Research Article

Introducing Concepts Through Games in the Economics Classroom

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Abstract
Faculty in higher education increasingly belong to Gens X and Y, while their students primarily fall into younger Gens Z and Alpha, who demonstrate higher reliance on technology, shorter attention spans, and increasing preference for interactive learning models. To provide a learning environment that is more compatible with contemporary students' learning preferences, faculty have increasingly implemented hands-on applications such as classroom games. We examine the effectiveness of an interactive, immersive game on student learning. This internally produced trade game has been adapted to address multiple concepts (e.g., immigration, trade barriers, and political conflict) in the context of an upper-division trade course. While this game had previously been used primarily to reinforce rather than introduce concepts, its most basic iteration can be used as an introductory tool. We have engaged introductory-level economics/business courses in the College of Business and the College of Agriculture to assess learning outcomes and student satisfaction from a variety of teaching methods. Participants were selected into lecture (face-to-face and online) or game treatments (randomly assigned of self-selected teams). Results indicate that, despite the majority preferring the game to lecture, the conventional face-to-face lecture demonstrates the largest improvement in student learning outcomes, though all methods exhibited net gains.

1 Introduction

Despite widespread adoption of classroom games as tools of content reinforcement in economics education, scant research examines whether games can effectively *introduce* new content. If games prove effective for initial content delivery, this could fundamentally reshape how faculty allocate classroom time and engage students with challenging material. Given the dwindling attention spans of younger generations of students and limited classroom time, this first empirical comparison of games with traditional and online lectures for introducing economic concepts is both pertinent and valuable to the advancement of pedagogical practices in economics education.

Students' preferred approaches to learning have shifted over the past several decades. Learning styles, as defined in Flemings' VARK model as visual, aural, reading/writing, and kinesthetic (Fleming and Mills 1992; Hassan et al. 2021), were once thought to be a principal driver of student learning. Through the work of educational psychologists and pedagogical experts (Hattie and Yates 2014), the current consensus is that—preferences notwithstanding—all human beings learn through the full gamut of their senses. Students today are more likely to *describe* themselves as kinesthetic learners (Lehman 2019; Subagja and Rubini 2023; Saetang 2025) indicating that they prefer hands-on learning applications, and faculty have been working to adapt and develop new teaching practices to meet younger generations where they are. While this may seem like a new development, student preference for hands-on learning actually appears to exhibit some cyclicality. Mantha and Krishna (2024) find that the Baby Boomer generation preferred an applied method of delivery over reading or lecture. Gens X and Y preferred in-person and online instruction, respectively—methods often considered in line with aural and reading/writing learning styles—while Gen Z has shifted back toward a preference for experience-based learning (Mantha and Krishna 2024). Along these generational lines, many students now prefer alternative course delivery methods and modalities to the traditional classroom lecture.

The Universal Design for Learning (UDL) is one of many initiatives to promote the use of various formats simultaneously to meet the diverse cognitive and perceptual needs of students (Gordon 2024). To attract and retain contemporary students, faculty are adapting curriculum and testing new innovative methods and applications that enhance the student learning experience (Cecchinato et al. 2019; Tewari et al. 2024). For example, many instructors have adopted a flipped classroom approach, allowing students to learn the material on their own (through prerecorded lectures and readings) and then use the classroom time for application and reinforcement activities. Student and educator perspectives on matching learning styles to delivery methods are subjective and do not always comport with reality (Yfanti and Doukakis 2022). Indeed, there are fault lines among the prior consensus that learning styles exist or are distinctly identifiable (Whitman 2023). Students often employ multiple learning styles simultaneously, and it is nearly impossible to match delivery methods with true student needs. As Ferrer-Valdivia et al. (2025) outline, the aim need not be necessarily to teach to each student's preferred learning style but rather to enhance the learning experience of all students by encouraging the use of diverse approaches.

A game, as defined by Becker (2021), involves interaction, rules, objectives, and measurable outcomes for progress or success. In their construction as with ours, a game also includes a recognizable ending, though that is not necessarily the case, and one can imagine many games that do not fit into this concise definition. In a classroom context, a game can provide structure for learning without the confines of a traditional expert–listener relationship inherent in the conventional lecture format. Experiential learning has long been viewed as a positive tool to connect students with content. Burch et al. (2019) demonstrated that students experienced better learning outcomes if experiential learning pedagogies are used. Games would certainly be considered experiential in nature and appropriate for the classroom. There is ample evidence to show that interaction and application, which involves multiple learning types, can provide more ways for students to engage with and learn the material (Cruickshank and Telfer 1980; Groff et al. 2016; Kangas et al. 2017). Groff et al. (2016) indicate the value of classroom games as reinforcement of learning objectives and deepening of understanding. But there is little extant research on games as a tool of content introduction or any comparison of traditional introduction techniques. Durham et al. (2007) examine the value of running experiments in the economics classroom; while that may include games, they are not necessarily the same types of application. Interactive games can have additional impacts on social skills beyond content delivery, as many papers have indicated (Vlachopoulos and Makri 2017). Gamification—the application of game-play elements, such as points scoring, competition, and rules of play, to content or curriculum that otherwise is not necessarily game-based—has shown promise also as an alternative pedagogical structure (Sailer and Sailer 2021), but this involves turning the existing foundation of the course into a points system to mimic a competitive game rather than introducing entirely new teaching elements.

