon, 1996, p. 111), or "the planning and patterning of any act toward a desired, foreseeable end constitutes the design process" (Papanek, 1985, p. 3).

From these definitions, it follows that collective action involves design. In collective action, groups devise plans to coordinate their efforts, mobilize resources such as money or labor, and influence decision makers to adopt solutions to societal problems (Hersh, 2020; Jansson, 2013) and devise theories of change. From this perspective, collective action appears to be nothing more than design, applied to society rather than other human creations like buildings, software, and vehicles (Ostrom, 2005). While there has been little research on scaffolding theories of change in collective action, there has been extensive research on how to scaffold design in other domains such as architecture and product design. Would it be possible to teach collective action using instructional models for teaching design?

Studio critique as a potential instructional model

This study explores how studio critique, the "signature pedagogy" in design education (Schrand & Eliason, 2012), might apply in collective action. Studio critique is the central instructional process in design education (Crowther, 2013; Oh et al., 2013; Schrand & Eliason, 2012). In a typical studio critique, students learn by responding to feedback from other members of a design studio, including peers and instructors (Dannels & Martin, 2008; Hokanson, 2012; Schön, 1987). Consider the following overview of the critique pedagogy:

> "Central to education in design is the critique. The critique methodology and practice is how design skills are developed around the world within a studio. It is there that work is presented by the designer, … and its virtues and failures are debated. … Designers must open themselves to the criticism of others and answer that criticism with the quality of their argument and improvement in their work." (Hokanson, 2012, p. 71)

Notice that studio critique engages learners in two key processes: argumentation and iteration (referenced above as "improvement in their work"). Argumentation is the process of generating tentative conjectures about the problem and solution and exchanging reasons to justify and critique those conjectures (Jonassen, 1997; Shin et al., 2003; Voss et al., 1983). Iteration is the process of generating tentative conjectures about the problem and solution, conducting investigations to evaluate the plausibility of those conjectures, and modifying one's conjectures accordingly (Adams et al., 2003; Carlson et al., 2020; Dorst & Cross, 2001; Schön, 1983).

Iteration and argumentation are the mechanisms through which the activity of studio critique makes its educational impact. By engaging in these processes, learners generate assertions about how to approach the problem, gather additional information about potential constraints, and evaluate their assertions in light of new evidence (Ball & Christensen, 2019; Buchanan, 1992; Carlson et al., 2020; Lynch et al., 2009; Reitman, 1964; Rittel & Webber, 1973; Schön, 1987). In the context of studio critique, learners do all of this with help from peers, instructors, and experts (Dannels & Martin, 2008; Schön, 1987). These processes play a central role in shaping learners' mental representation of their current project, and thereby, also shape the knowledge they will use to interpret future projects.

Intervention: scoping deliberations

This study explores whether studio critique can serve as the basis for an effective instructional model in collective action. To analyze this possibility, we designed a new instructional model called *scoping deliberations* that augments studio critique with domain-specific templates for planning collective action and repeats weekly to support sustained improvement to students' plans. Instructors also provided formal classroom feedback bi-weekly and informally through discussion. In this section, we describe the features of scoping deliberations, followed by the theoretical rationale for expecting that scoping deliberations would support the core processes of studio critique (i.e., argumentation and iteration) in collective action.

Description of scoping deliberations

In scoping deliberations, learners complete weekly cycles of proposing, discussing, and revising proposals for collective action projects (Fig. 1). Overall, we designed this process to support iterative cycles of divergence (idea generation) and convergence (idea selection & elaboration), consistent with processes used by professional designers (IDEO, 2015). We expected that, by following this process, learners would refine their underlying theories of change and propose better projects as a result. Each week, learners submit a proposal before coming to class. In class, learners discuss their proposals and plan additional work. Before the next class, learners search for information and revise their proposals. Their goal is to form a team with classmates and propose a collective action project they could feasibly implement with a community partner organization, to make a local impact on a civic problem.

This design was intended to be a prelude to a more traditional client-based project-based learning course with authentic clients (community partners/organizations). In project-based learning classes that involve a real-world client, including those that we teach, instructors are typically responsible for initial scoping of projects, including choosing the client (e.g., Reifenberg & Long, 2017; Rees Lewis et al., 2019). In this learning environment, we aimed for learners to complete some of that initial scoping work, including finding a problem and relevant partner, because scoping collaborative projects is a form of planning collective action.

Before class

To start, learners create project proposals using a domain-specific template for planning collective action (Figs. 1 and 2: Feature A). The proposal template has slots that prompt learn-

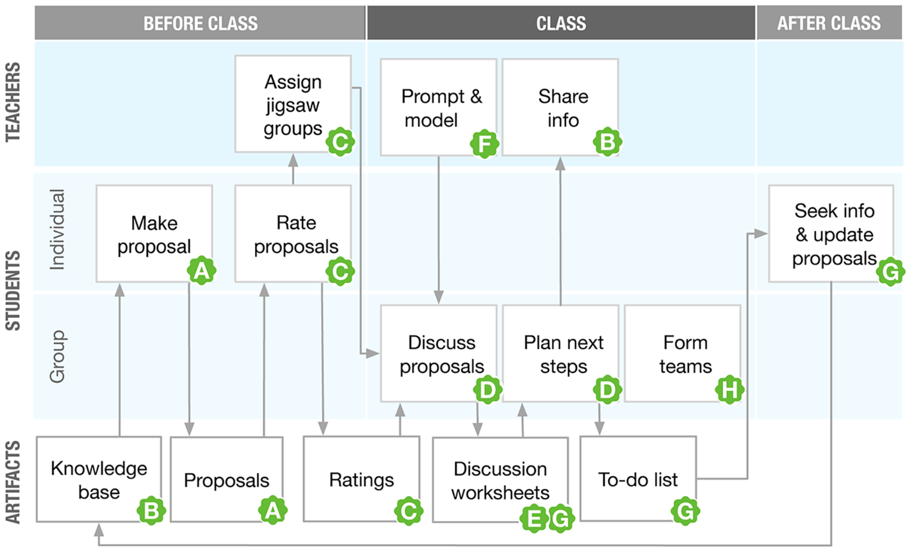

Fig. 1 In scoping deliberations, students complete a weekly cycle of activities with support of scaffolding techniques derived from prior research (see Fig. 2)

ers to specify their theory of change, including: (a) a public problem they want to address, (b) a policy solution that would address the problem, (c) a political strategy that would help implement that policy, (d) a community partner organization who would follow that strategy, (e) a problem the community partner faces, and (f) a feasible project that the learners could do to help the community partner.

To help learners propose projects, the teacher provides several examples of potential responses for each slot of the proposal template. In this study, we provided these options in a Google Document called the Knowledge Base (Figs. 1 and 2: Feature B). Learners initially choose from among these examples, then expanded upon these options in the following weeks as they added their own ideas to the Knowledge Base. When learners saw an attractive proposal from another student, they could 'upvote' that proposal by adding their name below it.

Once all learners had proposed or upvoted one project for the week, the teacher asked all learners to rate each project proposal on a scale from 1 to 10, in answer to the prompt: "How strong is this project proposal, in its current state?" The teacher used these ratings to create groups of learners with different perspectives in preparation for the in-class discussion (Figs. 1 and 2: Feature C). The teacher also prepared a worksheet that visualized the distribution of ratings for the members of each discussion group, for each proposal (Figs. 1 and 2: Feature C).

During class

In class, learners engaged in discussion to decide what their project should be. The teacher divided learners into discussion groups of 3–4 learners and instructed them to choose at least one proposal to discuss, understand each other's perspectives about its strengths and weaknesses, and plan next steps they could take to improve the proposal and increase consensus, especially seeking additional information. To support this process, teachers facilitated an activity that integrated argumentation and iteration. The activity had phases for choosing proposals to discuss, reflecting on pros and cons, identifying gaps in knowledge, and planning next steps (Figs. 1 and 2: Feature D). To support these phases, teachers provided a worksheet that visualized the distribution of learners' ratings of each proposal (Figs. 1 and 2: Feature C), a second worksheet that prompts students to record pros and cons (Figs. 1 and 2: Feature E) and questions that emerge in discussion (Figs. 1 and 2: Feature G), and a whole class to-do list where students record their next steps, including information seeking tasks (Figs. 1 and 2: Feature G). In this study, we used the Trello platform to host the to-do list.

Teachers also walked around the room to facilitate effective discussion practices, such as monitoring the groups and occasionally prompting learners to justify their ideas and respond to others' ideas (Figs. 1 and 2: Feature F) and asking how they could overcome a disagreement (Figs. 1 and 2: Feature F).

This phase of scoping deliberations supports the core practices of studio critique: students presenting ideas to other students, receiving detailed feedback, responding to questions, and taking notes to plan their next steps.

Before the end of each class, teachers asked each group to briefly pitch their project proposal to the whole class so that learners in other discussion groups could see whether they might be interested in joining it. Then, teachers asked each discussion group whether they were ready to form a team, or if they wanted at least another week to explore their options (Figs. 1 and 2: Feature H).

