From "Lab Rats" to "Mad Scientists": Cultivating Agentic Learning Through Student-Led Simulation Redesign

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ABSTRACT Simulations are increasingly prominent in classrooms, and research shows that such activities provide an array of benefits. In general, simulations tend to situate students as "lab rats" (Asal 2005) who get to discuss the experiment. We call for bringing students into a simulation not as lab rats but instead as "mad scientists." We specifically propose using a simulation's debriefing step as an opportunity for students to imagine how they might revise the simulation that they experienced and to defend their revisions using concepts from class. We argue that such student-led revisions cultivate *agentic engagement*, a form of engagement in which students recognize themselves as co-constructors of knowledge with and for their peers. To test this notion, we modified the "Isle of Ted" with an expanded post-simulation debriefing. We found that our approach cultivated student engagement and buy-in, required students to think of concepts dynamically, and was relatively simple to implement. Our study contributes to the literature on simulations as effective and engaging classroom tools, and it also emphasizes the potential for simulations to spark agentic learning.

In the Fall of 2021, I (Summer Forester) attempted a simple simulation on brinkmanship in my introduction to international relations (IR) course. Heading to class, I was confident about the simulation and eager to share it with my students. Unfortunately, the simulation—planned to be a short 20-minute game—quickly unraveled because the rules fell apart in practice. As that sinking feeling that I was losing control of the activity grew, the students stepped up to help salvage it. They began to recommend ideas on how to amend the simulation; however, I realized that they had become caught up in the game and had strayed from the core tenets of the concept. Instead of repairing a simulation that demonstrated brinkmanship, the students were devising game rules that were disconnected from the concepts of the course.

Ultimately, I pulled the plug on the simulation. Rather than finishing the game, we debriefed both the original simulation rules and their suggestions, which transitioned into a lively discussion about the concept of brinkmanship and its parameters. By identifying critical disconnects, the failed simulation successfully revealed gaps in the students' understanding and created an opportunity for me to clarify the nuances of the concept. Moreover—although I am sure the activity unraveling was a frustrating experience (it certainly was for me)—several students emailed me ideas about game revisions in the days after the simulation,

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continuing to engage enthusiastically with the activity and concept through the lens of revising the game.

When we reflected on this experience, my colleague and a student from the class had a collective realization about how simulations can stimulate engagement with course material even if—or, in this case, perhaps because—the activity is imperfect. The students' excitement for "fixing" the simulation sparked a new idea: Why not build opportunities for redesign or refinement into a simulation from the outset? Asking students to revise a simulation has the potential to reveal gaps in understanding, to strengthen connections across theories and topics, and to empower them to contribute new ideas about what a simulation has the potential to teach. Furthermore, doing so could extend and diversify the ways that students engage with activities by increasing their perceived agency in the classroom. In other words, such an approach creates opportunities for students to participate in simulations not only as lab rats (Asal 2005) but also as mad scientists.

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Many articles on simulations present an entirely new simulation that can help students to understand a complex concept (Sands and Shelton 2010), reveal overlooked intricacies of a political institution and its processes (Nance, Suder, and Hall 2016), and demonstrate connections across subfields (Zaino and Mulligan 2009). These interventions and developments are critical; however, we provide a more modest pathway for enriching student learning and comprehension vis-à-vis simulations by refocusing attention on the learning opportunities that exist *after* the simulation. We propose the use of targeted discussions and reflections that ask students to envision themselves as the creators of the game. We are not suggesting that students necessarily need to design an entirely new simulation on their own. Instead, we contend that instructors can use a simulation's debriefing step as an opportunity for students to imagine how they might revise the simulation that they just experienced. Stated differently, we are asking students to "fix" a simulation that is not broken. We believe that allowing students to serve as game makers cultivates *agentic learning*, a form of engagement in which students initiate original ideas and act as co-creators of knowledge.