There is considerable precedent for the incorporation of games in the economics classroom. Wilson (2023) simulates a water market in the classroom to demonstrate how various parties are impacted by market activity and the differences between theory and application. Like most classroom games, this is used to reinforce content taught in the classroom through traditional means. Game design is a crucial element in the success of an educational classroom game. Regardless of the format and content of the game, it should be simple enough for individuals to learn and there should be some degree of repetition to reinforce content and allow participants to become deeply engaged (Ebner and Holzinger 2007).

While much of the research on incorporation of games in the classroom tends to focus on their use as a reinforcement or retention tool (Vlachopoulos and Makri 2017; Ismaizam et al. 2022; Fernández-Raga et al. 2023), the current project examines the use of a game as a tool for content introduction. We engaged primarily introductory economics courses, both in the College of Agriculture and the College of Business. Students were introduced to new content (specifically international economics) in either a lecture or a game treatment, and pre- and post-treatment assessments estimated student learning outcomes and student satisfaction. Group construction for the game was considered, but as the group sizes and numbers varied based on class sizes, we only examined self-selection and random-assignment treatments. Several articles have examined the impact of group selection on learning outcomes, group dynamics, and student satisfaction, with varying results (Chapman et al. 2006; Kiessling et al. 2022; Ramírez et al. 2025).

Formally, the objective of this research is to determine whether classroom games can be an effective alternative to traditional lecture—either face-to-face or online—for initial introduction to new material. We examine this from two sides: student learning outcomes and student satisfaction. Further, we investigate whether the group structure in the game environment (namely students' ability to self-select into groups) significantly impacts those learning outcomes and satisfaction levels.

The remainder of the paper will be structured as follows: Section 2 walks through the various treatments: the two treatments of the game (self-selection and random selection) as well as the two lecture delivery methods (face-to-face and online). Section 3 summarizes the data collected during the experiment, participant demographics, and other key features of the sample set. Section 4 presents the researchers' main findings, and Section 5 explains the implications of those results. And finally, Section 6 provides some concluding remarks and discussion of pending extensions.

2 Methods

This project involved training in basic economic trade concepts (e.g., comparative advantage, resource endowments as a reason for trade, trade barriers), utilizing multiple delivery methods. As shown in Figure 1, students who participated in the experiment were randomly sorted into groups: those who would receive content via lecture and those who would receive content through the game. Once sorted into those sections, some classes were selected randomly to receive lecture training via prerecorded online lecture while others received a traditional, face-to-face lecture from an instructor. The instructor giving the lecture was the same throughout and had also prerecorded the video lecture. The students who participated in the game had one of two scenarios: self-selecting their own teams or being randomly assigned to teams. The number of teams and the number of students per team varied by class size.

2.1 The International Trade Game

The international trade game involves between four and six countries (the United States, Germany, China, Venezuela, South Korea, and Australia),[1] depending on the number of participants. Australia and then South Korea can be dropped from the game without deleterious effects on game play. Generally, the game can run successfully with as few as 12 students (three per group, using only the first four countries) or up to 24 students (with four per group and all six countries). Each country has certain endowed resources (e.g., low-skilled labor and iron ore) that do not necessarily match the endowments of other countries.

[1] Countries were selected for inclusion in this game based on their resource endowments, production capabilities, trade opportunities, and linkages. While the game could have been generalized to Country 1, Country 2, etc., early participants indicated an increased desire to engage with pared-down, named countries. Using these representative countries can be a valuable teaching tool, but it runs the risk of perpetuating stereotypes. Considering this, the proctoring scripts (i.e., game instructions) indicate that while these mimic real-world countries and trade conditions, they are not true or complete representations—they are strictly for illustrative purposes.