After class

After class, learners referred to the to-do list to remember what information they volunteered to seek (Figs. 1 and 2: Feature G). They searched for information online, in readings provided by the teacher, and by communicating with outside stakeholders. All learners added their information to the Knowledge Base document (Figs. 1 and 2: Feature B). When learners completed a task, they marked it complete in the to-do list.

Other instructional supports

Note that the scoping deliberations process was not the only support provided to students. Instructors also assigned readings and delivered interactive lectures to enhance students' background knowledge of politics, organizing, and human-centered design methods; provided students with bi-weekly feedback to help them improve their projects; and facilitated peer feedback sessions in which students received and addressed critiques from outside of their team (after forming teams).

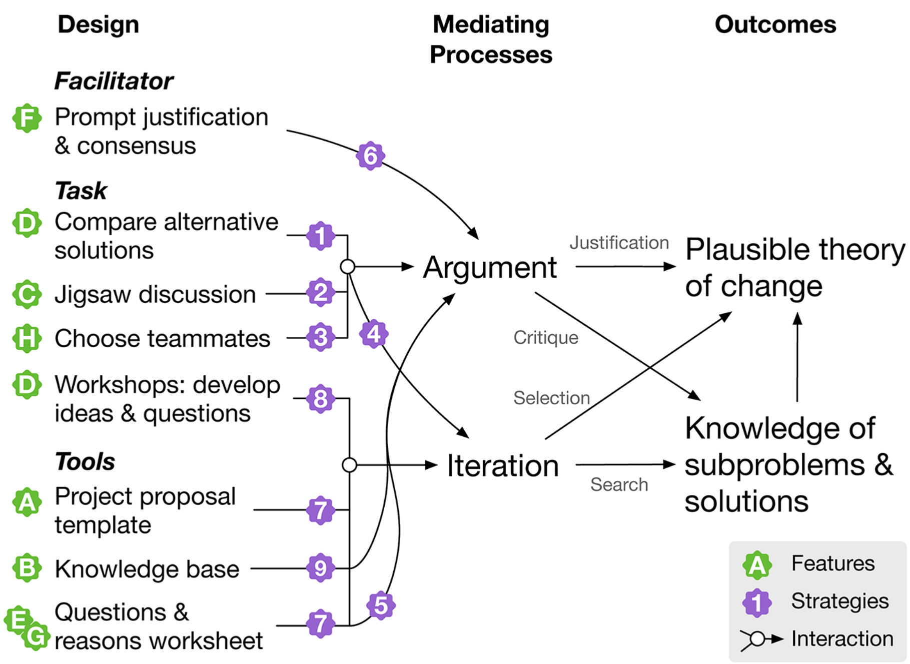

Fig. 2 Design hypotheses. We designed *scoping deliberations* to test whether we can help students develop plausible theories of change by combining existing strategies for scaffolding argumentation and iteration, consistent with the studio critique model of design education. Reference Fig. 1 (above) to see how we integrated these strategies into a coherent design

Theoretical rationale for scoping deliberations

There are many theoretical reasons, based in learning sciences research on scaffolding techniques, to believe that this instructional model would support the core processes of studio critique (i.e., iteration and argumentation). Many of these strategies are adapted from K-12 contexts in science education, which shares the emphasis on supporting practices of argumentation and iteration but is also a different context in ways that may be theoretically important. One of the theoretical issues we explored was whether and how these strategies can be adapted to transfer to design tasks in higher education.

First, scoping deliberations are designed to *motivate* argumentation and iteration by highlighting uncertainty:

- Scoping deliberations confront learners with open-ended questions (Strategy 1), which theoretically should elicit diverse ideas, motivating students to articulate and evaluate justifications for their ideas (Berland & Reiser, 2009; Berland & McNeill, 2010; Manz, 2015; McNeill & Pimentel, 2009). In a study of argumentative discussions in a middle school science classroom, Berland and Reiser find that the use of open-ended questions in a biology unit required a diversity of scientific reasoning that created opportunities for students to engage in constructing and defending their scientific explanations (Berland & Reiser, 2009). Similarly, in a study examining the complexity of student argumentation across grade level and instructional contexts, Berland and McNeill argue that open-ended questions create the need for students to argue and justify their arguments (Berland & McNeill, 2010). In a study of argument structure and dialogic interactions between students in three high school science classrooms, McNeill & Pimentel found that a teacher's use of open questions appeared to encourage students to justify their claims (McNeill& Pimentel, 2009). Manz, 2015, came to a similar conclusion in finding that when teachers pose questions to students, they were called to draw on new resources and engage in mechanistic reasoning to explain scientific phenomena like the changing colors of leaves (Manz, 2015).
- Scoping deliberations intentionally place learners into groups with a range of opinions (Strategy 2), which theoretically should further motivate students to articulate and evaluate justifications for their ideas (Berland & Hammer, 2012; Berland & Reiser, 2011). Berland and Hammer examine framing in argumentation in a sixth-grade class to show that supportive framing of argumentation helped to foster students' justifying of arguments when they experience the possibility of persuading others who may hold competing views (Berland & Hammer, 2012). In an examination of argumentative discussions emerging in two middle-school science classrooms, Berland & Reiser also found that an activity designed to support argumentative discourse provided both motivation and support for students to articulate their own ideas and attend to others' (Berland & Reiser, 2011).
- Scoping deliberations also require students to collaborate (Strategy 3), which theoretically should motivate students to build consensus by critiquing and justifying each other's ideas (Berland & Hammer, 2012; Berland & McNeill, 2010). By having students argumentatively discuss ideas in collaboration with others, Berland & Hammer found that students in a sixth-grade science classroom made claims, supported those claims with evidence and reasoning, and attended to and challenged each other's ideas (Berland

& Hammer, 2012). Berland and Hammer also examined how their learning progression for increasing the complexity of students' argumentation in science classroom discourse required students to learn that science class is for using evidence in collaborative knowledge building (Berland & McNeill, 2010).

- And by fostering critique that undermines learners' nascent theories of change (Strategy 4), scoping deliberations should theoretically motivate students to iterate by gathering more information to justify or improve their theory of change (Hokanson, 2012). In an examination of the design critique as a model for distance and online learning, Hokanson argues that critique benefits the learner by challenging them to gather and synthesize information before developing and communicating a guiding idea or concept to others (Hokanson, 2012).

Second, scoping deliberations are designed to *structure* the processes of argumentation and iteration:

- Interventions work by helping learners recognize important goals to pursue and how to organize their work (Reiser, 2004). In an analysis of two mechanisms to characterize how scaffolded tools support learning, Reiser argues how these mechanisms can address challenges learners face by structuring tasks to make their problem solving more tractable (Reiser, 2004).
- Scoping deliberations provide templates that prompt key elements of argumentation, such as pros and cons (Strategy 5), which theoretically should structure the process of argumentation (Bell, 1997; Berland & McNeill, 2010; Quintana et al., 2004; Reiser, 2004). Berland and McNeill also use scaffolds in the design of a K-12 science classroom to help students learn the implicit rules of scientific argumentation (Berland & McNeill, 2010). Bell described the use of an argument representation tool and presents results from formative classroom trials in which students report that the tool supported their individual and collaborative learning during a debate activity (Bell, 1997; Reiser, 2004 describes the mechanisms and arguments for scaffolds in guiding students through key components and supporting their planning and performance in complex learning (Reiser, 2004). Quintana and coauthors also synthesize prior design efforts, theoretical arguments, and empirical work into a set of guidelines for designing scaffolded software tools for science inquiry. In the resulting design framework, they argue for the support of templates to help learners engage with key epistemic assumptions that are often tacit in instruction (Quintana et al., 2004).
- In scoping deliberations, teachers use facilitation moves to model and prompt effective discussion practices, such as asking for clarification, justification, and evidence (Strategy 6), which also theoretically should structure argumentation (Michaels et al., 2008; Michaels & O'Connor, 2012). A practitioner guide for helping teachers teach students science argumentation recommends that teachers support productive talk in a science classroom through structures like strategic teacher talk moves designed to support student explication and reasoning, as well as different talk formats like whole group or partner talks (Michaels & O'Connor, 2012; Michaels et al., 2008, also present an "Accountable Talk" structure based on deliberative discourse, detailing benefits, challenges, and limitations of applying this structure to academic discourse.