The anecdotal experience from the failed brinkmanship game serves as a catalyst for our exploration of how targeted post-simulation discussions that require students to revise a simulation might create opportunities for agentic learning. We tested this proposition using the Isle of Ted simulation (Mitchell 2020; Thomas 2002). We first review the goals and benefits of using simulations in political science classrooms. We highlight the role of students as engaged participants—that is, agentic learners—in those activities. The discussion then describes how we applied this approach in the classroom. We ran the Isle of Ted simulation as designed but added a more expansive post-simulation debriefing. The expanded post-simulation discussion asked students to imagine changes that they would make to the simulation and to articulate how their proposed changes demonstrate a key IR concept or idea. The final sections present our observations, lessons learned, and conclusions. Our study contributes to the literature on simulations as effective tools for teaching theory and content (Asal 2005; Asal et al. 2018) and also emphasizes the potential for simulations to spark agentic engagement.

USING SIMULATIONS: GOALS AND BENEFITS

Professors increasingly use simulations and active-learning activities for the multitude of benefits provided to both students and instructors (Glazier 2011). Simulations in the classroom improve knowledge acquisition and retention (Levin-Banchik 2018), and educators using active-learning techniques report positive gains in the classroom through test scores, quizzes, student evaluations, and final grades (Baranowski 2006; Frederking 2005; Levin-Banchik 2018; Raymond and Usherwood 2013; Shellman and Turan 2006). Beyond the benefits to student learning, students also like simulations and give positive feedback that active learning is both fun and educational (Baranowski 2006; Gorton and Havercroft 2012; Shellman and Turan 2006).

Active learning offers many benefits, but what is active learning? Freeman et al. (2014) provide a consensus definition: "Active learning engages students in the process of learning through activities and/or discussion in class, as opposed to passively listening to an expert." Other scholars emphasize that the cornerstone of active learning is that students are "active agents during instruction," which increases their engagement in the classroom, fosters deep learning, and improves motivation (Järvelä and Renninger 2014; Lombardi et al. 2021, 9).

Central to these definitions is the idea of *engagement*, which researchers characterize across four distinct dimensions: (1) social-behavioral, stemming from participating with classmates; (2) cognitive, derived from increased effortful thinking, reasoning, and self-regulation; (3) emotional, from enjoyment, a sense of belonging, and other positive feelings; and (4) agentic, in which students recognize themselves as co-constructors of knowledge with and for their peers (Lombardi et al. 2021). High levels of engagement in any of these dimensions are linked to greater interest and retention. However, agentic engagement—the newest of the four aspects of engagement (introduced by Reeve and Tseng 2011)—is believed to be particularly important in promoting positive educational outcomes, including academic progress and achievement (Lombardi et al. 2021; Patall et al. 2019).

Agentically engaged students deliberately attempt to transform and improve their learning by offering input and collaborating with their instructors (Patall et al. 2019). More pointedly, agentic engagement refers to contributions initiated by a student (Montenegro 2019; Reeve 2013). Through these initiations, students improve their learning outcomes while also co-creating a supportive learning environment for themselves and other

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students (Reeve 2013). Empirical work finds that agentic engagement correlates only modestly with the other three aspects of engagement (i.e., social-behavioral, cognitive, and emotional) and explains the variance in students' positive outcomes independently from them (Reeve and Tseng 2011). In other words, having the opportunity to proactively exert their agency improves students' personal connectedness to the classroom and seems to uniquely improve their learning outcomes beyond effortful thinking and enjoyment.

Simulation Redesign and Agentic Engagement

Simulations are excellent tools for increasing social-behavioral and (it is hoped) emotional engagement, but following a prescribed simulation is less likely to spark agentic engagement. We contend that asking students to contribute original ideas about how to redesign a simulation facilitates their agentic engagement (Zainuddin et al. 2020). More specifically, we propose using a simulation's debriefing step as an opportunity for students to consider how they would (1) revise the simulation; and (2) defend their game-making decisions based on a concept, idea, or theory from the course. Asal, Miller, and Willis (2020, 98) note that a simulation's consecutive, mutually reinforcing steps—that is, preparation, enactment, pausing for reflection, and debriefing—"ensure that a lasting connection is established between the personal experience and the theory." Our approach focuses on the debriefing step and its potential as a site of agentic learning.

