

Research Article

Simulating Farm-Level Decision-Making in Smallholder Farming: The Green Revolution Game as an Experiential Tool for Teaching Agricultural and Development Economics

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Abstract

Currently, most students studying agricultural economics and agribusiness at universities come from nonagricultural backgrounds. Without firsthand experience, instructors must find avenues to engage them with abstract concepts through experiential learning. Cooperative learning and simulation games are effective tools for modeling the complex economic decision-making challenges faced by producers, especially smallholder farmers in developing countries. In this study, we explore students' experiences after playing the Green Revolution Game (GRG), a simulation game that places them in the role of a smallholder farming family in a rural Indian village. Through a content analysis of 62 reflection papers written by undergraduate students over 3 years in an agribusiness course focused on international agricultural development, we examine how students operationalized course concepts through the GRG to understand the complexity of smallholder decision-making. Emerging themes from students' reflections, analyzed through Kolb's Experiential Learning Theory and Game Theory, demonstrate that the GRG enhanced their understanding of concepts such as resource allocation, poverty traps, technology adoption, risks and uncertainty, and market dynamics in agricultural development. We recommend this and other simulation-based games to help students better grasp course concepts and cultivate higher-order thinking, problem-solving, and high-impact learning.

1 Introduction

The demographic landscape of students in agricultural majors at US land-grant universities has shifted substantially in recent decades, with approximately 65–75 percent now coming from nonagricultural backgrounds (Swan and De Lay 2014; Parrish et al. 2015). As agricultural economics and agribusiness courses increasingly attract students with limited exposure to production agriculture (Gillespie and Bampasidou 2018), educators face a significant pedagogical challenge: How can instructors help students with limited agricultural experience effectively understand and apply concepts in agricultural and development economics to increasingly complex real-world contexts?

The challenge becomes even more pronounced when preparing students for leadership opportunities in transnational agrifood systems. Enhancing their global competence and understanding of different agricultural systems, including smallholder farmer decision-making in low- and lower-middle-income countries, is crucial for their career growth. Smallholder farmers around the world are vital to our global food system, producing an estimated 70–80 percent of our food supply (Fairtrade Foundation 2013; Ricciardi et al. 2018), yet many students have a limited understanding of the realities these farmers face, including resource constraints, environmental uncertainties, price volatility, and competing household needs.

Experiential and high-impact learning (HIL) pedagogical strategies such as simulation games are essential for helping students build this foundational knowledge and cultivating the critical thinking, problem solving, and technical competencies necessary to navigate the complex and uncertain environments in the agricultural sector (Vandever and Guedry 1992; Noel and Qenani 2013; Gillespie and Bampasidou 2018; Tewari et al. 2024; Connolly 2025). Murphrey et al. (2016, p. 162) described HIL experiences “as activities that purposefully and systematically encourage students to create new knowledge, make connections across [the] curriculum, explore opinions/views/perspectives beyond their own, and engage in critical thinking.”

Simulation games offer promise as high-impact learning pedagogical tools because they promote cooperative learning and mimic real-world situations, engaging students in authentic learning experiences that apply abstract course concepts to practical challenges and problem-solving (Greenblat 1973; Vlachopoulos and Makri 2017; Robinson et al. 2021). Using games such as the Green Revolution Game (GRG) to model the multifaceted economic decision-making challenges encountered by producers, particularly smallholder farmers in low-to lower middle-income countries, bridges the experiential gap by immersing students in situations that mirror real-world conditions and require them to develop solutions to address complex problems.

1.1 Purpose and Objectives of the Study

The purpose of this study was twofold. First, we analyzed how students operationalized key concepts in agricultural and development economics through participation in the GRG, a simulation that places students in the role of smallholder family farmers in rural India. Second, we evaluated the game’s effectiveness as a pedagogical tool for enhancing students’ understanding of the complexity of decision-making processes faced by smallholder farmers from low- to lower-middle-income countries. Based on the examination of student reflection papers from 3 years of an undergraduate Agribusiness Management/International Agricultural Development course, the specific objectives were to evaluate (1) how students connected their gameplay experiences to key concepts in agricultural and development economics, such as market development, resource allocation, and technology adoption; and (2) the ways in which the GRG enhanced their comprehension of smallholder farming systems as well as agricultural and development economics principles.

1.2 Contribution and Applicability of the Study

Although the GRG has been used for decades as a teaching tool across several disciplines, limited empirical research has examined how participation in the simulation helps students connect gameplay experiences to specific concepts in agricultural and development economics. This study contributes to the literature by providing a systematic content analysis of 62 student reflection papers collected over 3 years in an undergraduate international agricultural development course that integrates the GRG as an experiential learning tool. By mapping students’ gameplay decisions to concepts such as resource allocation, poverty traps, technology adoption, risk and uncertainty, and market dynamics, our study demonstrated how simulation game-based learning can help reinforce core concepts in agricultural and development economics while strengthening students’ understanding of economic decision-making in smallholder farming systems. While the analysis is based on an undergraduate course at a US land-grant university, the instructional approach and insights are relevant to other institutional settings, class sizes, and courses that seek experiential ways to teach agricultural and development economics concepts to students with limited agricultural backgrounds. Though the outcomes may differ in graduate-level courses or in non-US contexts depending on students’ prior exposure to agricultural systems, the experiential learning and simulation nature of the GRG remains broadly transferable.

1.3 Defining Smallholder Agriculture

The terms “smallholder agriculture,” “smallholder farming,” “small-scale farmers,” and “small-scale agriculture” are used interchangeably, although their precise meanings vary across countries and regions (Food and Agriculture Organization 2016; Lowder et al. 2016; Bartol 2022). In the context of this paper, smallholder agriculture/farming refers to farmers in low- to lower-middle-income countries who operate family farms of less than 10 hectares, predominantly rely on family labor with low levels of mechanization, and derive their primary source of income from farming (Food and Agriculture Organization 2016; Lowder et al. 2016). Many smallholder family farms in low- to lower-middle-income countries are considered subsistence or semi-subsistence farms: They primarily produce to feed their family, selling any surplus in local markets to meet their basic household needs (Fairtrade Foundation 2013; Norton et al. 2022). While agricultural systems vary considerably depending on context, a foundational understanding of smallholder agriculture is crucial for students to understand agricultural and development economics concepts, as these systems reflect a large percentage of farming around the world.

2 Background: The Green Revolution Game as a Pedagogical Tool

The following section provides an overview of the Green Revolution Game, its historical development, and role as a pedagogical tool for teaching agricultural and development economics concepts.

2.1 Overview and Historical Context

The Green Revolution Game (GRG) is a simulation game that offers players the experience of living and making decisions as a member of a smallholder family farm in a rural Indian village. This game translates abstract agricultural and development economics concepts into practical, experiential learning opportunities, requiring players to navigate resource constraints, environmental uncertainties, price volatility, and competing household needs while making high-stakes decisions to improve farm productivity. It also exposes students with limited production agricultural backgrounds to subsistence farming systems they are unlikely to encounter in the US context.