- Scoping deliberations also provide templates for articulating a representation of the problem and solution (known as the theory of change), recording unanswered questions, and planning to seek new information (Strategy 7), which theoretically helps to structure the process of iteration (Puntambekar & Kolodner, 2005; Rees Lewis et al., 2018). In a design-based research study, Rees Lewis et al. used a template for undergraduate design teams to create a shared representation of a highly ill-structured problem as an important step for identifying gaps in knowledge that the team address through iteration. Teams that used these shared representations both noted more reasons for iterating and iterated more than teams that did not use shared representations. Puntambekar & Kolodner also used templates to teach middle-school students to learn science from design activities and found that scaffolds were important for supporting learners to incorporate inquiry into the design process, such as by prompting students to think about what design features needed to improve based on their own research (Puntambekar & Kolodner, 2005).
- Finally, scoping deliberations create a recurring sequence of activities in which learners identify gaps in knowledge, plan investigations to seek new information, and incorporate that information into their theory of change (Strategy 8), which theoretically should help to structure the iteration process (Rees Lewis et al., 2018; Singer et al., 2000; Zivic et al., 2018). To help undergraduate design teams structure the iteration process, Rees Lewis and coauthors facilitated a planning process that helped them define elements of the problem and solution, identify risks associated with these elements, identify risks associated with those elements, prioritize risks to address, and make plans to iterate to reduce those risks (Rees Lewis et al., 2018). Singer and coauthors describe pilot work on six inquiry projects utilizing design principles for helping students go through a sequence of multi-week activities to identify questions, gather data, analyze and reflect on findings from their inquiry to promote scientific learning (Singer et al., 2000). In an analysis of a middle school science classroom in which instructors use a driving-question board to support students' questions about an observable natural phenomenon in the classroom and took up those questions throughout a unit of instruction, Zivic and coauthors found that students perceived their questions are driving their learning. Instructors thus could use this structured process to iteratively draw out students' prior knowledge and work with them to identify questions, co-construct next steps, and engage with them as partners in knowledge-building (Zivic et al., 2018).

Third, in scoping deliberations, teachers provide relevant background information (Strategy 9), which theoretically should support more effective argumentation and iteration by helping students generate better ideas, answer questions, and resolve disagreements (Edelson et al., 1999; Puntambekar & Kolodner, 2005; Zivic et al., 2018).

- For example, in their review of five significant challenges to implementing inquiry-based learning and presentation of design strategies to address them, Edelson and coauthors articulate the challenge of ensuring learners have the background knowledge to develop and apply scientific understanding (Edelson et al., 1999). The authors discuss the use of a library of resources to provide this background knowledge. Puntambekar and Kolodner provided students with scientific background information to support their iteration process (Puntambekar & Kolodner, 2005), and middle school teachers in Zivic and coauthors' study of an inquiry-driven science unit similarly supported students in reflecting on the answers to their questions to drive their learning throughout the unit (Zivic et al., 2018).

Research question

The purpose of this study was to evaluate and improve the design argument[3] presented in the previous section. In doing so, we address the research question: *scoping deliberations based on studio critique to be an appropriate instructional model in helping students develop plausible theories of change in collective action?*

Methods

We tested and refined the design argument by conducting a design-based research development study (Plomp, 2013) powered by process tracing analyses to evaluate causal explanations for events observed in a case study (see Analysis section for details; Collier, 2011). We implemented and studied scoping deliberations in a 10-week undergraduate course. Data include weekly snapshots of students' project proposals and diverse observational data from the learning environment including field notes, student work, and log data from online collaboration tools.

Design-based research studies can take different forms depending on the goals and stage of the research, ranging from relatively open-ended development studies to controlled experiments (Easterday et al., 2017). Given the early stage of research on scaffolding theories of change in collective action projects, we chose a development study. In development studies, researchers design and implement a complex learning environment based on predictions drawn from prior research (as described in the previous section), and refine these predictions based on empirical evidence gathered during implementation to produce an instructional model grounded in empirical data (Plomp, 2013; Sandoval, 2014).

Our positionality as learning scientists and designers with experience in community organizing, deliberation practice, and agile development methods informed our roles as designers and researchers in this study and as instructors of this course. To guard against the bias of seeking only confirming evidence for our hypothesis that instructional models from design education can be applied to collective action, we intentionally explored alternative hypotheses and looked for both confirming and disconfirming evidence. As our findings demonstrate, the evidence from this study disconfirmed many of our initial design theories (e.g., the jigsaw technique) and prompted us to update instructional and design strategies we might have expected to have been effective based on our prior experiences.

Context and participants

We implemented the learning environment with 10 students (5 women, 5 men) in a 10-week project-based undergraduate civics class at a private university. Participants attended an R1 university with an acceptance rate of 9%, where students' race/ethnicity includes: 52.2%

[3] A design argument is a complex hypothesis about the relationship between features of a learning environment, learning processes, and learning outcomes (van den Akker et al., 2006; Sandoval, 2014).

White; 24.5% Asian American; 17% Hispanic or Latinx; 12.1% Black or African America; 1.6% American Indian or Alaska Native.[4] Students also include 21% Pell Grant recipients; 15.2% first generation and 10.5% international students.

The students were spread across 2nd year (3 students), 3rd year (5 students), and 4th year (2 students), and majored or double-majored in organizational change (8 students), economics (1 student), learning sciences (1 student), and manufacturing engineering (1 student). The class met for 80 min, twice a week. The class was an elective and students were informed about the research activities during the registration period so they could make an informed and voluntary decision about whether to participate. In the first few weeks of the course, students had not formed project teams, but by week 4, they had formed teams around specific issues. The initial topic of the course and course teachings was money in politics; however, this project topic was quite flexible. In the early weeks of the course, two of the three groups rejected the initial topic of money and politics and switched to voting.

Two of the authors taught the class. This is consistent with the logic of design-based research, which requires researchers to be intimately involved in design and implementation in order to develop valid and practically relevant findings (Brown, 1992; Plomp, 2013). All participant names included in the paper are pseudonyms.

Data collection

Consistent with principles for conducting qualitative and design-based research, we gathered data from a broad range of sources to be able to triangulate our understanding of learners' interactions with each other, the designed environment, and external stakeholders (Miles et al., 2013; Plomp, 2013; Shenton, 2004). This approach helps to mitigate the potential for bias that is inherent in participatory methods like design-based research, where students may selectively disclose information in order to make a positive impression on researchers (who are also their teachers).

Field notes and video data

To understand learners' activity during class, we collected field notes and video data. We collected over 75 pages of field notes, which included annotated images, and recorded three teams' one-hour discussions over four weeks, for a total of 12 h of video data. One researcher collected jottings during class and immediately after class, which they used to write up field notes as soon as possible after that (Spradley, 1980). We focused on collecting field notes about key incidents when learners acted in desired or unexpected ways, including incidents that revealed whether or how learners were engaged in the desired activities of argumentation and iterations. We expanded on the field notes based on debriefing these incidents in our team after teaching each class, a technique called triangulating investigators, which helps to ensure reliability in qualitative research (Miles et al., 2013; Shenton, 2004; Plomp, 2013). We also collected video data for 4 weeks of the course, which allowed us to balance the focused nature of the field notes with more comprehensive data about what happened during some of learners' discussions, gain a deep understanding of students' interactions with scaffolds in early weeks, and ensure students were interacting with the scaffolds as

[4] Note that these percentages add to greater than 100% because 17% of first-year class report 2 or more races/ethnicities.

expected. Video cameras were placed on students' worktables directly across from students, which allowed the camera to capture all students in a group in the same field of view. Video records were analyzed in video form rather than transcribed to retain the richness of the data.

Artifacts

To understand how learners used the worksheet tools during class, we collected images of artifacts like worksheets at the end of each class period. We collected images of approximately 90 total student artifacts. Compared with field notes, which provided more in-depth accounts of specific incidents we were able to observe, these images provided a more comprehensive overview of the proposals that groups chose to discuss, the pros and cons that groups identified, and the questions they raised during their discussions.

Revision histories and log data

To understand learners' activities between classes, we collected revision histories from Google Docs (including the project proposals and Knowledge Base) and log data from the Trello board (the online to-do list). This enabled us to trace what projects students proposed, how they contributed to the Knowledge Base, and what tasks they created and completed in the to-do list. This allowed us to understand what students worked on outside of class, and how their proposals evolved over time. Students were fully aware that we had access to these online documents.

Online communications

To gain additional insight into what learners did between classes, we observed students' online communications in Slack chatrooms that we created for the purpose of collaboration and feedback among students and instructors in the class. Students discussed their projects in these chatrooms in addition to in class, so observing the chatrooms gave us a fuller picture of students' thinking.

Analysis

Consistent with early-stage design research methods, our aim in this study was *theoretical development* rather than conclusive validation (e.g., Bielaczyc & Collins, 1999; Sandoval, 2014). Our analytic methods reflect this approach. We performed analysis using process tracing, a qualitative method for generating causal theories that are consistent with case studies (Collier, 2011). Note that process tracing does not aim to *prove* causality, but rather to *generate* causal theories that are plausible in light of the available evidence.

In process tracing, researchers generate several alternative causal narratives to explain events in a case study. Researchers assess the relative strength of these alternative models by looking for supporting evidence and disconfirming evidence. For example, researchers in political science have used process tracing to understand the causes of major historical events (Collier, 2011). To understand what caused a military coup, researchers would start by generating several competing explanations, such as economic stagnation or foreign meddling. Next, researchers would review historical sources to weigh the evidence for each explanation. If researchers discovered evidence that unemployment was at record lows before the coup, that would decrease confidence in the economic stagnation explanation. Researchers report process tracing studies by explaining the alternative explanations they considered and the evidence that led them to their ultimate conclusions.