Each country has its own technology (or production capabilities over certain intermediate and final goods) and demands (i.e., final goods for which participants earn points), which differ from other countries. Endowments, technology, and domestic demand mirror empirical reality, providing the game with a real-world applicability. For instance, the US is a major producer of grain, livestock, and transportation equipment, and it is a major importer of vehicles and various consumer goods. The US is endowed with land, high-skilled labor, and oil, among other things.

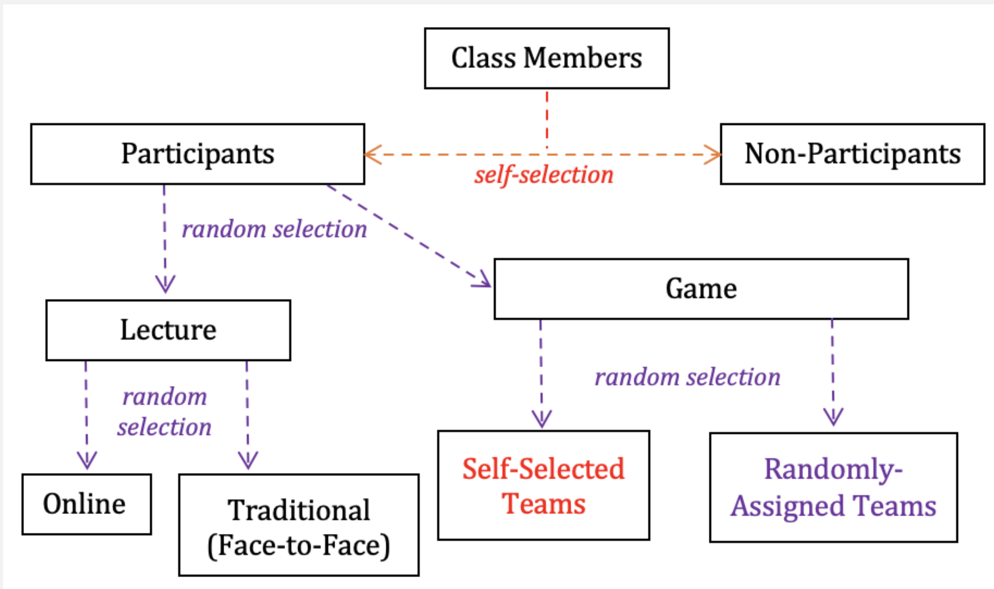

Figure 1. Outline of student dispersion into various content delivery types, and modes of selection

Prior to discussing the game, participants take a survey to establish their baseline knowledge. Students use a numerical identifier to connect their pre- and post-game surveys. Participants are split into groups, either randomly or through self-selection, depending on the treatment. The proctor hands out a packet of country-specific materials and gives the instructions orally (see the appendix). After answering any questions, groups are given a 3-minute strategy session before engaging with other countries. Once the strategy session expires, the groups have a 15-minute trading session. Students are able to conduct trading business as they see fit: walk around the room and discuss with other groups; trade resources, intermediate, and final goods; and form alliances and contracts. All production occurs at a production station at the front of the room, managed by the proctor(s).

Upon completion of the trading session, points are calculated based on the number of demanded goods and money amassed by each group; information about these calculations is provided in the oral instructions and in the packet. As packets are collected, students must explain why the winning country was likely to have won, identify the bottlenecks and trade barriers, explain how the specific treatment (the first treatment is a no-information treatment, where countries do not know about the endowments, technologies, or demands of their trading partners) impacted their ability to conduct business, and discuss several other prescribed topics to facilitate student learning. Next, a second packet is distributed along with oral instructions. This second treatment provides full information—much of which had been gleaned through the initial treatment, but a script is now provided—as well as a technological improvement whereby all intermediate goods production increases threefold. Due to time constraints, there is no strategy session in the second round. Instead, there is only a 15-minute trading session followed by calculations and a discussion of changes with the second treatment. Upon completion of the second-round discussion, students fill out a second survey to determine any changes in their answers. The content questions for the survey are identical, though satisfaction questions are different.

There are many extensions of the game, and it has been used previously to reinforce concepts in an international trade class. In that class, students played the game once a week with the new concept discussed in class that week (e.g., tariffs, immigration, or other trade conflicts). The game does a decent job simulating real-world outcomes under each scenario. However, this experiment examines the game's use as a tool to introduce concepts rather than reinforce existing knowledge. In this experiment, students' success in the competitive game itself was not measured. This project examines the value of the game as a teaching tool. The student experience—and hence the learning experience—varied significantly across sessions. This was due, in large part, to group dynamics. We captured some of this variability in the treatment effects of selection method. Some groups adapted more easily to the guidelines of the game than others. Playing two rounds helped to level that learning curve.