Agentic learning, as described previously, refers to engagement in which students initiate ideas, acting as co-creators of knowledge. Students implementing their own original simulation could facilitate agentic learning, but this approach requires significant time, preparation, and input from both professors and students, making it infeasible for many courses. Asking students, instead, to refine a simulation in which they have already participated is a relatively easy way for them to engage a concept from class in a new way and consider how they would bring a concept to life. Moreover, revising a simulation—that is, not creating a new simulation—requires students to consider how their proposed changes will interact with the existing rules of the game. They must stay attuned to the ways that concepts intersect and interact with one another; that is, concepts must be understood in relation to one another, not only in a silo.

DEBRIEFING, AGENTIC LEARNING, AND THE ISLE OF TED

With the goal of increasing opportunities for agentic engagement, we expanded the post-simulation discussion of a well-tested political science simulation: the Isle of Ted. First developed by Thomas (2002) and updated by Mitchell (2020), the Isle of Ted is designed to model collective-action problems, particularly those related to climate change. In the simulation, teams of students are assigned to six different territories on an imaginary island and asked to make decisions around a set list of actions across a series of rounds. Some actions benefit only the individual team (e.g., sending out fishing boats), others create common goods such as a shared-road or a collective-defense system. Each round also has defined periods of intergroup discussion; however, although students can make promises to other teams regarding their actions, their final actions must be kept secret.

In making different decisions, each team gains or loses points, yet the goal of the game is never defined by the instructor. Likewise, fish represent a common-pool resource that is susceptible to overuse, but this is unknown (but discoverable) to the students. As Thomas (2002) described, students almost universally make decisions that benefit their own territory, often at the expense of other territories, and they treat the game as competitive among teams rather than seeking to maximize the point total for the entire class. Student behavior, combined with the design of the simulation, makes this simulation an ideal tool for demonstrating an anarchical international system and constructivist approaches to IR. Both Thomas (2002) and Mitchell (2020) highlighted a broad range of potential discussion questions and related concepts, including free-riders, transparency, absolute and relative gains, early-versus-late adopters, and different types of public goods.

OUR REVISIONS

We co-taught the Isle of Ted in the 2022 Spring term, following the simulation as designed and implementing changes only to the post-activity discussion sessions. The Isle of Ted concludes by presenting a series of terms that students should have encountered during the simulation (e.g., the free-rider problem and anarchy) and provides prompts for discussing these concepts. We added other discussion and written reflection questions that asked students to consider how and why they might revise the simulation.

This back-and-forth interaction between students and their instructor helps to capture the "co" part of co-teaching that is central to agentic learning; the instructors crystallize the linkages that students identify between concepts and game play.

Furthermore, in agentic learning, students work collaboratively with their professors to generate new ideas and connections. In our approach, the instructor necessarily helps students to work through their ideas and ensures that their proposed simulation refinements successfully demonstrate something from the course. This back-and-forth interaction between students and their instructor helps to capture the "co" part of co-teaching that is central to agentic learning; the instructors crystallize the linkages that students identify between concepts and game play.

Debriefing–Day 1: Small-Group Discussions and Collaborative Revisions

Our debriefing took place across two class periods. After the final round of the Isle of Ted, we led a general discussion about the simulation outcomes. We discussed the key concepts that the simulation demonstrated (e.g., the tragedy of the commons, free-riding, and anarchy), following the recommendations of the

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original simulation. This initial discussion ensured that the students had a solid grasp of the concepts at play in the simulation.

Following the more general discussion, we provided each team with a collaborative revision form. The form asked a single question: "Thinking together with your teammates, what revisions would you make to the simulation that would make it more effective or interesting?" In essence, we asked students to begin tinkering with the rules of the game and to consider how their changes might modify behaviors in the simulation or ameliorate negative outcomes (e.g., drastically overfishing). While each team discussed the question and wrote down their ideas, we listened in but offered minimal feedback, which gave students the space to initiate their own ideas.