We applied process tracing as follows. The causal model underlying our initial design can be stated simply as: If teachers scaffold engagement in argumentation and iteration, then this will help learners to propose plausible theories of change. This model is specified more precisely by the design hypotheses in Fig. 2. The analysis consisted of weighing this model against the full corpus of data to identify supporting and falsifying evidence. When falsifying evidence was identified (such as seeing that students made dubious rather than plausible assertions about their community partner's needs), we developed a new model that was consistent with the data. This process is illustrated throughout the findings.

Process tracing gives researchers a systematic method for generating and evaluating causal models in situations when experiments are too costly, too slow, or too reductive; unlike experiments and quasi-experiments, process tracing allows us to generate and test many causal propositions in a single study, enabling researchers to develop and refine theories that are more complex, more quickly, and with lower costs for both researchers and participants. This makes process tracing useful in design-based research, in which researchers utilize lower-cost methods that enable rapid iteration on theory and prototypes to make faster progress in early stages of theoretical development (Bannan-Ritland, 2003; Easterday et al., 2017; Kelly, 2004; Rees Lewis et al., 2020). Process tracing is an ideal analytic method in early-stage design-based research studies such as this one, which aims to develop an initial causal theory of how a complex learning environment works based on a single case study.[5]

Findings

We will now give an overview of the findings followed by a deeper discussion of each analysis. By analyzing student work and observational data from the workshops, we found that all discussion groups engaged in argumentation and iteration that had an observable impact on their theories of change. However, by the end of the class, 2 out of 3 teams still made implausible, untested claims about two core issues in their theories of change: the *problem-solution fit*, and *key partnerships* they hoped to forge with community organizations. The exception was one team (out of 3), which validated and falsified some of their assertions about problem-solution fit and key partnerships by gathering feedback from a community organization. Despite being given the critique that they should gather feedback from community organizations, the other two teams did not do so, which placed an upper limit on the plausibility of their theories of change.

This suggests that contrary to our initial predictions, studio critique alone may not provide students with the support they need to plan effective collective actions. In studio

[5] Process tracing is highly compatible with conjecture mapping, a widely used method in the learning sciences (Sandoval, 2014). In conjecture mapping studies, researchers propose complex causal narratives to explain what happened during single deployments of complex learning environments. The process tracing methodology provides the epistemic basis for these kinds of causal inferences. Learning scientists might consider adopting process tracing as an attempt to define the underlying analytic logic that makes conjecture mapping studies possible.

critique, the primary source of feedback is critique among *learners and instructors* (and sometimes practitioners) but not stakeholders (Hokanson, 2012). Without access to feedback from community members who are stakeholders in students' projects, students may develop implausible theories of change.

Engagement in argumentation and iteration

By analyzing student work and observational data from the workshops, we found that all discussion groups engaged in argumentation and iteration, which had observable impacts on their theories of change. This suggests that the scaffolds were broadly successful in supporting both argumentation and iteration, as expected.

Using argumentation to justify and critique theories of change

First, consider argumentation. In a focused analysis across the first three weeks of class, we examined students' notes on the discussion worksheets. We found that all groups, in each week, produced arguments to justify (e.g., "Getting signatures is easier to train volunteers [to do] than convincing city officials") and critique (e.g., "Voter turnout is probably not the best way to address money in politics") the theories of change embedded in their project proposals (Table 1).

While leading workshops, we used field notes to capture illustrative examples of argumentation in which we observed students justifying their proposals with reasons and evidence and questioning the justification for other proposals. For example, consider the following exchange between Emma and Henry, which we captured in field notes. Here, the two are considering whether increasing voter turnout would be an effective way to make politics more democratically representative:

> Emma said she liked one of the project proposals that focused on using voter education to increase voter turnout. She said she liked this proposal because it didn't include money, which she thought was "interesting".
> Henry said: "I thought it was interesting too, but on its own, it's not effective because of Tweedism. Even if 100% of people are voting, it's still not representative." He then pointed to the other two projects. He explained how they might have a voter education component even though it wasn't yet explicit in the proposals.

Table 1 Evidence of argumentation. A focused analysis of the first three weeks revealed that students engaged in argumentation to justify and critique project proposals, suggesting that the scaffolds were broadly effective as expected

Week	Group[a]	Count of key reasons recorded on worksheets	
		Justifications	Critiques
Week 1	A	*6*	*3*
	B	*4*	*5*
	C	*4*	*3*
Week 2	D	*4*	*4*
	E	*2*	*2*
	F	*4*	*3*
Week 3	G	*4*	*3*
	H'	*3*	*3*
	I	*4*	*6*

[a] Discussion groups had different members each week. Group ABC, Group DEF, and Group GHI are each a different group of students.

> Emma said: “what you said makes sense with voter turnout and education applying to the first 2 solutions. So if you want to focus on either of those I’m ok with that.”

In this conversation, Henry and Emma exchanged several arguments that shaped their thinking and helped them to make decisions about which ideas to pursue further. Argumentation played both an epistemic and persuasive role—it helped students to both evaluate ideas and agree on decisions (cf. Berland & Reiser, 2009). It played an epistemic role when Henry invoked the concept of Tweedism[6] to argue that increasing voter turnout would not be an effective way of making politics more representative of the public interest. But Emma said that she was more moved by the persuasive argument that Henry made next—that the other two projects could have a voter education component, which might make them more interesting for Emma. Argumentation had a clear impact here because it led Henry and Emma to eliminate one of the proposals from consideration because they lacked confidence in the underlying theory of change.

Engaging in iteration to refine theories of change

Engaging in iteration also helped students to develop their theories of change. For example, in week 2, three students proposed a project to increase voter turnout by training local volunteers to register voters. During the workshop, students questioned whether this would be an effective strategy and recorded the question, “What are other ways to help increase voter turnout?” on their discussion worksheet (Fig. 3). At the end of their discussion, they added the task “Identify 2–3 ways politicians and city officials can help increase voter turnout, look at other countries/states” to the online to-do list. One of the students volunteered to complete this to-do. After a few days, he marked it complete and added 1.5 pages of new information to their online project proposal document, with five key ideas, including “provide an incentive,” “automatic registration,” “increased flexibility in the voting process,” “redesigning voting booths, ballots, and polling stations,” and “keeping the public better informed.”

For the first 4 weeks of the course, students iteratively created and discussed project proposals each week, creating a total of 16 project proposals. Each proposal specified five core elements: a policy solution, an organizing strategy, a partner organization, an organizing problem, and a design solution. We consider a proposal a new solution, rather than a minor addition or elaboration, only if one or more of its elements differs categorially from the previous proposal. By this criterion, 14 of 16 of these proposals were significantly different proposals than those in previous iterations. The first week’s discussion included 4 seed proposals based on course readings: 2 proposals on small donor matching, using either a ballot initiative or lobbying strategy, and 2 proposals for democracy vouchers, using either a ballot initiative or lobbying strategy, all of which involved designing training materials. Both donor matching proposals were modified in week 2 to focus on training volunteers, but then dropped completely in later weeks. Both democracy voucher lobbying proposals were

[6] The term Tweedism comes from Lawrence Lessig’s book *Republic, Lost: How Money Corrupts Congress—and a Plan to Stop It*, which was an assigned reading for this class. Lessig argues that full participation in voting would be insufficient to ensure that politicians represent their constituents’ interests because their re-election prospects would still depend on political machines funded by private interests. Henry used this argument to critique Emma’s suggestion that there might be a way to make politics more representative without addressing the role of money.

Fig. 3 Example of one change. In this change, students elaborated a theory of change about how to make politics more representative. Students recorded a question during the workshop about how to increase voter turnout, made a to-do to find info to answer the question, and later, added to their proposal a new list of ways to increase voter turnout

dropped in week 2, but the democracy voucher ballot initiative was revived in week 3 and split into two variations: a raising awareness campaign and a volunteer training program, the latter of these received support and remained largely unchanged in weeks 4 & 5 before eventually being selected by one of the teams for their project. In week 2, students proposed a voter turnout and education project, which they split into two variations in week 4: the first focusing on student turnout, which was later expanded to include turnout and education about candidates; the second focusing on citywide turnout of marginalized voters, and in later weeks expanded in scope to redesigning the city's entire voting process. By week 5, all of the students had chosen a team and a single proposal from week 5 as their project for the rest of the quarter, during which each proposal continued to evolve.

This was important progress because the students moved from having relatively vague concerns about choosing an effective strategy, to having specific alternative hypotheses about root causes and solutions to the problem of low voter turnout. For example, the strategy of providing an incentive implies that civic actors do not vote because they don't see voting as valuable (one potential root cause), while the strategy of automatic registration implies that civic actors do not vote because they are not registered (a different, potential root cause). Armed with these specific hypotheses, the team could gather and weigh the evidence for each root cause and make an informed decision about which strategies would be effective. In the following weeks, students formed a team around the idea of improving automatic voter registration—an example that demonstrates how these iterations had an influence on students' theories of change.