The GRG was developed more than half a century ago by Chapman and Dowler (Chapman 1973). The simulation has been used as a social simulation laboratory to teach concepts across disciplines (Corbridge 1985; Boştenaru Dan and Panagopoulos 2014; Bostenaru Dan 2015; Robinson et al. 2021). In 1995, Park and colleagues analyzed the role of the GRG in cultivating students’ critical thinking skills, problem-solving abilities, and interpersonal relationships (Park et al. 1995). However, 30 years since their publication, a notable gap remains in the literature regarding its effectiveness in fostering students’ understanding of the foundational concepts in agricultural and development economics. Addressing this gap is important, especially for today’s students, many of whom lack direct experience with production agriculture, especially in the context of smallholder farming systems in low- to lower-middle-income countries, as defined by the World Bank (2024). At the University of Missouri, we have used this simulation game in an Agribusiness Management/International Agricultural Development course for more than 30 years to help students conceptually and experientially understand key concepts in agricultural and development economics.

2.2 Gameplay: Rules of the Game

The game is typically played over two 75-minute class sessions in the middle of the semester, both to reinforce concepts in agricultural and development economics that students have learned so far and to set the course’s direction for the remainder of the semester. As Chapman (1982, p. 3) explains,

The core of the game is based on the production of a staple food – rice – for family consumption and marketing. Families which accumulate surplus capital can choose

between a variety of inputs to improve production. Inequalities in landholding and family size, food deficits and surplus provide the driving force for interaction between players [community members], and the boundary constraints within which negotiations take place.

Two facilitators act as game managers to help manage gameplay. The class sizes range from 25 to 30 students, and they are broken up into groups of two to three people, each group representing a family in a rural agricultural village in India. At the start of the game, each family is randomly assigned a family size (number of family members, including adults and children) and landownership (number of acres for farming rice). Depending on the total number of families, the people and land allocated per household are determined using guidelines in *The Green Revolution Game: Managers' Handbook* (Chapman 1982). Once this determination is made, the amount of land available to the community overall is fixed, creating a realistic constraint that mirrors the land scarcity challenges faced by rural farmers in many low- to lower-middle-income countries. The game manager explains that each family will grow rice on their farm and that they must feed all family members every season prior to bringing rice to the market for profit. Food consumption requirements are set at nine maunds of rice (approximately 740 pounds) per adult per season and five maunds of rice (approximately 411 pounds) per child per season.

2.2.1 Seasonal Decision-Making

Once family size and acres have been distributed and the rules explained, gameplay begins, and families must make decisions at different timepoints of the season. At the beginning of a season—"the calling of the monsoon"—each family must decide whether to use different inputs, such as which seed to grow (either ordinary seed or hybrid seed), whether to apply fertilizer and/or pesticides, and whether to invest in irrigation (purchase a well). Families can also purchase additional land from other families at a cost of 600 rupees per acre (negotiable through bargaining), while a water well can be constructed for 1,300 rupees per acre.

Once families finalize their preseason decisions, the season commences in three rice-growing phases. Each phase, cards are drawn at random to represent different occurrences, such as weather patterns (rain or drought) and pest attacks. After the third growing phase is complete, the season ends and families calculate their rice production levels based on set guidelines of what transpired on their farm. Each family tracks this information on a balance sheet (see Appendix B) and keeps a seasonal record sheet to track weather events, input decisions, and yield outcomes for the season (see Appendix C).

2.2.2 Food Security and Market Dynamics

As noted, families must first feed their household members the rice they produce. Families experiencing food deficits are required to purchase, borrow, or develop innovative strategies such as sharecropping or engaging in barter trade (hiring out their extra family labor to other farms in exchange for food to meet their family needs). In cases of extreme starvation, child mortality occurs first, leading to a reduction in household consumption needs for the subsequent season. After meeting their family food needs, they can take any surplus to the market to sell it for profit. Each family's production is reported to the game managers, who keep a running score board of total village yields (see Appendix D).

At this point, a period of interaction occurs, as families decide whether and how much rice to sell on the market, purchase inputs, secure credit or loans, negotiate labor exchanges with other families, and generally interact with each other in the "community." The total village supply to the market is compared against a price chart to determine the market price offering. The game managers may introduce external shocks—such as tariff policies or food aid—to the community, which may have impacts on production and/or the market.

2.2.3 Ongoing Gameplay

When this interaction period concludes, each family makes another round of decisions about how to manage their rice acres for the coming season. The game manager also flips cards to indicate whether a family will expand each season. Families can have a maximum of four children; if a family has four children and a new birth occurs, one child transitions to adulthood. Regarding labor, one adult can work either 2 acres of dry land or 1 acre of irrigated land per season. Each family tracks information about income (sale of rice, labor, and land sale/rental) and expenses (inputs like fertilizers and seed, land purchases, labor, wells, and, if needed, rice for family consumption) in the balance sheet (see Appendix B). The game continues with these stages over the course of six to eight seasons (two 75-minute class sessions). Further details about the rules of the game can be found in *The Green Revolution Game: Managers' Handbook* (Chapman 1982).

2.3 Student Reflections

After the game is played in class, students are required to write a reflection paper on their experiences and dynamics of the game, including what transpired within their households. A grading rubric guides students as they write their papers (see Appendix E). Students also submit the balance sheets that they used to track their progress each season. In their reflections, students are encouraged to connect their family decisions made during the gameplay to the key concepts in agricultural and development economics covered in class discussions and in the course's main textbook, *Economics of Agricultural Development: World Food Systems and Resource Use* (Norton et al. 2022). These concepts include market development, resource allocation, gender roles, and technology adoption.

3 Theoretical Framework

This study is grounded in two complementary theoretical frameworks: Kolb's Experiential Learning Theory and Game Theory.