2.2 Lecture

Alternatively, about half of the students participating in this research received content through a lecture, either in person or prerecorded (online). The lecture covered similar material to the trade game, but it was presented linearly as opposed to coming through an application experience. While the lecturer was the same in both scenarios, students in the face-to-face version were able to ask questions and engage directly with the speaker. In the online simulation, a proctor played the prerecorded video in a classroom and did not answer any content-related questions. This mimicked the asynchronous element of the online lecture experience while ensuring students participated in the learning module. While the slides and content were identical, the speed of delivery differed between treatments; the face-to-face version of the lecture spanned 45–55 minutes per session while the online version lasted only 25 minutes. Students took the same pre- and post-training surveys as in the game treatments.

Initial predictions for participant learning outcomes were that the face-to-face lecture would have the most positive impact on student learning outcomes and that the online lecture would have the smallest impact. We predicted that the game's impacts would fall in between, with the self-selection version yielding more positive impacts, since the students would be more comfortable to take full advantage of the game (i.e., adapt fully and quickly). Random selection was believed to create communication barriers between participants that would cause them to adapt less well and integrate less of the content. The results matched those predictions in part (the lecture outcomes), but the game did not entirely meet those predicted patterns.

3 Data

Over the course of 2 weeks in April 2025, the researchers and administration team collected data in eight separate classes (three in Agricultural Business and five in Economics) using a two-part survey, one administered before each session and one after. While 352 total students were available to participate in the experiment, only 239 actually participated in a treatment and 223 opted to fill out either of the two surveys. Among those, several incorrectly filled out one or both of the surveys or did not provide some of the necessary information for inclusion in the study. The researchers ended up with 215 completed two-part surveys that could be linked.

Among the eight classes included in the experiment, two were lower-division agricultural business courses, one was an upper-division agricultural business course (International Agricultural Trade), and five were principles-level economics courses (three macroeconomics courses and two microeconomics courses). The economics courses are offered for general education course credit, so enrollment includes students from various disciplines. The lower-division agricultural business courses serve as electives for students in various agricultural disciplines, but the upper-division trade course serves only agricultural business students. Table 1 shows the final breakdown of completed surveys by treatment and course types.

Table 1. Survey completion rates by delivery method and course type

	Game (Random Selection)	Game (Self-Selection)	Lecture (Face-to-Face)	Lecture (Prerecorded)
Agribusiness classes	15	42	15	28
Introduction to Ag Business		18	15	
Intro to Agricultural Economics	15			11
International Ag Trade		24		17
Economics classes	40	27	18	30
Principles of Macroeconomics	27	12	9	20
Principles of Microeconomics	13	15	9	10

We can further examine participants by demographics and major. It is worth noting that economics courses in the business school serve as a prerequisite for several upper-division agricultural economics courses. Using majors as opposed to the college offering each course may, therefore, be more informative. Table 2 provides a breakdown of participation rates and demographic representation by college housing the student's major. Prior to the training, students indicated their direct preferences over delivery methods. Figure 2 illustrates those preferences, and the trend is immediately clear that students largely prefer face-to-face lecture and games to online lectures.

Table 2. Key demographic representation by major college

Category	Major in College of Business	Major in College of Agriculture	Major in Other Colleges	Overall
Overall Participants	35.21%	54.46%	10.33%	100%
Female	41.33%	50.86%	18.18%	44.13%
Age	19.413	20.526	19.773	20.056
GPA	3.279	3.331	3.395	3.310
Caucasian	77.33%	93.97%	63.64%	84.89%
Black	13.33%	2.59%	9.09%	7.04%
Hispanic	8.00%	0.86%	22.73%	5.63%
Multiracial	1.33%	1.72%	4.55%	1.88%
Native American	0.00%	0.86%	0.00%	0.47%