These findings suggest that the learning environment was broadly effective in supporting argumentation and iteration, and students' engagement in these processes is plausibly connected to the improvements in their theories of change. There is one important caveat to this statement, which was a minor conflict between the scaffolds for iteration and argumentation.

Tension between scaffolding iteration and argumentation

In implementing the learning environment, we uncovered a tension between two of the scaffolding features, which were designed to support argumentation and iteration, respectively. On the one hand, we used jigsaw discussions—a standard technique for supporting argumentation based on the instructional strategy that students are more likely to justify their ideas with reasons and evidence when they have disagreements with each other (e.g., Ber-

Table 2 Students who solicited feedback from the community developed more plausible claims about problem-solution fit and partnerships

Team	Claim	Epistemic status	Tested
Problem-solution fit claim			
CVR	More students at our college will vote in midterm years if we create a new registration program to make it less confusing.	Implausible - existing registration program already achieved 90%+ registration; students aren't voting in midterms for another reason.	No
AVR	HI voters will be swayed to advocate for local legislation by "out-of-state callers from a prestigious university" in the Midwest.	Implausible – no evidence that HI voters were aware of the university or its prestige or view out-of-state students as credible authorities.	No
DV	Helping the local Democratic Party organize a panel on democracy vouchers will lay groundwork for ballot initiative.	Supported – a local Democratic Party organizer told the team this is a plausible route to policy impact.	Yes
Partnership claim			
CVR	Campus voting office and/or VoteRiders will give us staff and funding to implement our new program because they care about student voting and this will help them "expand their sphere of influence".	Implausible– organization unlikely to give staff and funding to support an unaffiliated student project, and no evidence of interest to "expand their sphere of influence."	No
AVR	AVR HI will develop a script for our volunteers to use because they care about passing the legislation. Campus voting office will recruit volunteers for us because they want to make it easier to vote.	Implausible – assumes if an org is aligned with our goals, that means they will do work to help us; assumes that the campus voting office extends to policy advocacy in other states.	No
DV	Local Democratic Party will host our panel because of shared values and the appeal of the topic to members.	Falsified – team learned that this project is low priority for the local Democratic Party.	Yes

land & Hammer, 2012; Berland & Reiser, 2011). On the other hand, we used weekly workshops to support iteration based on the instructional strategy that students are more likely to iterate on their design ideas when they are led through a process of articulating design ideas, asking questions, gathering more information from the outside world, and revisiting their design ideas to consider whether they should change (Rees Lewis et al., 2018). In implementation, we found that this combination of scaffolds created an inauthentic tension for learners between the goals of iteration and argumentation, which are meant to be complementary processes. Specifically, the jigsaw discussion method interrupted learners' ability to iteratively build on their ideas week over week, because learners were intentionally placed in different groups each week.

This tension became apparent when one student named Kayla actively resisted her jigsaw group assignment because she wanted to follow up with her group from the previous week. We captured field notes of the moment when Kayla gestured to her group mates from the previous week (now assigned to different groups) and said she wanted to understand why all of them switched to proposing "this other project" instead of the proposal they had worked on. She asked for a chance to go speak with them and said "I want to get Henry on my side" to form a team. Kayla ultimately left her assigned group to speak with Henry. By the end of class that day, Kayla and Henry decided to continue iterating on their theory of change as a permanent team.

To resolve this tension, we revised the design to let students cluster around their favorite proposals each week instead of imposing group assignments to maximize opinion diversity. Counter to our initial expectation that this might encourage groupthink, we observed that students still had disagreements to work past within these groups. To ensure that students were still getting critical peer feedback (consistent with the core practices in studio critique), we added weekly peer feedback sessions before each round of deliberation as well.

Up to this point, we have focused on establishing that the learning environment generally worked as intended by scaffolding argumentation and iteration that shaped students' theories of change. We will now take a broader view to understand whether this kind of learning environment is sufficient to help students gain experience developing *plausible* theories of change. We will argue that a major limitation of this learning environment was that it did not help students to overcome the challenge of initiating real-world community partnerships.

Implausible, untested claims in the absence of community feedback

In this section, we present evidence to establish that the College Voter Registration (CVR) team and Automatic Voter Registration (AVR) team did not gather any feedback from community organizations, and as a result, in their final project proposals, made dubious claims about their problem-solution fit and the key partnerships they hoped to forge (Table 2). In contrast, the Democracy Vouchers (DV) team gathered feedback from a community organization that helped them to validate their core assertions about problem-solution fit and falsify their partnership plan. These findings suggest that community organizations can provide critical information that helps teams to test and improve claims in their theories of change. They conversely also suggest that it can be difficult for teams to develop plausible theories of change without access to feedback from community organizations.

The CVR and AVR teams did not succeed in finding any community partner that was interested in working with them (beyond referring the team to resources on the partner's website). Based on field notes of in-class discussions with teams, records of teams' conversations in Slack, and teams' final project proposals, we found that all teams identified community organizations that were topically relevant to their projects. But in their final theories of change, both the CVR and AVR teams wrote about their plans to work with community partners who had not agreed to work with them—and in some cases, had not even returned their emails. The teams' struggle to initiate genuine community partnerships put an upper limit on the plausibility of their theories of change. Specifically, these teams made dubious and unvalidated claims about their problem-solution fit and key prospective partnerships.

Of course, students may not have truly believed the claims they put forward (e.g., if they felt their assignment was to make the best possible argument). This is likely, as instructors provided feedback to help students understand these weaknesses in their project proposals. Nevertheless, this feedback was insufficient to help students produce more plausible proposals. This is a large part of why outside feedback from community partners may be helpful. Community partners are better positioned than instructors to provide realistic suggestions for how students can improve their proposals given their firsthand knowledge of the relevant real-world constraints.

Making implausible claims about problem–solution fit

First, the CVR and AVR teams both made dubious and unvalidated claims about the fit between the problem and their solution (Table 2). For example, consider the CVR (College Voter Registration) team. The CVR team wanted to increase how many students at their university voted in midterm elections because they had found that midterm voting levels were much lower than voting levels in presidential elections. In their final project proposal, they argued that the root cause of this problem was that students did not understand the process of registering to vote. Therefore, they designed a program with the goal of simplifying the registration process by providing students with easily accessible information about how to register. However, this view of the problem and solution was implausible according to statistics in the team's own project proposal, which showed that the existing voter registration program on campus successfully registered 91% of eligible voters in the 2016 presidential election (compared with only 61% of eligible voters in the 2018 midterm elections). The complexity of voter registration did not stop the existing program from being overwhelmingly effective in 2016, and it is unlikely that the existing program became *less* effective at simplifying voter registration between 2016 and 2018. This suggests that the team's hypothesis—that their fellow students do not vote in midterms because they are confused by the complicated registration process—was most likely untrue. Consequently, they had designed a solution that might not make any significant difference in midterm voting among their fellow students.

The AVR (Automatic Voter Registration) team also made dubious claims about problem-solution fit in their final project proposal. Consider the team's following implausible claim about AVR Hawaii, an out-of-state advocacy organization that had not agreed to partner with them:

> Partnering with us for this project will benefit AVR Hawaii because a fleet of out-of-state callers from a prestigious university gathering support among Hawaii voters for SB412 SD2 may be helpful in persuading legislators to pass the bill, which is a major goal of AVR Hawaii.

There are more and less reasonable aspects to this statement. On the one hand, the team's core idea for collective action—organizing phone banking events at which civic actors in one state try to mobilize civic actors in another state to take political action—is broadly consistent with the tactics used by many progressive political groups to mobilize voters in swing states ahead of the 2020 U.S. presidential election (Velasquez-Manoff, 2020). On the other hand, the team's claim that Hawaii voters would be convinced to take action in state politics by “out-of-state callers from a prestigious university” is implausibly arrogant. First, it is unclear why Hawaii voters would consider the students’ opinions or credentials as relevant to their decisions about civic participation in Hawaii—a state where none of the students had ever lived. Second, many Hawaii voters might not even be familiar with the students’ university, which is located in the Midwestern U.S., thousands of miles from Hawaii. This claim, at the core of the team’s theory of change, indicates that the team was projecting their own worldview onto Hawaii voters rather than trying to understand voters’ worldview. This created a risk that the students’ program would not be effective for mobilizing Hawaiians in policy advocacy. While a dedicated community partner might have questioned these implausible assertions and helped the team identify a more appropriate plan, this team did not have that opportunity because they were unsuccessful in initiating a partnership or gathering feedback from prospective partners.