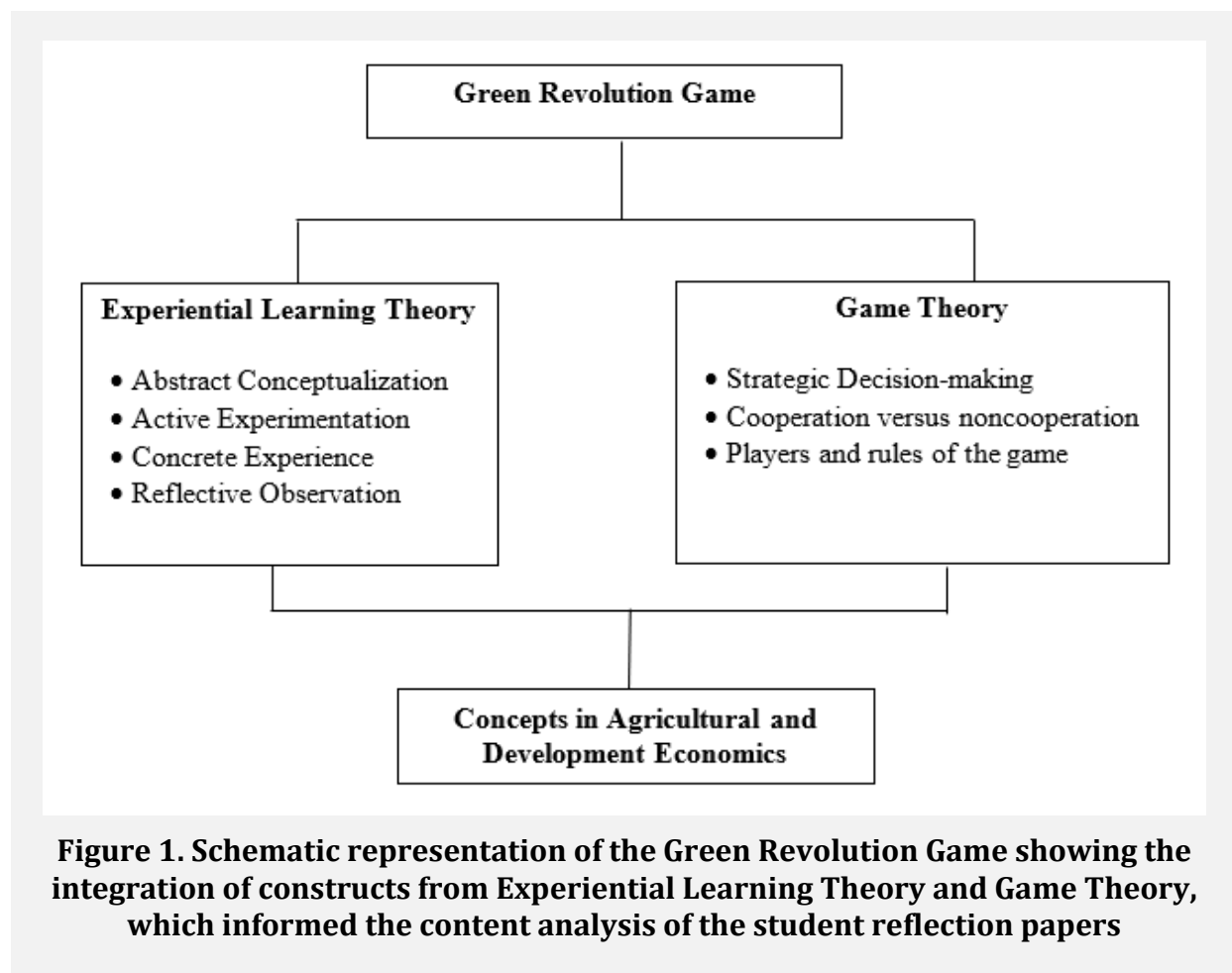
3.1 Kolb's Experiential Learning Theory

Drawing on Kolb's Experiential Learning Theory (Kolb 2014; Peralta et al. 2024), we examine how the GRG fosters a cyclical learning process involving abstract conceptualization, active experimentation, concrete experience, and reflective observation. Through this process, students can apply abstract theoretical concepts in the International Agricultural Development course to their active experimentation and experience through the GRG. According to Herz and Merz (1998), simulation games such as the GRG engage students in *hands-on, minds-on* learning experiences that promote self-reflection, aligning well with Kolb's framework. As a result, students not only gain a better understanding of core concepts but also develop essential skills such as critical thinking, communication, decision-making, interpersonal relationships, problem-solving, self-awareness, and empathy (Park et al. 1995; Vlachopoulos and Makri 2017; Uzun and Uygun 2022).

3.2 Game Theory

In addition, Game Theory (Von Neumann and Morgenstern 1944, 2007) provides a lens to interpret the interactive behavior and strategic decisions made by students during the game and how their actions could impact others. Because the GRG involves players making decisions under conditions of uncertainty, resource constraints, interdependence, and competition among players, it aligns well with Game Theory concepts. For example, students reported withholding produce from the market after observing high supply to the market from other players, anticipating that excess supply would depress prices. In some instances, wealthier households deliberately flooded the market to suppress prices, reflecting strategic behavior consistent with Game Theory principles. While traditionally applied in quantitative modeling

(Bekius and Gomes 2023), Game Theory has been increasingly adopted in qualitative research as a framework to analyze strategic decision-making, bounded rationality, and behavioral outcomes in complex, rule-governed environments (Ostrom 2005; Tarrant et al. 2010; Coleman 2017). Applying Game Theory in this GRG helped us understand how students navigated trade-offs, managed family-market dynamics, mitigated risks and uncertainties, negotiated cooperation or competed, and allocated scarce resources, mirroring the realities of smallholder subsistence farming systems. Consistent with Game Theory, where rules define the structure of choices and associated outcomes (Ostrom 2005), the rules of the GRG are explicitly known in advance and serve to shape players' available choices and influence decisions made by families throughout the game. Figure 1 presents a schematic representation of the GRG, including constructs from Kolb's Experiential Learning Theory and Game Theory that guided the analysis of student reflection papers.



4 Data Collection, Handling, and Institutional Review Board Approval (IRB)

We conducted a content analysis of 62 student reflection papers collected from an undergraduate agribusiness course over three semesters (2022–2024). We reached out to the university's IRB for guidance and were informed that IRB approval was not required because we were analyzing secondary data. However, they recommended that an external person remove all students' identifying information before analysis. Following their recommendations, all students' reflection essays were anonymized by an external person prior to uploading them to NVivo for content analysis. We utilized a hybrid thematic

analysis approach that integrated both theory-driven deductive reasoning and exploratory data-driven inductive reasoning (Fereday and Muir-Cochrane 2006; Proudfoot 2022) to conduct a content analysis (Krippendorff 2018; Clark et al. 2021).

Because deductive thematic analysis is often guided by predefined theoretical constructs or researchers' perspectives, it may carry the risk of interpretive bias; integrating it with inductive thematic analysis—which allows for emergent, data-driven themes—helps mitigate such biases and reinforces the analytical rigor (Joffe 2012; Proudfoot 2022). In this study, we allowed our themes to emerge organically from the students' reflections through open coding (inductive), but we also drew from theoretical constructs in agricultural and development economics, especially from the course grading rubric (see Appendix E) and key concepts from course's main textbook, *Economics of Agricultural Development: World Food Systems and Resource Use* (Norton et al. 2022), and alongside our guiding theoretical frameworks: Kolb's Experiential Learning Theory and Game Theory. This dual approach facilitated both our empirical grounding and theoretical alignment, enhancing the depth and rigor of our analysis (Fereday and Muir-Cochrane 2006).

We used NVivo software to categorize, organize, code, and analyze the data, following Bengtsson's (2016) guidelines for conducting content analysis. First, we decontextualized the data by familiarizing ourselves with it by reading through the students' reflection papers to make sense of their experiences before doing the open coding (Bengtsson 2016). Open coding is an inductive process through which researchers develop codes or meaningful segments from the data itself (Lune and Berg 2016). Initially, each researcher independently coded the data, but the coding process was interactive, involving ongoing dialogue and cross-checking with each other. We reviewed each other's codes and held spirited discussions about the most appropriate codes for different phrases in the students' reflections until a consensus was achieved (Bengtsson 2016). This collaborative approach helped foster multivocality, enriching the research with diverse perspectives and enhancing its credibility (Tracy 2010; Tracy and Hinrichs 2017). Some of the key phrases in our codes included "markets" and "resources," and some of the phrases/statements coded were: "The selling price for rice was determined by the overall surplus being sold from each farm, every season" and "One major hang-up was the availability of land in the village."

After developing the initial codes, we revisited the original data to compare them with our coded segments, ensuring that all salient and relevant aspects of the students' reflections were thoroughly captured, which aligned with the recontextualization stage (Burnard 1991; Bengtsson 2016).