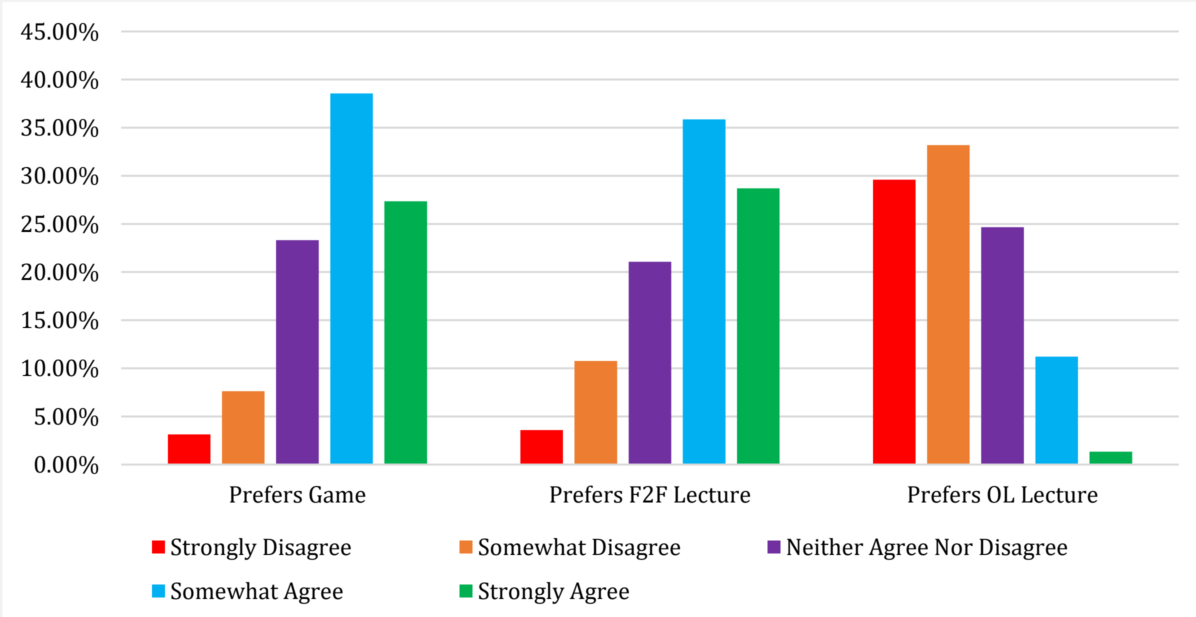

Figure 2. Pretraining direct stated preference over preferred delivery methods for learning

Self-stated learning styles vary across the sample, mostly learning toward visual and kinesthetic learners. While it may be intuitive that agricultural students—a more applied set of majors—self-identify more commonly as kinesthetic learners, the distribution is not unlike other colleges. Figure 3 demonstrates the college-level breakdown. The majority of students self-identify as kinesthetic learners, with visual learner style coming at a close second. Auditory and reading/writing learners are least represented in the sample, which corresponds with current global trends.

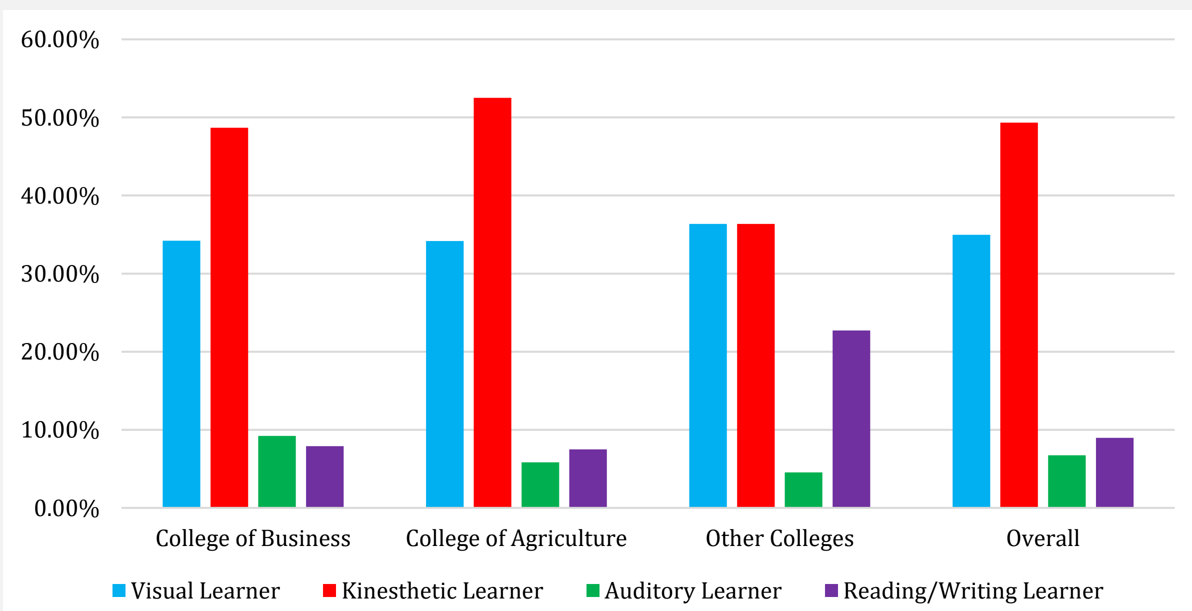

Figure 3. Self-described learning styles of participants, arranged by college housing their major

4 Results

We begin with a brief analysis of aggregate impacts (i.e., all students regardless of treatment). Based on mean scores, the sample group improved approximately 4.48 percent between assessments, ignoring any treatment effects or differences in starting point. For the simple questions (where 65–75 percent of students answered correctly in the initial assessment), there was a more substantive increase in correct responses (up by as much as 15–17.5 percent). Differences were less pronounced for the more difficult questions where initial success rates were under 40 percent. Nearly half of respondents did not exhibit improvements in assessment scores pre- and post-treatment (48.36 percent).