In the last 10 minutes of class, we added another question for the teams to consider: we asked them to critically examine the changes that they had proposed so far and to articulate which IR concepts, ideas, or theories their revisions demonstrated. They also were asked to consider how incorporating a new concept or idea might affect the original concepts that the game demonstrated and/or the possible outcomes of the simulation.

Continuing to follow their lead, we encouraged each team to think about concepts that we discussed earlier in the term and how they might address an aspect of the simulation that they found confounding or frustrating. For example, many students noted that free-riders benefited in the simulation and that the teams that contributed to the common-pool resources were comparatively disadvantaged. Without providing specific concepts or theories, we nudged students to think about how different IR paradigms would address free-riders and how they might incorporate different perspectives in the Isle of Ted.

Our primary goal for this first round of revising the game was for students to collaborate with their teammates and generate new and different ideas for the simulation. Working in teams meant that students could draw on one another's strengths as they endeavored to balance game play with substantive IR material. Additionally, keeping them in their preassigned Isle of Ted team encouraged them to think about their own experience with the game, setting the stage for the larger in-class discussion. For example, some students were keen on designing more elaborate ways for each team to spend their points each round; other students wanted to devise ways to incorporate feminist IR perspectives into the game. Watching students navigate simulation design while considering alternative theoretical additions was one of the most enriching aspects of this experiment for us as instructors. From our perspective, this effectively harnessed the aspects of agentic learning that center on peer-to-peer knowledge production and co-creation.

Debriefing–Day 2: Written Reflections and Connecting Revisions to IR Concepts

In addition to the revisions that the students generated with their team, we asked them to answer a series of questions on their own as homework after the first debriefing day. These post–Isle of Ted surveys asked students to reflect on the following three key questions:

1. From your perspective, what were the results of the simulation?
2. What did you learn from the Isle of Ted?
3. Imagine that you are tasked with revising the Isle of Ted. What would you change in the simulation to create different results or outcomes?

The first question is specifically about the outcomes of the Isle of Ted. It is an intentionally insular question, designed to make students think through the events and interactions that transpired to produce the different outcomes (i.e., overfishing and lack of roads) in the simulation. The second question is broader, asking them to explain what the simulation taught them. The pairing of these two questions is key: it reinforces the idea that simulations must enhance our understanding of something beyond the simulation. Although this clarification is likely obvious to instructors, we believed it was worth reinforcing with students who may not immediately think of the pedagogical rationale underscoring simulation decisions. Combining these questions also confirms that the intended learning goals of the activity aligned with what the students believed they learned.

The third question asks students to describe a change to the game that might alter the results. Following our previous analogy, it switches the students from "lab rats" to "mad scientists." The Isle of Ted—as well as many simulations modeling political systems and collective-action problems—is designed such that the outcomes often are not what the students hoped for (i.e., overfishing and failures in trust). This is critical for students to understand the complexities of international systems but also can lead to them feeling disheartened and trapped in an unavoidable "tragedy of the commons." Providing an opportunity for revision presents an alternative to that perceived inevitability, asking instead for them to consider what needs to change for a different outcome to occur. They must make their own individual decisions about how to revise the simulation in order to generate a different outcome.

The take-home questionnaire served as the discussion prompt for the final in-person debriefing day. We invited students from each Isle of Ted team to share their revision suggestions that they had devised at home. We did not have time for every student to respond but at least two from each team volunteered a revision idea. We discussed how the revisions would change the outcomes of the simulation if we were to replay the game with those rule adjustments. Then we posed our final questions: How would you implement your proposed changes, and what would they teach us about IR that we otherwise would not learn in the simulation? Students had to justify their revision suggestions using concepts that were covered in class, particularly given that we ran the simulation in the penultimate week of the term. As students responded, we wrote their ideas and connections on the chalkboards around the classroom. By saving this line of questioning for in-class discussion, we could intervene in any misunderstandings in real time. Moreover, it allowed us the opportunity to make connections between different ideas that students posed, thereby reinforcing peer-to-peer learning.