This was followed by a categorization phase, where individual codes were condensed and organized into subcategories and broader themes using a deductive approach guided by the study's theoretical frameworks and existing literature in agricultural and development economics. Through iterative refinement, we developed themes that captured the underlying meaning within students' reflections, ensuring that each theme was internally consistent and mutually exclusive (Graneheim and Lundman 2004; Bengtsson 2016).

In the final stage, we presented our findings by transforming the themes into a coherent narrative, supported by direct quotes from the student reflections to illustrate and substantiate our interpretations. This approach not only enriched the analysis but also amplified students' voices (Lester 1999), enhancing resonance with readers and increasing the potential of transferability and practical application of our recommendations (Tracy 2010).

Throughout the analysis and writing process, we actively worked to bracket our preconceived notions through collaborative discussions and peer reflection, iterating until a consensus was reached (Creswell and Poth 2024). As Bengtsson (2016) recommends, we compared our findings with the existing literature to enhance confirmability and trustworthiness. We mapped the emergent codes against our theoretical frameworks (Kolb's Experiential Learning and Game Theory) and key concepts from the course grading rubric (see Appendix E) and textbook (Norton et al. 2022). This comparison is reflected in

the summary table, where we align our themes with the guiding theoretical frameworks, and in the conclusion, where we relate our findings to the broader literature on agricultural and development economics within the context smallholder subsistence-based farming in low- to lower-middle-income countries and game-based learning.

5 Findings

First, we assess how the game evoked concepts of agricultural and development economics including five key themes that reflect students' understanding of critical agricultural and economics concepts within smallholder farming and decision-making processes in low- to lower-middle-income countries. These concepts are resources allocation (96.77 percent), poverty traps (91.94 percent), technology adoption (90.32 percent), risks and uncertainty (82.26 percent), and market dynamics (74.19 percent) (see Figure 2).

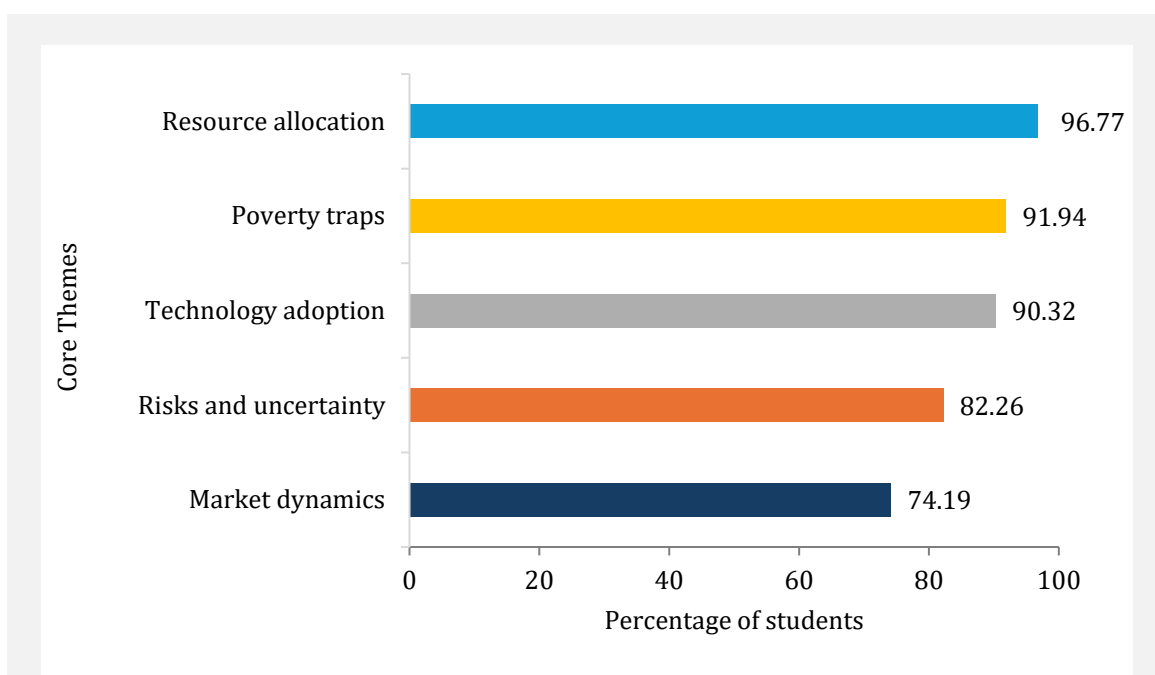


Figure 2. Percentage of students addressing agricultural and development economics concepts in the Green Revolution Game reflections

Note. These percentages represent the proportion of students ($N = 62$) whose reflection papers had codes attributed to each theme.

Woven throughout reflections are students' demonstrations of concepts related to experiential learning, game theory, and agricultural and development economics. The themes also capture students' understanding of the complex decision making experienced by smallholder farmers in low- to lower-middle-income countries as they navigate resource constraints to meet their household needs for survival.

Table 1 provides an overview of five agricultural and development economics concepts and selected subthemes that students engaged with in their reflections about playing the Green Revolution simulation game.

Table 1. Key concepts in agricultural development and economics definitions and subthemes from reflection papers

Concept/Theme	Description	Subthemes
Resource allocation	The process of deciding how to distribute and utilize available resources like labor, capital, land, and inputs to support livelihoods and meet various needs.	Access to land Labor allocation Input rationing
Poverty traps	The conditions and cycles that keep individuals or groups locked in poverty, making it difficult to achieve economic mobility (Azariadis and Stachurski 2005; Kraay and McKenzie, 2014)	Inequality due to unequal distribution of resources Increase in family size/population growth Low yields High prices Competition versus cooperation
Technology adoption	The factors that influence decisions to adopt new technology, maintain adoption, and/or disadoption (discontinuance).	Rogers' Diffusion of Innovation (DOI) theory Relative advantage Triability Observability Complexity
Risks and uncertainty	The unknown factors that may influence agricultural production and markets, including the potential risks associated with taking different actions to try to mitigate the negative impacts of uncertainties.	Events out of our control Weather variability Pests Yield uncertainty Labor uncertainty Market and price uncertainty
Market dynamics	The forces and factors that influenced the behavior of prices, supply, and demand within a market and how they interact in response to various internal and external pressures.	Market price fluctuations due to forces of demand and supply. Family-market dynamics Credit and interest rates Policy and institutional influence

5.1 Resource Allocation

Throughout the game, students navigated the challenge of distributing limited resources amid competing needs. Decisions about which inputs to utilize and how to allocate their land and labor to ensure sufficient food production for the family, increase yields, and protect against external shocks such as drought, pests, and price fluctuations were a big challenge. Students often grappled with a trade-off between short-term needs, such as feeding their families, and long-term strategic goals aimed at building wealth and ensuring sustainability. This tension reflected real-world challenges faced by smallholder farmers in developing countries, who must balance immediate needs for survival with long-term goals.

Under the category of resource allocation, three subthemes emerged as crucial factors for strategic decision-making and family progress. These included access to land, labor allocation, and input rationing.