Initially, the results indicate that lecture treatments yielded larger average improvements than the game treatments. Table 3 provides a snapshot of improvements by treatment type, aggregated at the game-versus-lecture level as well as individually. We can see that the lecture treatments were almost exactly twice as effective as the game treatments, but all three treatments yielded net gains. Games with randomly selected teams demonstrated a significant improvement over the self-selection model.

Table 3. Change in mean score by treatment type

Treatment	Mean Score Change
Game treatments	3.15%
Self-selection	1.78%
Random selection	4.88%
Lecture treatments	6.33%
Face-to-face lecture	6.53%
Ol lecture	6.22%

Examining the general results by course and course discipline, we see that students enrolled in economics courses through the business college demonstrated larger overall gains from the training, regardless of treatment (Table 4). While students in the Introduction to Agricultural Economics course exhibited the largest gains, the business courses exceeded the agricultural economics courses, on the whole. Pretraining assessments were almost identical between these two groups, so this is not indicative of any kind of catching up or convergence story but rather one of divergence between the colleges.

Table 4. Change in mean score by course and course discipline

Course Detail	Mean Score Change
Agricultural economics (Agricultural College)	3.12%
AGEC 110: Introduction to Agricultural Business	1.10%
AGEC 220: Introduction to Agricultural Economics	7.52%
AGEC 335: International Agricultural Trade	1.93%
Economics (Business College)	5.66%
ECON 201: Principles of Macroeconomics	6.04%
ECON 202: Principles of Microeconomics	5.13%

Table 5 shows the mean percentage changes in score by the college housing students' majors. While on the surface it stands to reason that students in the colleges that house economics courses would have less to gain from such a training, leading the way for other students with majors in other colleges to benefit more, this is misleading. Students in other colleges actually began at a mean advantage of 1.67 percent and 2.23 percent higher than College of Business and College of Agriculture students, respectively. This indicates more substantive gains for students whose major does not directly relate to the course material, despite starting ahead of the curve on average. The represented majors outside the two main colleges include political science, engineering, computer science, nursing, secondary education, health and human performance, and interdisciplinary studies. Some—particularly the political science majors—may have an advantage in trade content.

Table 5. Change in mean score by major college

College Major	Mean Score Change
College of Agriculture	2.86%
College of Business	5.52%
College other than Agriculture or Business	9.50%

This preliminary analysis ignores some major demographic and other factors. Class rank, prior grades and training, and many other factors can impact student learning outcomes. A deeper analysis by the 20 majors represented in the sample indicates that the top initial average scores largely fell outside of related disciplines (see Table 6). Agricultural Business—the principal economics discipline in the College of Agriculture—began in the 12th spot at 35.71 percent. All of the top post-treatment assessment scores fell outside the economics-related disciplines, though accounting was in the fifth spot. Economics was sixth at 51.14 percent, and agricultural business was 13th at 39.51 percent. Comparing gains, the top five majors mirrored the top five finishers with a shuffled order. Economics had the 10th largest gains (6.82 percent) and agricultural business was 14th (3.80 percent). It is notable that three majors actually exhibited score declines: veterinary science and technology (−3.50 percent), political science (−4.55 percent), and secondary education (−9.09 percent). Political science and secondary education only had one participant each, but veterinary science and technology had 13 and was among the top initial average assessment scores.

Table 6. Top pre- and post-treatment assessment scores by major

Rank	Initial Assessment	Post-Treatment Assessment	Improvement
1	Interdisciplinary Studies (50%)	Interdisciplinary Studies (63.64%)	Computer Science (36.36%)
2	Secondary Education (45.45%)	Health and Human Performance (59.09%)	Health and Human Performance (31.82%)
3	Veterinary Science & Technology (44.76%)	Computer Science (59.09%)	Accounting (14.55%)
4	Economics (44.32%)	Mechanical Engineering (54.55%)	Interdisciplinary Studies (13.64%)
5	Engineering (41.32%)	Accounting (54.09%)	Mechanical Engineering (13.64%)