In contrast, the DV (Democracy Vouchers) team validated their core assertions about problem-solution fit by gathering feedback from a local Democratic Party organizer. After several unsuccessful attempts to schedule meetings with local progressive advocacy groups that the team thought might be interested in advocating for democracy vouchers, the DV team scheduled a meeting with Jay, a leader in the local Democratic Party. By meeting with Jay, the team learned that the local Democratic Party often uses panel discussions to raise their member’s awareness about policy issues and set the policy agenda for local progressive activism. The team knew they would need the support of local progressive groups to achieve their ultimate goal of passing a local ballot initiative to enact a democracy vouchers program—a process that requires civic actors to collect many signatures to put an initiative on the ballot, and even larger numbers of votes to pass the initiative. So, Jay’s feedback provided the team with expert validation that organizing a panel on democracy vouchers was a plausible first step for influencing local policy.

Making implausible claims about key partnerships

The CVR and AVR teams also made dubious and unvalidated claims about key partnerships they needed to forge for their project to succeed (Table 2). For example, the CVR team claimed in their final project proposal that they had two prospective partners: the campus voting office and the VoteRiders nonprofit. The team claimed that one or both of these organizations would be willing to invest their operational resources, including time, staff, and funding, to implement the team’s program. To support this claim, the team offered two reasons. First, that these organizations cared about helping people to vote. Second, that implementing the students’ program would help these organizations to “expand their sphere of influence” on the college campus. Once again, there are elements of this argument that are more and less plausible. To be sure, it is hard to imagine why any organization would implement the team’s project if they did not care about helping people to vote. On the other hand, this is hardly a sufficient reason for an organization to implement the team’s project. Here, the team made the dubious and unvalidated assertion that any organization that is sympathetic to their project goals would be willing to do work (or spend scarce resources) on behalf of the team. But resource-constrained organizations cannot take on every conceivable project to advance their mission, and they are often constrained by path dependencies that require them to spend their existing resources on the projects they already have going. The students also baselessly claimed that the campus voting office and VoteRiders would want to "expand their sphere of influence" on campus. Given that the campus voting office was already capable of achieving 91% voter registration on campus, it is dubious whether they would see this as a high priority. And for VoteRiders, a national nonprofit focused on restrictive voter ID laws, it is unclear why they would have a strategic priority of expanding their influence on a single college campus in a state without restrictive voter ID laws.

Interestingly, the CVR team reported they had emailed VoteRiders to propose a partnership. In their email, the CVR team emphasized that their project would benefit from having access to VoteRiders' "information regarding absentee voting in all 50 states." An executive at VoteRiders responded and expressed enthusiasm for a partnership in which the CVR team would distribute VoteRiders resources (ostensibly at little to no cost to VoteRiders). But the team did not follow up and gather feedback on whether VoteRiders would be willing to actually *implement* the program students had designed—as students described in their final project proposal. Instead, the team reported that they stopped corresponding with VoteRiders because they were in the final weeks of class and did not plan to continue their project afterward. This suggests that the time constraints of the class, combined with the difficulty of finding a relevant and responsive partner, prevented the team from validating or falsifying their dubious assertions about how to build the mutually beneficial partnerships required to implement collective actions.

The AVR team also made dubious, unvalidated claims to justify their plans to partner with community organizations. Recall that the AVR team planned to organize phone banking events in which fellow students would volunteer to call voters in Hawaii and ask them to contact their state representatives to support legislation that would enact automatic voter registration. In their final project proposal, the AVR team claimed that AVR Hawaii would support their project by developing a script for the volunteers to use when they called Hawaii voters. The team also claimed that the campus voting office would support their project by recruiting volunteers. In fact, neither organization had agreed to provide these services to the AVR team. Like the CVR team, the AVR team had made the dubious assertion that any organization that shared their goal of helping people to vote would be willing to devote resources to the team's project. Again, mission-alignment is a necessary but insufficient reason for mission-driven organizations to take on new projects; path dependency and resource constraints are plausible reasons to the contrary.

The AVR team also seemed to dismiss the significant differences between their goals, and those of the campus voting office. The campus voting office's mission was to register voters on campus. Yet the team expected that the campus voting office would see it as part of their mission to recruit volunteers for an out-of-state policy advocacy effort. This expectation depends on the campus voting office having a very broad interpretation of their institutional mandate, and a willingness to devote their limited resources to projects that are not directly aligned with their core mission. Even allowing for this slim possibility, it was risky for the team to assert that this partnership would work without validating this assertion with feedback from the campus voting office.

In contrast, the DV team falsified their partnership plan after several conversations with Jay, their contact in the local Democratic Party. Although they initially believed that the local party organization was interested in working with them to organize a panel discussion about democracy vouchers (which could put democracy vouchers on the policy agenda of local progressives), they later learned that the party organization was less enthusiastic about the idea than they originally thought. This happened when they received an email from Jay with only two weeks left in the class, in which he suggested a different community partner for the team to work with.

The team discussed this in their Slack chatroom for the class. Kayla shared her interpretation of Jay's email—that the team's project did not fill a need for the local party organization, so they should explore other options for a community partner:

> Kayla [12:46 PM]
> "I just think this is Jay saying Iike the [local Democratic Party organization] can't really or isn't the best to help us
> So like we aren't filling a need for them
> So it's worth exploring other options"

Sam responded to this message by agreeing that it now seemed like Jay and the local Democratic Party were not as interested in working together, but the new community partner seemed like a better fit. In their final project brief, they wrote that this new community partner was the director of a statewide research and advocacy nonprofit devoted to democratic reform. This partner was explicitly interested in advocating for democracy vouchers and had already drafted an ordinance for enacting democracy vouchers.

While the team was initially excited about contacting this new partner, they ultimately decided against it because they had run out of time in the class:

> Kayla [12:18 PM]
> "Wow wait this is def a better partner

We should 100% get in touch"

> Luis [12:28 PM]
> yeah the new suggestions definitely do seem promising, but we were also discussing in class that at this point–with 2 weeks at most left—the most we can potentially do is design the materials … Really wish that we were this far into it at the beginning of the class and i feel like we could've done some pretty cool stuff.

.These messages indicate the team's excitement about making progress finding promising community partners, and their disappointment that they would not fully realize the opportunities opened by these partners given the time constraints of the class.

Discussion

This study was devoted to understanding whether we can teach students to plan collective action using an instructional model based on studio critique. Leading collective action requires design skills to change existing situations into preferred ones (Simon, 1996, p.111). It follows that we might teach collective action using the "signature pedagogy" in design education: *studio critique* (Schrand & Eliason, 2012). We asked, to what extent can studio critique serve as the basis for an effective instructional model in collective action? We analyzed this question by developing a new instructional model called *scoping deliberations*, which combines the process of studio critique with new templates for planning collective action projects. This model has potentially wide-ranging applications, given that the vast majority of real-world problems exist in *collective action domains*—domains that require collective action to implement solutions—with civics being just one example (cf. Ostrom, 1990).

This approach had mixed results. On one hand, the scoping deliberation process and templates successfully engaged students in explicitly developing theories of change—something that rarely happens when people discuss politics in everyday conversations (Hersh, 2020). This suggests that scoping deliberations are a useful practical innovation for civics educators, and advances model-building in instructional science by showing how instructional strategies from scaffolding research can be applied to focus students' effort on developing theories of change.

On the other hand, scoping deliberations alone were insufficient to help students develop plausible theories of change. The findings suggest that initiating real-world community partnerships is a major challenge for students planning collective action projects. This suggests that if instructors can facilitate learners' initial connections with community stakeholders who are relevant to their project and interested in collaborating, we may be able to support a better learning experience and enable learners to make a real impact despite the difficulty of this task and the time constraints of undergraduate courses.

This result suggests that the standard model of design education—critique of students' work—is insufficient for learning collective action because it does not provide students a way to test their assertions against feedback from real-world stakeholders. Many other instructional models share the same basic assumption: that learning can be facilitated within an insular environment, without interaction with outside stakeholders (e.g., Bielaczyc & Collins, 1999; Chen et al., 2021; Hmelo-Silver, 2004; Singer et al., 2000; Tao & Zhang, 2018; Vogler et al., 2018). This assumption appears to break down in collective action domains, in which outside stakeholders are required to implement solutions, indicating the need for alternative instructional models that help students to work more closely with community stakeholders so they can gather real-world feedback.