Access to land emerged as a critical determinant of a family's progress toward self-sufficiency and economic prosperity. Students observed that families with larger initial landholdings and smaller family sizes were better positioned to achieve financial stability and growth. These families could afford to rent out some of their land, engage in share-cropping arrangements, or even sell portions to generate additional income. Unlike families with smaller acreages who faced severe consequences from failed investments, households with larger acreage were able to absorb more risk and experiment with new technologies such as constructing wells and adopting high-yielding rice varieties (HYV) without jeopardizing their household food security or financial stability. For example, one student shared,

Since we had so many family members and few acres, it made it difficult for us to produce enough yields on our own to feed everyone. This seemed to be a common problem in the village, but families with more land tended to do better with producing enough to eat and having some leftovers to sell at the market.

Labor allocation was another crucial factor and a mixed blessing in determining a family's progress during the game. Some families had more labor than they could effectively use, while others struggled with too few workers for the land they owned. As family sizes grew from season to season, finding productive work for additional members became a challenge for some households with extra mouths to feed. On the other hand, for some families with larger landholdings, added family members offered an economic opportunity to maximize production. Depending on the season, some families were able to expand their production or hire out their surplus labor to neighboring farms, generating incomes while others could not, which created a scenario of mixed fortunes. For example, one student shared that in

the fourth year [season] we had another child. This allowed us to have enough labor for all seven of our acres.

For other families, this extra labor was a challenge:

As each season progressed, it seemed that our family continued to grow. This was not a good thing as everyone else also seemed to be cursed with this. Being that each family was growing, always adding adults meant way too many people for the land available, which led to an abundance of adults sitting around idle eating rice that could be sold.

Another central reflection point was *input rationing*. For example, some wealthier families built wells and irrigated a fraction of their farmland and left the other unirrigated, or applied fertilizers on select portions of their acreage rather than the entire farm. In other cases, families that could not afford to purchase the high-yielding varieties opted to save some of the ordinary seed variety and bought some high-yielding seeds, opting to plant both as a form of risk mitigation.

5.2 Poverty Traps

Poverty traps are a common topic when discussing agricultural and development economic concepts, particularly in low-income agricultural economies. Students identified multiple examples of poverty traps that either their own or other families faced.

The impacts of *wealth inequality (unequal distribution of resources)* were easily observed in this game. Some families began with disproportionately large acreages relative to their household size, granting them superior resource endowments, while others started off with deficits that they could not grow out of. Households with more acres were able to also rent out some of their land or sharecrop, which brought in more resources. As their yields and incomes increased, they could further expand their

investments, bringing in more income that they could use to continue expanding their investments, creating a positive feedback loop that compounded the initial advantages and exacerbated the wealth gap in the community. This observation was echoed throughout the game:

From the beginning of the game most teams did not have enough to get through and as the game went on those who had nothing from the beginning became worse off. It seemed to me that once you are behind and unable to provide for the family it is nearly impossible to pull yourself out without help.

Another student saw that

farms that had greater resources had the advantage of accessing credit, hiring labor, and acquiring land. Technology and initial endowments shaped the markets of the game.

The use of technology in the game increased the wealth gap among families:

This late in the game the other groups were far advanced from us. These groups had many acres of land, they had wells to irrigate their land, and plenty of workers to farm all their acreage. With wells and fertilizer, pests and drought had far less effect on these groups than the devastating way it affected our family.

Population growth—or, more specifically, *expanding family size*—was another subtheme. At the start of each new season, the instructor randomly drew a card to determine which families had welcomed a newborn. For households with limited land, an additional mouth to feed meant seeking-off farm work (which was scarce) or making sharecropping deals with wealthier neighbors to generate extra income or food. However, as resources in the community were stretched thinner with each new birth, these opportunities became increasingly scarce, straining families' resources and pushing them deeper into poverty. One student recalled:

Our family certainly had the worst cut from the very beginning. We started out with three adults and four kids with only three acres to support us. Unfortunately, at the start of season four we had additional kids, leaving us with five adults and four kids. This means our consumption at the end of the season will [was] now be 65 mounds. We were down from the beginning and could never get ahead of other groups partly because we were getting the same price for our crops...Other groups seemed to be worried about how to afford fertilizer, spray and irrigation while we were worried solely about how we were going to feed our family.

Depending on where a family started, and the market for additional labor, some families had a contrasting experience, wherein the addition of a new child provided extra labor to expand their production and boost incomes. Some households turned the challenges of having a big family into opportunities to generate additional income:

Before season four began, we had another child join our family and had one of the existing children upgraded to adult. We never bought any land so the smartest choice for our family was to hire out the labor of the new adult. This created another source of income for us and helped keep us afloat.

Another student voiced a similar experience, with notable differences in how they talked about adding a new family member:

When the third season rolled around, we were excited. Along with the new season we were gifted with another child. By having another child, we gained an adult, which allowed us to be able to work all of our land ourselves.

Another factor trapping families into poverty was consistently *low yields*, caused by bad weather and pest outbreaks that led to reduced harvests across the community. Many families operated at a semi-subsistence level, having to take care of feeding their families first, leaving them with nothing or little to sell to the market. Several students shared how poor harvest seasons made it nearly impossible to get ahead:

After a good amount of rain in the germination phase, there was a drought in the next two phases leading to low yields in our fields. This meant we did not have enough rice to feed our whole family. We had to spend all our remaining funds on food for our family . . . Too many bad seasons of drought, flooding, or pests can eventually lead to deaths in the family or extreme debt for life.

Related to low yield, *high prices* were another poverty trap for many families. Low yields led to low supply, driving up prices in the market, which meant that households with food shortages had to spend more of their income on food to feed their families:

We had to buy mounds from the market which happened to be very expensive because of the lack of crops [seeds] for sale. That meant for our family going into season two, we were in the negatives.

The increased competition and indifference of other wealthy households to those that were starving exacerbated the wealth inequality and poverty among households in the game:

I would also say that our lack of partnership as a village contributed to everyone's mutual struggle.

Another student also observed,

There was another family that started out with 10 [people], but they had 7 acres. They were rolling in money and selling a lot of rice. 3 acres made the difference between them making the most money and at one point us being in debt. They were also not generous at all.

5.3 Technology Adoption

Students encountered a range of innovative technologies—including HYV varieties, use of synthetic fertilizers, application of pesticides, and irrigation wells—that they could adopt to boost their production and buffer against risks and uncertainties. Throughout the game, students exhibited a range of adoption behavior: Some readily adopted new technologies, others chose not to adopt at all (nonadoption), and some adopted but later discontinued their use because to various factors. From students' descriptions of their adoption behaviors, several factors from Rogers' Diffusion of Innovation theory emerged (Rogers 2003), particularly surrounding the assessment of innovation attributes such as relative advantage, complexity, trialability, and observability.

Relative advantage was prevalent in many reflections: Participants described weighing the benefits of adopting new technologies (e.g., high-yielding seed varieties, fertilizer, or a well) against the traditional practices they were using (e.g., ordinary rice varieties, no fertilizer, and rain-fed cultivation). Each "new technology" had a cost and, depending on what happened during the season, could offer an added benefit, but the benefit was not always a given. HYV varieties could produce higher yields, but this seed did worse under drought than the ordinary variety if the family had not also purchased a well—another new technology that only became available in certain seasons.

Some families benefited from adopting a new technology:

What happened after this year is what I believe sets our group apart from the groups that struggled throughout the rest of the game. Technology for wells became available and we were able to irrigate 2 acres of our land. This made us immune to droughts on half of our acres.