Regarding class rank, sophomores started a little behind (34.25 percent), with all others averaging between 37.12 percent (seniors) and 39.52 percent (juniors). Seniors exhibited the largest mean gains (+6.63 percent), followed by sophomores (+5.23 percent), freshmen (+4.34 percent), and juniors (+1.52 percent). Students with GPAs between 3.0 and 4.0 (71.6 percent of participants) scored an initial average of 38.37 percent and improved 5.14 percent on the final assessment. Students with GPAs between 2.0 and 3.0 (25.82 percent of participants) scored an average of 33.14 percent on the initial assessment and improved 3.39 percent on the final. While those GPAs may seem inflated, many students in the classes opted not to participate, and their GPAs were lower on average than those who opted to participate in the experiment. Students who self-identified as female initially tested 3.23 percent higher on average, but scores converged slightly with that same group scoring only 2.65 percent higher on the post-training assessment.

To further control for the impact of various demographic and other factors on changes in assessment scores, we use the following regression equation:

(1) $$ScoreChange_i = \beta_0 + \beta_1 InitialScore_i + \sum_{j=1}^{3}\left(\beta_{j+1} Treatment_j\right) + \sum_{k=1}^{n}(\beta_{k+4} X_k) + \epsilon\ .$$

Table 7 provides the results of a standard ordinary least squares (OLS) regression. In the initial model (Model 1), without including any additional regressors, we find that treatment type does not have a statistically significant effect on improvements, though all treatment led to smaller improvements than the traditional lecture. When controlling for additional variables, we find that ACT composite scores, college GPA, and age had a positive and statistically significant impact. The self-selection game had a mildly significant impact on learning, making it lower than the face-to-face lecture. Students in the College of Agriculture also had lower improvements between the pre- and post-training assessments, regardless of training type.

Running an initial regression of initial scores on all our key demographic variables (Model 2), the only two variables to exhibit a statistically significant impact (both positive) were age and GPA. Since the dependent variable is in terms of point differentials between the two assessments (net changes on the 11-point test), we can only discuss this from a directional standpoint rather than comparing relative magnitudes between variables measured in different units (like age and GPA).

We can extend the analysis by examining some interactions. For example, in Model 3 we consider interactions between students' self-stated preferred learning styles and their randomly selected modes of delivery. The impacts of certain variables shift significantly when controlling for these additional factors. First and foremost, the direction and statistical significance of the game treatments shifts, and the interaction between preferred learning style and treatment types is also important—with the exception of kinesthetic learners being paired with either of the game treatments. Including dummies for preferred delivery method and interactions boosted the magnitude of the selection approach for the game (self- or random selection), though the difference between the two approaches' impacts on learning outcomes remains the same. This warrants further examination by allowing students to directly select into their preferred treatment to measure satisfaction and learning outcomes.

In terms of stated satisfaction, students responded to Likert scale questions on their feelings about the survey. We regressed their stated post-training satisfaction on various pretraining values and key demographics:

(2) $$Subj.Value_i = \beta_0 + \beta_1 ScoreChange_i + \sum_{j=1}^{3}\left(\beta_{j+1} Treatment_j\right) + \sum_{k=1}^{n}(\beta_{k+4} X_k) + \epsilon\ .$$

Table 7. Regression of score changes on initial scores, treatment type, and other key demographic variables

Variable	Model 1 Estimate (St. Dev.)	Model 2 Estimate (St. Dev.)	Model 3 Estimate (St. Dev.)
Initial score	–0.4624*** (0.062)	–0.5967*** (0.069)	–0.6321*** (0.074)
Online lecture treatment	–0.0359 (0.314)	–0.3640 (0.315)	–0.3065 (0.348)
Self-selection game treatment	–0.4309 (0.304)	–0.5038* (0.298)	3.4595** (1.456)
Random selection game treatment	–0.2881 (0.358)	–0.4098 (0.309)	3.4363** (1.458)
Female		0.2853 (0.205)	0.4230* (0.223)
Age		0.2125** (0.086)	0.2502*** (0.094)
Major in College of Business		–0.4573 (0.335)	–0.6088* (0.367)
Major in College of Agriculture		–0.7108** (0.333)	–0.8561** (0.368)
GPA		0.4255** (0.186)	0.3861* (0.206)
ACT composite score		0.0866*** (0.029)	0.0835*** (0.032)
Dummies for class rank		*included*	*included*
Dummies for race		*included*	*included*
Dummies for preferred delivery method			*included*
Visual pref. + lecture treatment			3.7565** (1.487)
Kinesthetic pref. + game treatment			0.0452 (0.249)
Kinesthetic pref. + lecture treatment			4.1984*** (1.078)
Auditory pref. + lecture treatment			3.3929** (1.643)
Reader/writer pref. + lecture treatment			4.1373*** (1.600)
No. of obs.	213	203	208
R^2	0.2205	0.3483	0.3968
F-statistic	14.71	7.77	5.83

Note: Statistical significance is presented at the 90% (*), 95% (**), and 99% (***) levels.