Scoping deliberations as a practical innovation

Scoping deliberations are first and foremost a practical innovation that solves a significant problem in teaching collective action: focusing students' effort on developing theories of change. We designed the scoping deliberation model by combining the process of studio critique with templates for planning collective action projects (see Fig. 4 for detailed list of features). Our findings suggest that teachers can use these scaffolds to promote argumentation and iteration around the core design task in collective action: developing theories of change. This is practically significant because it is rare for anyone—let alone students—to have sustained discussions about theories of change, a necessary condition for learning this skill. Large segments of the U.S. public rarely discuss politics or follow political news (Gould et al., 2011; Hersh, 2020). Among those who do seek out political information, most are engaged in a form of political discourse called "hobbyism" which is primarily about entertainment and speculation and has little to do with understanding how to build and exercise power in the real world to solve specific problems through collective action (Hersh, 2020). Given the widespread lack of engagement in thinking about theories of change, it is

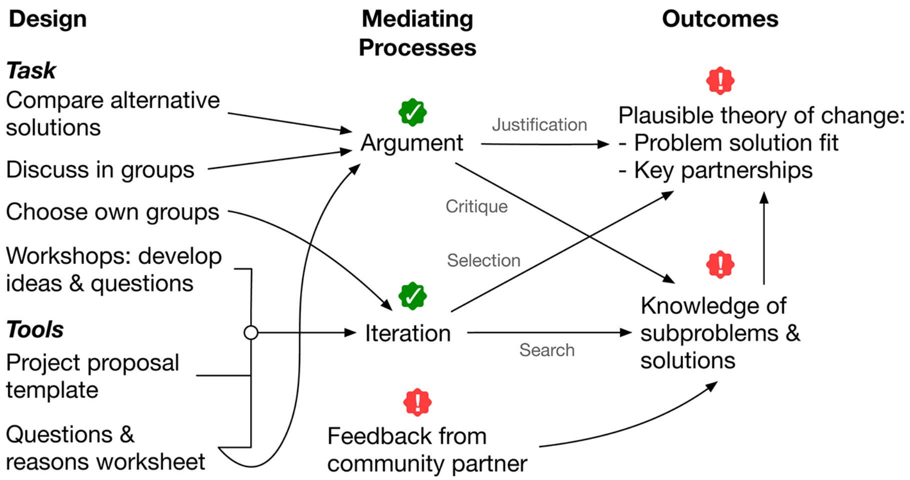

Fig. 4 Final design hypotheses. While the scoping deliberation model engages students in constructing theories of change by scaffolding argumentation and iteration, it is insufficient to help students develop *plausible* theories of change in the absence of feedback from real-world stakeholders such as community partners

nontrivial to understand how we can help students to ask the right questions when planning collective action projects—even if we do not yet understand how to help them find the right answers. To plan effective collective actions, students need to shift from "hobbyist" thinking that frames collective action as a dramatic act of righteous self-expression, toward strategic thinking that situates collective action within a theory of change (Singer, 2019). Our findings indicate that scoping deliberations supported this shift in thinking, even if students did not have the raw information they needed to develop *plausible* theories of change.

Understanding instruction in collective action domains: an opportunity for instructional design

That said, practical innovations are difficult to spread in an effective way unless practitioners understand the underlying instructional strategies (DeBarger et al., 2013; Zhang et al., 2011). As described in the Introduction, educators have grown increasingly interested in teaching collective action over the past 15 years across multiple learning contexts (Ballard et al., 2016; Curnow & Jurow, 2021; Engeström, 2001; Gingold, 2013; Kirshner, 2008; LeCompte et al., 2020; Levinson, 2014; Pham & Philip, 2020; Takeuchi & Ishihara, 2020, Uttamchandani, 2020). Findings highlight how learners receive guidance, motivational support, and task support through social interactions with peers, organizers, and advisers (Kirshner, 2007; Kirshner, 2008; Tivaringe & Kirshner, 2021).

This study makes several contributions to theory-building in instructional design for collective action. First, it shows how instructional strategies from scaffolding research can be applied in collective action domains, to focus students' effort on developing theories of change. Second, it clarifies the nature of support that students need, by showing that students are unlikely to develop plausible theories of change in the absence of feedback from real-world stakeholders. Third, it suggests that studio critique may be an insufficient instructional model in this domain because it does not support feedback from real-world stakeholders. We now discuss each of these contributions.

Applying instructional strategies on scaffolding to focus students' effort on theories of change

The first way in which this study advances model building is by demonstrating how scaffolding strategies that were first identified in other learning domains such as the natural sciences and engineering design also hold true in collective action. We designed scoping deliberations by synthesizing strategies from prior research on scaffolding iteration and argumentation. We took this approach based on the prediction that iteration and argumentation would be critical processes in learning collective action, because they are widely considered as key processes for learning design skills more generally (Adams et al., 2003; Jonassen, 1997; Shin et al., 2003; Rees Lewis et al., 2018; Schön, 1987).

Based on prior research in other learning domains, we predicted that asking open-ended questions, grouping students with different ideas, and requiring students to collaborate would create a need for students to justify and critique each other's ideas—that is, to engage in argumentation. We predicted that these interventions would also create a need for iteration by undermining students' initial ideas, thereby motivating students to gather more information to strengthen their ideas. We also predicted that teachers could use templates and facilitation to focus learners' attention on both the *processes* of argumentation and iteration and the desired *goal* (refining their theory of change). Finally, we predicted that providing students with background information would help them to engage in more effective iteration and argumentation, meaning that these processes would lead more quickly to a plausible theory of change.

These instructional strategies were mostly effective when we applied them in collective action. We found that students did indeed engage in both argumentation and iteration. Moreover, these processes had an observable impact in shaping their theories of change. We even found evidence that students used the supportive information we provided via reading assignments, to help them construct and evaluate their theories of change[7]—such as the example above, in which Jack appeals to the concept of Tweedism to evaluate the likelihood that a particular theory of change would be effective in reducing corruption. All these findings are consistent with the interpretation that the strategies listed above can be applied effectively in collective action, just as they have been applied in the past to domains in the natural sciences.

There is one caveat that provides additional insight into how these strategies must be applied in collective action to be effective. Recall that the most significant change we made to the design of the scoping deliberations during this study was allowing students to choose their own discussion groups rather than creating group assignments that combined students who had different ideas. We found this was necessary to allow students to make sustained progress on developing a theory of change. This indicates that the strategy of grouping students with different ideas in order to motivate argumentation (Berland & Hammer, 2012; Berland & Reiser, 2011) needs to be applied cautiously in collective action domains. This

[7] This is significant because prior research has shown that students do not always incorporate information from readings and research tasks into their problem solving process in problem-based and project-based learning environments (Puntambekar & Kolodner, 2005; Rees Lewis et al., 2018).

intervention may be *so* effective at motivating students to seek consensus through argumentation that it inauthentically disrupts the true goal in collective action—progressively building a coalition that is increasingly committed to executing a plan of action. When students are constantly regrouped in order to foster disagreement, this prevents them from building the commitment among themselves needed to execute any particular plan (or even continue developing their plan long enough to establish its plausibility). Instead, letting students choose their own groups gives them the opportunity to build on their ideas together.[8] The broader lesson from this finding is that teachers and instructional designers need to be careful not to allow lower-level discussion scaffolds from cannibalizing the higher-level goal of leading collective action. Because of the powerful influence that scaffolding techniques (like grouping students with different ideas) can have on focusing students' effort and attention, they may in fact distract students from the broader goal by focusing too much attention on lower-level processes such as building consensus in a discussion group.

Limitations of studio critique: why insular instruction fails in collective action domains

The second way in which this study advances model building is by clarifying what support students need to develop plausible theories of change. Our findings suggest scoping deliberations are insufficient to help students develop plausible theories of change in the absence of feedback from community stakeholders (Fig. 2.4). Counter to our initial expectations, most of the students did not access feedback from the community organizations who were implicated as stakeholders in their theories of change. This placed an upper limit on the plausibility of their theories of change. Specifically, two of the three teams never validated the fit between the problem and their solutions. And by the end of the class, none of the teams understood the organizational needs of their potential partners well enough to make a plausible case for why those organizations would want to collaborate on their projects.

This may well be the most important thing for students to learn in collective action domains. If students can develop an understanding of how their abilities enable them to make contributions that are needed and valued by real-world organizations, they are better prepared to build partnerships and plan collective actions that magnify their individual power and impact on social problems. On the other hand, if students do not understand what they can contribute to support like-minded organizations, they are more likely to feel powerless and overwhelmed by the scale of social problems (cf. Weick, 1984).

These findings suggest that studio critique model falls short of addressing the assistance students need to develop plausible theories of change. While studio critique has been called the "signature pedagogy" in design education (Schrand & Eliason, 2012) and equated to the fundamental practice through which people learn design skills (Hokanson, 2012), it now appears that studio critique may not be a comprehensive instructional model in all design domains. Specifically, it is insufficient in design domains where collective action is needed to implement solutions—what we call collective action domains. The studio critique model assumes that students should learn design skills entirely through feedback from peers, instructors, and practitioners. This is similar to other widely studied instructional models

[8] But note that we also added weekly peer feedback sessions and provided biweekly instructor feedback outside of the scoping deliberations to ensure that students were exposed to critical feedback, a core instructional process in studio critique.

such as inquiry-based learning (e.g., Chen et al., 2021), knowledge-building communities (e.g., Tao & Zhang, 2018), project-based learning (e.g., Vogler et al., 2018), problem-based learning (Hmelo-Silver, 2004), and so on—all of which share the basic assumption that learning can be facilitated within an insular environment, without interaction with outside stakeholders.