Other students weighed the cost and benefits of adopting a new technology like HYV and did not perceive a clear return on investment, either choosing to not adopt at all or to disadopt. One family of nonadopters stated,

Recognizing the risk-reward of an ordinary crop as opposed to a HYV (high-yielding variety), we deemed it acceptable to begin our first season with all nine acres consisting of an ordinary crop.

For families that discontinued the adoption, they felt that the “relative advantage” was not worth the risk and added costs:

We decided to go back to our original strategy of planting all ordinary rice. We did this because the continued cost of HYV seed outweighed its low profit margin in consecutively bad years.

Trialability was another technological attribute that was well-represented in reflections. For example, some students were able to adopt a technology and try it on small portions of their land to assess how it performed. If successful, they expanded their use of the technology; if not, they abandoned the technology. Students described their reasons for disadoption:

We tried high-yielding rice and fertilizer and saw improved yields, but they were not consistent. Both my partner and I are very conservative, and we felt as though the added risk was not offset by enough reward.

While some depended on their own ability to try out a new technology (*trialability*), others turned to *observability*: observing the benefit it gave to others and determining how to best reap those benefits. This was visible among some families who adopted HYV after seeing how their neighbors made it work:

We also decided to diversify planting between ordinary and high yielding variety (HYV). We did this because of some apparent success other families had with it. We also made sure to irrigate one of the fields containing HYV for added protection against possible droughts.

Students also assessed the perceived *complexity* of using a new technology to its most benefit. For example, some families saw that adopting HYVs was unpredictable and needed more resources, such as fertilizers, irrigation, and pesticides to realize the additional benefits; without these, the performance was worse than that of ordinary varieties. One student reported,

In seasons three and four we chose to purchase two acres of high yielding seed because we had the funding. However, we quickly found that factors out of our control such as drought and harm done by pesticides reduced the quality of high yielding crops very quickly, and we returned back to the ordinary yielding crops for the remainder of the game.

5.4 Risks and Uncertainty

Another theme that emerged during the game concerned the risks and uncertainties inherent in agricultural production. Navigating risks and uncertainty is a throughline in all farming but can be especially pronounced in smallholder farmers in low-income agricultural systems, where many families are stuck in subsistence farming situations. Students reflected on these realities during the simulation game, including technology adoption, highlighting how risks and uncertainties shape smallholder

farmers' choices. Whether facing changing weather patterns such as drought, pest or disease outbreaks, lack of fertilizers, or sudden market changes, students frequently brought up "events out of our control":

As the game continued we did take more risks, some paid off while others set us further back. However, in the end it was the factors that we couldn't control were the ones that affected our crop yield the most, whether that be; droughts, pests, or random events such as when the train didn't arrive with the fertilizer.

As these unpredictable events unfolded in the simulation, students had to balance the risks and potential rewards of their decisions each season.

During the planting seasons, there was a lot of *variability in weather*, a key cause of uncertainties. Students reflected on how drought impacted their yields and, ultimately, the livelihoods of their families:

The weather played a huge role in yields for our crops. If there was a drought that meant little yield when crops were being harvested.

Season four, Mother Nature won the battle for the whole community. Droughts in germination and flowering seasons killed the final crop state. In our last season, our household were deficit of nine Maunds of rice and suffered another year of not having enough food for everyone.

Pests were another cause for uncertainty, impacting crop yields and increasing the cost of production. In one reflection, a student shared,

Everything went bad in the flowering although we got rain the pests came in and we ended up losing out big on high yield variety with getting the minimum of ten bushels per acre, a big loss for the season.

If they had the resources, families could elect to try using pesticide to mitigate pest damage, but many families did not:

The first three seasons, among other factors, we had problems with pests. Due to this our yields were not as high, and we could not afford pesticides because our income was not very high. It became a problem because year after year our yields were not at a high level...As this was happening to us, other families in our communities had better opportunities based in the decisions that they made for their own land.

Labor availability was another cause for uncertainty as it varied a lot through the seasons, getting scarce at some times and being plentiful in others when families experienced birth as the seasons went on. This made it hard for some households that were relying on external help to till their land or those that depended on hiring out extra family labor to bring in income or food to plan for their households:

Sometimes there was a high availability of labor and at other times there wasn't enough labor for others to farm.

Also, the *inability to predict your yields* was another cause of concern for some households, especially those that had adopted the high-yielding rice varieties:

Your yield becomes super unpredictable since you don't have any fertilizers, pesticides, or irrigation to help keep your yields stable. It becomes more of a game of luck rather than skill if you can't afford technology to increase your yield chances.

Finally, *market and price volatility* were a major source of risk and uncertainty. Market values depended on the community's combined supply after harvest, so families could not be certain what price their rice would fetch after the growing season:

The market was a whole another problem in itself because we were not sure if the price was going to be high enough to make money off the little amount of mounds we were going to be able to sell.

Due to this volatility, families might have produced a strong yield, but the benefit decreased:

With the large amount of supply that we had introduced to the market, the price of all rice had dropped. We made less per unit of rice than before. Our group began to discuss this price drop and how we could best deal with this situation.

These price shocks could be compounded by other factors, such as *unexpected input shortages*. At one time during one simulation game, a train accident halted fertilizer delivery, which in turn severely impacted households that had planted the HYV, a technology adoption risk taken that did not return the benefit. One student recalled,

During season three we couldn't use any fertilizers or pesticides because the train had stopped.

Other institutional policies such as the introduction of taxes on irrigated land that emerged in season three were also a concern for some households as it introduced a recurring cost and eroded the benefits of adopting wells, which hurt some families.

5.5 Market Dynamics

Through the simulation game students experienced different market dynamics, including market price fluctuations, navigating supply and demand, risks associated with credit and interest rates, as well as the influence of policies and institutions on markets. At harvest, students experienced how the forces of supply and demand impacted prices, including price volatility throughout the seasons. During a bumper harvest, partly due to technology adoption, households brought larger quantities of rice to the market, causing prices to fall sharply compared to periods of low yields:

It seemed that the market price gradually went down over time as the technologies that each farm was able to buy increased season to season. As more wells, fertilizers, and pesticides were purchased, a higher yield of rice was harvested per acre. This led to a flooding of the market, pushing the price per maund of rice down.

A different student also recalled,

The markets for the rice in this game varied based on the amount of rice being brought into the market, so if there were only 100 mounds of rice being taken to market then the price of the rice would rise to a good market value, and likewise if the amount of rice brought in was high such as 250 mounds, then the market value would lower.

Family-market dynamics was another concept that resonated with students throughout the game. There was an interplay between household decision-making and market engagement: Families had to ensure that their households were fed first before determining what to bring to the market. This phenomenon is common among smallholder farmers engaged in subsistence farming:

We always keep in mind how much it costs to feed the family, so it is important that we at least have enough food after every season. Once we are confident our family is fed, we sell the rest in order to make profit and gain necessities as the game went on.

Decision-making, especially during lean periods, mirrored the delicate balancing act between catering to the family's needs and selling surplus for extra income. This parallel reflected the essence of semi-subsistence farming—where a significant chunk of the

harvest feeds the household, while the surplus finds its way to the market to meet other demands.