Based on the collaborative revision form, the take-home questionnaire, and our in-class discussions, the prevailing recommendation was to incorporate some form of an international organization that would provide a forum for planning, discussing, and/or monitoring and reporting on the behaviors of different territories (by observing their actual-versus-promised decisions). Some students explicitly advocated for including a United Nations team that would guarantee transparency throughout the game. We partnered this overarching recommendation with a slightly less common revision idea: planting covert

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operatives to either influence a team's decision or to provide another team with valuable information. The latter point led students to question how an international organization could control covert operations that might undermine their transparency efforts. Together, these suggestions generated an excellent discussion about the role and limits of international institutions in constraining "bad actors."

Other students envisioned a version of the Isle of Ted in which states could attack or wage war with other teams. They suggested revising the game so that teams could allocate some of their points for offensive—not only defensive—measures. This revision idea prompted a discussion of the unintended consequences that waging war would have on trade, defense, and fishing. For instance, students questioned how teams would pay for war if they already struggled to pay for roads. We stayed engaged with the students throughout this debate and continued to encourage them to link their ideas and questions to IR concepts. In this case, we revisited the notion of "the second image reversed" (Gourevitch 1978) and how domestic politics (i.e., roads) are related to international politics (i.e., war). The students organically arrived at this notion, but we reconnected it to a precise concept that we previously had discussed in class.

To summarize, on the first debriefing day, students initially worked together to brainstorm ideas about revising the Isle of Ted. They then defended their team decisions based on course materials. For homework, they reflected on what happened in the simulation, what they learned from the simulation, and what they individually would change in the simulation. On the second debriefing day, we—including the instructors—collectively discussed their ideas. Instructor involvement was critical at this point because we clarified what their revisions would teach us about IR that we otherwise would not have discussed, which was a key learning objective for this debriefing activity. In this way, the debriefings were not simply a lengthier recap of what the original Isle of Ted prompted students to consider. Moreover, discussing their revision ideas and helping them finesse their decisions using IR concepts was interactive and iterative, extending active-learning processes into the debriefings. Students shared an idea, we helped them to refine it, and then they ran with it farther. Students liked this type of debriefing and it certainly made for a dynamic classroom experience.

LESSONS LEARNED

Before this intervention, we tended to revert to more passive teaching practices—namely, lecturing—when concluding an active-learning activity. We found that using the debriefing step to devise new game revisions prompted students to remain actively engaged throughout the simulation and afforded them another opportunity to demonstrate their comprehension of the course material. We contend that this process activated agentic engagement; students generated original ideas and co-created knowledge with both their peers and instructors.

We derived three key lessons based on students' written responses, our observations from in-class discussions, and our notes from the simulation debriefings (which included transcriptions from the ideas and connections that we wrote on the chalkboards).

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Co-Collaboration Fosters Student Engagement and Buy-In

The benefits of agentic engagement stem, at least in part, from a belief that students are important contributors to their own (and their classmates') learning environment (Reeve and Tseng 2011). Asking students to redesign a simulation necessarily requires them to think about the activity from a position of ownership. Indeed, in class discussions, their language evolved during the course of the activity. Rather than referring to the simulation as "the Isle of Ted," students started referring to their iterations from a first-person perspective (i.e., "*my* simulation"). There was a sense of excitement in the room as they bounced ideas off one another and the instructors and manipulated "their" simulations to reflect their own vision and interests. This opportunity for students to engage agentically in the classroom likely improves their learning outcomes as well as the overall quality of the course by promoting greater dialogue between students and instructors.