Our findings suggest this assumption, and the correspondingly insular instructional approaches, may not generalize well to collective action domains. We found students made implausible claims when they tried to construct theories of change without feedback from real-world stakeholders, such as claiming (without evidence) that key community organizations would want to help with implementation. This suggests that when students are learning to solve problems in collective action domains, it is likely ineffective to receive feedback solely from people cloistered in a design studio, who lack direct experience of the problem and investment in the solution. Nevertheless, models inspired by studio critique (such as scoping deliberations) and other insular pedagogies may still be a useful part of learning environments for collective action—provided that there is some other way for students to access real-world evidence about their progress.

Theoretical approaches to assisting scoping

The goal of this project was to test whether we could use an existing signature pedagogy, studio critique, and augment it with deliberation to teach students to scope collective action projects with the community. We found that this approach was successful in engaging students in planning collective action—students articulated and refined their plans through argumentation and iteration as intended. In overcoming this challenge, a new challenge emerged: students struggled to contact the community stakeholders they planned to work with, and as a result, their plans rested on implausible, untested assertions. While solving this new challenge is outside the scope of this paper, we can speculate how this challenge might be addressed in future work.

It is important to acknowledge that scoping is extremely difficult. It requires learners to identify a need in the community, find community partners, find an overlap between this need and their interests, develop trust, plan a scope of work and commit to implementing it. This is difficult even for experienced community organizers. Scoping requires novice learners to build social capital, know plausible theories of change, quickly reject ideas and change direction—knowledge, skills, resources that are rarely practiced before entering college.

One approach to improving studio critique and deliberation for teaching scoping is to improve critique from community partners. Community partners have unique information about their community and organizational needs that cannot be provided by students or instructors. This feedback from community partners can be used to predict whether an approach is likely to work prior to implementation. There are two reasons to expect community stakeholders' feedback would be more effective than instructors' feedback at helping students to test and improve their plans in collective action. First, community stakeholders have more domain knowledge about the problem and community context than instructors have. They bring not only practical expertise but also firsthand knowledge of the situation and other stakeholders, whereas instructors are more likely to have expertise in conceptual frameworks and the history of collective action. All this knowledge is ostensibly important, so students are best served by receiving feedback from community stakeholders as well as instructors. Second, community stakeholders are ultimately the people who decide whether a student's plans are implemented—not instructors. Even if instructors had uniquely excellent insight into the problem, from a pragmatic perspective, the community stakeholders' opinions are more important to address. Feedback from community stakeholders is a more externally valid test of whether students' plans are feasible.

Note that instructors still play a critical role in this approach. Instructors also provide feedback to students during proposal scoping and can teach students general theories of change that may apply to a particular partner. Instructors with greater ties to the community and institutional resources are critical for connecting students to potential community partners by recruiting community organizations in advance. These partners can serve as 'clients' who define the project goals and provide regular feedback throughout the class (Rees Lewis et al., 2018; Reifenberg & Long, 2017). Furthermore, instructors may also help students manage the process of getting and using feedback from partners. Nevertheless, instructors and other students do not have unique information about the partner's context, particular theory of change, and constituent needs necessary to fully scope projects, as seen in this study.

Another complementary approach for developing more plausible theories of change after scoping is for instructors to support testing. Scoping occurs at the beginning of a project, and sometimes again later when new problems arise that require the project to change direction. While scoping attempts to anticipate and avoid problems before implementation, another strategy is to move to implementation and test whether a solution works, as is common in engineering design and education. In engineering, designs can behave (and fail) in unpredictable ways. Students therefore learn to test their designs to ensure that the functionality works as expected. Likewise, students may benefit from "testing" their plans in collective action. Despite the conceptual similarities between these two kinds of testing, however, they require different kinds of instructional support. While engineering designs can often be tested through prototyping exercises in the classroom (Crismond & Adams, 2012), collective action plans must be tested through interaction with community members in collaboration with community partners whose cooperation (or opposition) will determine success. Furthermore, feedback about whether a solution has a desired result in the community is more valuable than feedback from the community partner about whether a scoped project might work. Testing is thus another critical strategy complementary to scoping. However, testing comes later in the project, during implementation, thus leaving the question of how to help students with the initial task of scoping unanswered.

A third approach is to embed students in community organizations and delay scoping to later in the curriculum. Scoping a new project is arguably more complex than executing a well scoped project, because designers need experience with many different projects and theories of change to anticipate potential pitfalls. For example, in adhocracies, such as design consultancies, scoping new projects and clients is done by the most experienced executives (Mintzberg, 1979). Ironically, while scoping occurs in the initial phase of the project, it may be the last skill to learn. A similar phenomenon can be observed among apprentice tailors, who cut cloth as one of the initial steps in making a garment, but learn to perform this step last, given that it is difficult and risky to perform (Lave & Wenger, 1991).

One could imagine a different curricular sequence where students practice scoping later, after they have developed a deeper relationship with a community organization. For example, students could start by volunteering in an organization, then take on well-scoped projects scoped by the organization, before scoping their own projects later. This progression would mirror the kinds of learning of work-based skills in organizations, which typically happens after college (Schlozman et al., 2012). In this curriculum, students would be embedded in a community organization as part of a practicum or through internships, while still receiving school-based support (Fischer et al., 2007). They could also participate in extra-curricular opportunities for collective action directly through community organizations that provide formative learning experiences even without complementary school-based learning (Kirshner, 2008; Tivaringe & Kirshner, 2020). Of course, this approach would require a fundamental restructuring of undergraduate academic programs, as it requires intensive engagement with a single partner over several years.

Future work is needed to evaluate which of these approaches, if any, might be effective for helping students develop plausible theories of change and execute impactful collective action projects. More to the point, future work should develop theoretical instructional strategies for understanding why and how particular strategies for connecting students with community members are effective.

Limitations

Consistent with design-based research methods, we used the close analysis of a case study to generate an empirically grounded theoretical model (Plomp, 2013; Sandoval, 2014). This approach, while useful for generating new models based on data, has limitations that can be mitigated by future research.

First, future research is needed to understand how broadly this theoretical model will generalize. This study was a single-cycle DBR study, which limits our ability to make claims about replicability. As a necessity of performing case-study-based research, this study focused on a particular context. We studied 10 particular students working on three particular civics topics. Furthermore, this case study focused on students at an R1-classified research university in the United States, who may have different motivations and prior knowledge to students in other institutions and countries. Given this is a single case study, it is likely that the characteristics of our participants and context place limits on the generalizability of our findings and theory. However, precisely because this is a single case study, it is not clear which participant characteristics will be significant, or how (Small, 2009). Future research can clarify whether the model we developed to explain this case study will also be useful in generating explanations and predictions in other contexts (Small, 2009).

Second, we propose a causal model without randomization or a control group. This is typical in theory-building research involving many variables of interest (Collier, 2011), especially research on the design of complex learning environments (Sandoval, 2014), but it is important to acknowledge the limitation. Future research can use experimental and quasi-experimental study designs to increase confidence in causality.

Finally, this study explores how to develop the cognitive abilities needed to strategize about collective action. Social and affective abilities are no less important, but they were beyond the scope of this study.

Conclusion

Collective action is the primary way in which people make changes in organizations, communities, and society when they lack the authority or ability to make those changes as an individual (McAlevey, 2020; Ostrom, 2005). It is perhaps the most important skill set for students to learn, to fully participate in a democratic society (Levinson, 2012). Yet we lack models for understanding how to teach these skills.

This study launched a new research agenda to build models for teaching and learning collective action. It shows how existing instructional strategies for scaffolding argumentation and iteration can be applied in new ways to design *scoping deliberations*, an innovative learning model that enables teachers to engage students in practicing the core design skill in collective action—developing theories of change. This study also highlights one of the central learning challenges students face in collective action: difficulty gathering feedback on their theory of change stemming from their relative lack of relationships with community stakeholders. This suggests that scoping deliberations inherited a conceptual flaw from studio critique, the model of design education on which scoping deliberations are based. The central instructional strategy in studio critique is that students learn design skills by discussing the merits and shortcomings of their design ideas. In learning to plan collective action, there is a non-negotiable need to test one's assertions against feedback from real-world stakeholders—a process that is not supported by studio critique.

The results of this study suggest that it might be most effective to create an instructional model that combines scoping deliberations with techniques for helping students to work more closely with community stakeholders so they can gather real-world feedback. Future work is needed to investigate whether this kind of model is effective and how it might be practically implemented. In this way, the field of instructional science can strengthen democracies by empowering students to hold influence over events in their communities, organizations, and society.

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Availability of data and material The dataset analyzed during this study is not publicly available to protect the anonymity of participants.

Code availability Not applicable.

Declarations

Conflict of interest The authors declare that they have no conflicts of interest.

Ethics approval The Institutional Review Board (IRB) at the authors' university made a determination that this study did not constitute human subjects research, and therefore did not require IRB approval.

Consent to participate Written consent was not required by the IRB. Researchers took other measures to ensure participants' informed and ongoing consent. This research took place in an elective class so that participation was voluntary. Students were informed about the research goals and activities when they registered for the class so that they could make an informed decision about whether to participate. Researchers advised students that they could withdraw from data collection at any time.

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