Availability and access to credit in the market: Although credit was available for participants, it was not easily accessible due to the high interest rates that were offered in the “open market,” up to 50 percent. As a result, some households resorted to informal markets borrowing from their neighbors, who offered a better rate than what was offered by the community bank in the game:

Access to credit came with unfavorable conditions, such as fifty percent interest rates on loans, thus creating a community dynamic in which very few families participated in directly acquiring credit. This led to a “secondary” market where access to capital, land for rent or sale, and rice maunds were offered by the families that were more well off in that season.

With interest rates being fifty percent for the bank, it was nearly impossible to afford to borrow money to buy food for the family or resources like a well to use on our farm and not having to rely on the fortune of good weather.

Markets could also be impacted by external forces, such as the introduction of *foreign aid in the form of rice donations and new policies*. While theoretically meant to offset rice shortages so that families had enough food, foreign aid led to excess supply in the community, causing disruptions to market prices. Some households that had had a good season lost money because of the aid. In addition, in some seasons, new policies —uch as tariffs on inputs like fertilizers and pesticides as well as taxes on wells—led to market disruptions. The impact of foreign aid and these policies were described by one student:

There were many events that occurred over the six seasons that we were able to simulate the Green Revolution, some like the sharecropping and getting off-farm jobs were in our control, while others, such as foreign aid coming in and greatly reducing the market price of rice one season, or tariffs and restrictions put on fertilizer and pesticides that were totally out of our control. Some of those, such as the aid induced price cuts, affected our farm, cutting our profits in half for the first season.

6 Conclusions

Based on the recurring themes emerging from the content analysis of student reflection papers, we found that the Green Revolution simulation game enabled the students, most of whom lacked a production-agricultural background, to gain “firsthand” insight into the challenges faced by resource-poor smallholder famers in low-income countries. By placing them in the smallholder farmers’ shoes through a simulation in low- and lower-middle-income country context, students developed a deeper appreciation for the complex decision-making they must navigate amid resource constraints. Student reflections demonstrated that the game effectively illustrates key theoretical concepts in agricultural and development economics in the course, including scarcity of resources such as land and labor and the various risks and uncertainty inherent in agriculture production (e.g., weather variability, price volatility, pests, and yield uncertainty). Other development concepts that were highlighted by students were factors contributing to the vicious cycle of poverty, such as inequality, population growth, low yields, and market volatility.

The game also helped students understand the factors impacting adoption of new technology in development, including the various attributes of an innovation: relative advantage, trialability, observability, and complexity of the innovation as explained by Rogers (2003). Regarding market dynamics, the game clearly demonstrated the relationship between supply and demand and their influence on price, including the volatility smallholder farmers in low- to lower-middle-income countries

face when selling primary products. The family–market dynamics, where students had to meet their household food demands first before taking any surplus to the market, reflected the semi-subsistence agriculture practiced by smallholder farmers in developing countries, who keep one foot in subsistence and the other in the market.

In Appendix Table A1, we show how the themes that emerged from the students' reflection papers connect to the theoretical frameworks grounding this study (Kolb 2014; Von Neumann and Morgenstern 1944, 2007).

7 Discussion and Implications

This section discusses the findings in relation to existing literature and outlines the implications for agricultural and applied economics and agribusiness programs.

7.1 Discussion

Though the students highlighted the importance of the GRG in their reflection papers, they also critically evaluated the game for its limitations, noting that it did not present all the attributes in smallholder farming in low- and lower-middle-income countries. For example, the game was based on one crop—rice—so there was a lack of diversification of crops and livestock, which is common among smallholder farmers.

One aspect we did not see in The Green Revolution was the availability of livestock. In many places, livestock act as a savings account. When times get exceptionally hard, these animals can be sold or eaten to help the family survive. By implementing some sort of livestock market, the game could take another step towards truly representing those traditionally farming in underdeveloped countries.

Several students also recognized that the game did not demonstrate various gender roles and expectations that are often common in subsistence smallholder farming:

Another thing that we did not really simulate was the different roles for men and women in some of these countries. We just had adults and children, but we did not split up their roles based on their genders as well.

By bringing up these limitations of the game, students also showed their critical engagement with the course's core concepts. However, alternatives to the GRG may expand upon what the game is unable to simulate for students. One example is the African Farmer Game,¹ an open-source experiential game that integrates more agricultural development concepts, including decision making under conditions of uncertainty with imperfect information, gender roles, agricultural resilience, and social dimensions of rural poverty. Other aspects in the African Farmer simulation game not covered in the Green Revolution Game are schooling, nutrition and health, and mechanization.

7.2 Implications for Agricultural and Applied Economics and Agribusiness Programs

With the changing demographics of students enrolled in agricultural economics and agribusiness programs, many of whom come without agricultural background, simulation games can be an effective strategy in helping students understand abstract concepts in agricultural and development economics and their relevance to real-world smallholder farming systems. To this end, we recommend that agribusiness and agricultural and applied economics instructors integrate simulation games into their

¹ <https://africanfarmergame.org/index.php>.

courses to help students learn agricultural and development concepts. The Green Revolution Game is one effective model, but others like the African Farmer Game may serve similar purposes.

A key aspect of making these in-class games effective is incorporating intentional reflection activities that help students concretize their learning (Kolb 2014), fostering higher-order thinking, critical problem-solving, and high-impact learning (Bloom et al. 1984; Murphrey et al. 2016). Including reflection papers or journaling as a part of formal assignments can help instructors gain a deeper insight into how students grasp course concepts and apply theory to real-world contexts (Mukembo 2017). While reading assignments and examinations are useful tools to assess students' short-term comprehension, true high-impact learning also requires active engagement, firsthand experience, and deliberate reflection. Although it can be difficult to immerse students directly in real-world situations where rural smallholder farmers in low- and lower-middle-income countries navigate production and marketing systems, we as educators can use simulation games to offer a felt scenario where they can try to navigate some of these similar challenges.

7.3 Practical Insights for Instructors

Instructors considering the GRG should maintain class sizes of 20–30 students divided into groups of two to three, as this keeps gameplay manageable and facilitates “household” decision-making and saves time during the gameplay. Sharing the grading rubric for the reflection papers in advance is also important, as it helps guide students' attention during gameplay and prepares them for the subsequent writing assignment.

Before the full simulation, conducting a brief practice round helps to familiarize students with game mechanics and expectations. This saves time and allows for playing more seasons during the actual simulation exercise in class. For large classes, a teaching assistant can be helpful for maintaining community records of seasonal weather conditions (e.g., rainfall timing, drought occurrence, and other external factors), seasonal total rice production, the amount brought to the market, and the corresponding prices per season.

During debriefing, instructors should systematically link game experiences to core course concepts, such as opportunity cost, risks and uncertainty, resource constraints, price volatility, and technology adoption determinants. Encouraging students to share their experiences during the game and compare their household decisions and constraints with those faced by typical smallholder farmers in low-to lower middle-income countries can deepen this connection considerably.

In this study, our analysis was limited to secondary data from student reflection papers. We recommend conducting additional follow-up interviews with some of the students who have taken courses in international agricultural development where simulation games have been used to as part of the course design to gain a deeper and more comprehensive understanding of their experiences and any additional impacts such games may have had on their understanding of concepts that may not be captured in their reflection essays or other modes of evaluation.