In our experience, students are good at making suggestions about how to refine games. However, when they enter a simulation as players—not as game-makers—they may confuse the rules of the game with the nuances of the concepts contained therein. Therefore, instructors have a vital role in helping students to adhere to the constraints of particular concepts or ideas. The back-and-forth process of refining a simulation and then defending their choices cultivates a deeper understanding of that concept. Bringing students into the design of a simulation ensures that they understand the concepts that they endeavor to simulate in the activity. Because they must defend their revisions by explaining their connection to course material, we can intervene in any misunderstandings about a given topic. In this way, students are less likely to confound the constraints of an idea with the rules of the game. Stated differently, this approach avoids a scenario in which students are left thinking that the rules of the simulation are more consequential than the theory or concept on which the game is based.

Student-Generated Revisions Require Thinking Dynamically About Concepts

We found that asking students to articulate how their revisions interacted with the original concepts presented in the Isle of Ted forced them to think dynamically about IR concepts. They needed to consider, for instance, how incorporating an international institution might affect the anarchic nature of the game or how adding broader military actions shapes cooperation. This process of revising the simulation forced students to think about the

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complexities of the game and how initiating a small change can have a ripple effect across the system. Similarly, we emphasized how this holds true in the international system. Although they might learn about IR in discrete modules (e.g., human rights, globalization, and war modules), in reality, the lines between ideas and concepts are more muddled and intertwined. As students work through scenarios in the simulation in which an additional rule has fallout effects, they develop their understanding of how real-life international phenomena interact and can engender downstream effects. This was particularly effective in our course given that we played the Isle of Ted at the end of the term when students already had been exposed to myriad concepts, ideas, and scholars.

This Approach Is Simple and Practical for Both Instructors and Students

Running a simulation requires a significant amount of work by the instructor. Our approach is akin to Asal et al.'s (2018) mini-games: it builds on the instructor's preparation for the simulation to maximize the impact of the activity without the need for excessive, additional time commitments. We reimagined the debriefing—which all well-run simulations already include—as a moment for students to take ownership of the game and what it has the potential to teach us. Rather than thinking of the simulation as only a preordained activity to be imposed on students, we suggest using the structure of the simulation as a pathway for advancing learning goals.[1]

Moreover, because our approach relies on revising a simulation in which the entire class already had participated, students arrive at the debriefing with a shared understanding of the activity. From that point, they have the freedom to imagine new iterations of the simulation and can solicit feedback from their peers with relative ease. This approach simplifies the amount of background information necessary to explain their new version of the simulation. As a result, students can spend most of their time making sense of how a proposed revision would capture a different aspect of IR that the original simulation did not include. It allows students to contribute novel ideas that they otherwise might not have offered.

FUTURE DIRECTIONS AND CONCLUSIONS

To be sure, there are limitations to what we can glean from our approach. These conclusions are based solely on our experiences running the Isle of Ted in our introduction to IR course. The Isle of Ted was well suited for this approach, and students easily imagined ways to alter the game. Other simulations may have too many existing parameters that would make envisioning revisions prohibitively difficult. Nonetheless, students are creative and, in future applications of these techniques, we are excited to see what types of alterations they could imagine for various simulations and games. Furthermore, using the debriefing to brainstorm hypothetical changes does not fully replicate the experience of implementing those ideas. In courses for which more time is available, it would be possible to take those student-developed ideas and actually iterate the game, observing how the changes do (or do not) alter outcomes.

At the most basic level, agentic learning depends on dialogue, on the back-and-forth exchange of ideas and the refining of understanding. It is in this dialogue that the real classroom "magic" happens: instructors can help students to understand key theories and concepts, and students—assuming the role of mad scientists—can spark new ideas about or applications of concepts that instructors—and other students—may not have considered. Instructors still need clear learning objectives—and they must keep those objectives in mind—but even something as subtle as rethinking how we debrief a simulation allows for the type of agentic engagement discussed and advocated for in this article. Ultimately, taking steps to maintain an engaged learning environment, even when not in the midst of designed activity, can extend the benefits of active-learning tools beyond the boundaries of game play.

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CONFLICTS OF INTEREST

The authors declare that there are no ethical issues or conflicts of interest in this research. ■

NOTE

1. We appreciate the comments of reviewer 3 that helped us to arrive at this point.

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