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Appendix A: Linking Themes to Experiential Learning and Game Theory Frameworks

The themes emerging from the content analysis of the students’ reflection papers about their experiences playing the Green Revolution simulations game align with some of the constructs of the theoretical frameworks on which this study was grounded: Experiential Learning Theory and the Game Theory, as described in Table A1.

Table A1. Connections between emerging themes and constructs in theoretical framework

Theoretical Framework/ Construct	Description	Examples of Themes and Subthemes from the GR Simulation
Experiential learning theory		
Concrete learning	The learner encountered new experiences or reframed existing experiences.	Market dynamics: students experienced firsthand the price volatility and how the forces of supply and demand affect the prices of agricultural products.
Reflective observation	The learner intentionally reflected on their experience and shared how they adjusted to the various challenges in the simulation game.	Risks and uncertainty: students reflected on the impact of their experiences, such as trying new technology, to inform how they will navigate uncertainty going forward. Poverty traps: Students reflected on the various challenges that held some households in poverty such as family size, inequality due to unequal distribution of resources, low yields, and competition versus cooperation
Abstract conceptualization	The students modified their thinking and actions based on knowledge, experiences, observations, and reflecting on past experiences.	Technology adoption: students channeled what they learned from reflective observation and trials before developing strategies to adopt, continue to adopt, or disadopt a new technology.
Active experimentation	The learner tested different ideas to evaluate the benefits.	Resource allocation: students made decisions and experimented with different ways to use their family resources such as land, labor, and inputs.
Game theory		
Strategic decision-making	The learners made decisions based on the choices available with a goal of reaping potential	Technology adoption and resource allocation: Students made decisions to adopt or not to adopt new

Table A1. Connections between emerging themes and constructs in theoretical framework

Theoretical Framework/ Construct	Description	Examples of Themes and Subthemes from the GR Simulation
Cooperation vs. noncooperation	<p>benefits of feeding their family and growing their household wealth.</p> <p>Households had limited resources such as land and labor that they had to allocate among competing needs and made decisions that best suited their economic situation; noncooperation -wealthier families adopted technologies to maximize output leading to oversupply and low prices. Or, households could work collectively through sharecropping, storage of excess supply, and planting ordinary varieties with less fertilizer inputs.</p>	<p>technology based on the potential rewards strategy. They observed and others tried out new high-yielding varieties on a small scale. Resources were allocated by prioritizing the needs of the family first before the market. The differences in household resource endowment and ability to obtain credit impacted the strategies adopted by some households. For example, adopting the high-yielding varieties versus construction of wells leading to resource rationing</p> <p>Market dynamics where excess supply of rice led to price fluctuations leaving families worse off than if they had held back on some of their supplies. The lack of help from some of the neighbors and the family–market dynamics led to competition and increased wealth inequality where every family was looking out for their household needs first.</p>
Players and rules of the game	<p>Students are the players and make choices based on the rules of the game such as consumption requirements of nine maunds of rice (approximately 740 pounds) per adult versus five maunds (approximately 411 pounds) per child per season. The family food requirements must be met first before surplus can be brought to market</p>	<p>Land allocation per household was random leading to uneven distribution of resources. Family market dynamics – households had to meet their food requirements first before selling to the market. Rice prices in the market were based on forces of supply and demand, except when there was government intervention such as aid distribution.</p>

Appendix B: Balance Sheet

Description	Season 1	Season 2	Season 3	Season 4
Initial endowment or carry over Rupees	100			
Income				
Sale of rice (Price X Yield)				
Sale of labor				
Sale or rental of land				
Interests/Payments received				
Total Income				
Expenses				
Fertilizer (Price X acres)	50	55	60	65
Pesticide (40 Rp X Acres X number of applications)				
Land (Price X Acres) = 600 rupees				
Labor (20 mounds per season)				
Well (1300 Rp X Acres)				
Ordinary rice for seed, plus what was held back (Market Price X 1.20 X Maunds)	20			
HYV rice seed (Price x maunds)	30	33	36	39
Interest/payments				
Rice to eat (Market Price X 1.20 X maunds)				
Total Expenses				
Net Income				
Net Income per acre				
Ending Balance				

Appendix D: Game Summary Documents

Manager Community Records

No.	Household Members	Farm Name	Acres		Family Size		Births/Deaths			
			Start	End	At the Beginning of the Game	At the End of the Game	1	2	3	4
1										
2										
3										
4										
5										

Note: The size of each household and its number of acres are determined at random at the start of the game. As the game progresses, household size may increase or decrease due to birth or death. Acreage can also change: Families may acquire more land if they have enough resources to buy from neighbors, or they may lose acreage if they sell land to meet their needs.

Seasonal Production and Rice Prices

Season	Total Production	Total Consumption in the Village	Amount Supplied to Market	Price
1				
2				
3				

Note: The prices are determined based on the amount of rice supplied to the market.

Family Records: Crop Planted and Seasonal Weather Conditions

	Season			Type of Rice Variety Planted
	Example (Season 1)	2	3	Legend
Germination	R			Ordinary/High-Yielding O = Ordinary; H =High-Yielding B = Both O and H
Middle Growth	D			
Flowering	R			

Note: At each planting stage, the manager draws a card to determine whether the community experiences rain or drought. If there is rain, all the students write R in the corresponding stage of growth. If there is drought, they write D. After that, for each household, the manager draws another card at random, depending on the rice variety planted, to determine whether that family encounters pests or no pests at that stage of the growing season.

Appendix E: Scoring Criteria

Green Revolution Game and Individual Reflection Paper Assignment Rubric

Evaluation Criteria and Other Notes for Guidance	Total Allocated Points on the Criteria	Student Overall Score on Criteria	Feedback/Comments as Applicable
Budget Sheet Submission: Turn in your budget sheet. You should make copies so that every team member has their own copy to prepare their assignment. This is necessary for me to relate your assignment to what happened with your family.	5		
Family Performance Analysis: Analyze how initial endowments (land, family size) and decisions (crop variety, fertilizer use, pesticide use, etc.) influenced family performance. Discuss both controllable and uncontrollable factors (weather, institutions, etc.). Include comparisons with other families where applicable and why your situation was different from theirs.	20		
Market Development: Discuss how markets for credit, labor, and land developed during the game. Analyze how technology, initial endowments, and personal preferences influenced market participation. How did the prices change through the game and what factors contributed to this phenomenon. Address power dynamics and inequalities in access to resources.	20		
Connection to Course Materials: Relate the concepts in the game to Chapter 7 and other course materials on international agricultural development, including your interview you had early in the semester. Identify aspects of traditional agriculture were present in the game, technology adoption, and market integration. Use specific examples from the game and readings, e.g., how much rice was consumed by the household and how much was marketed? How does this relate to the idea of semi-subsistence farming?	20		
Limitations of the Game: Reflect on what aspects of traditional agriculture/ subsistence farming were not represented in the game. Discuss how this might affect the realism of the simulation	10		
Personal Reflection: Share your overall experience playing the game. Identify key agricultural and economic development concepts embedded in the game. Reflect on how your decision-making evolved and what you learned about resource-constrained decision-making.	15		
Writing Quality: (Clarity and grammar, paper organization and flow, & adherence to the word Limit - the length of the paper should be minimum 900; max. 1100words). Use of examples to support arguments/reflection.	10		
Total Score	100		

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