Figure 4 illustrates the rates of those responses. In short, students were much more likely to agree or strongly agree that they felt that their method of learning was the best way for them to learn the material, regardless of delivery method. To account for student satisfaction based on the match of the stated learning style preference to the actual treatment, we can regress satisfaction on those interaction terms from above. The relationships are mostly intuitive: Kinesthetic learners were less satisfied with a lecture (statistically significant) versus the game; reading/writing learners were less satisfied with the game. Visual learners, however, were significantly less satisfied if they were in the lecture treatment. Visual learners were also more likely to report feeling that they learned less if they participated in the lecture treatment. Kinesthetic learners were less likely to report having changed their mind about something if they participated in the lecture treatment, which makes sense as their less preferred method of content delivery.

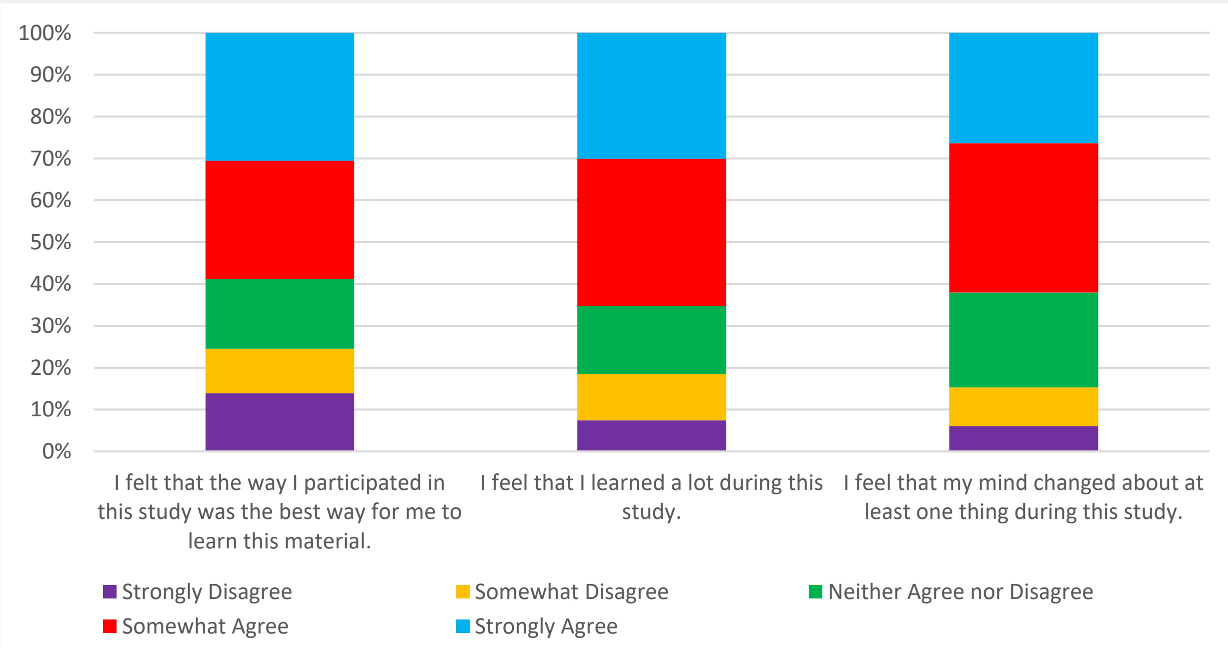

Figure 4. Post-training satisfaction survey results by rate of response

Regressing students' post-training satisfaction on prior preferences delivery methods, we find that those who preferred the game and were selected into that treatment were the most satisfied with their learning experience (Table 8). Students who strongly preferred online lecture delivery were not as satisfied when randomly selected into that delivery model. That could be in part based on the online lecture being delivered in a classroom as opposed to the traditional asynchronous delivery for online educational content. Controlling for learner types, scores, and key demographics, it becomes clear that those who were selected into their preferred content-delivery methods were more satisfied with the overall experience. Students were generally happier in the game treatments, regardless of type, and higher GPAs were inversely related to satisfaction.

Table 8. Regression of subjective post-training student assessment of methods on pretraining preferences, treatment type, and other key variables

Variable	Model 1 Estimate (St. Dev.)	Model 2 Estimate (St. Dev.)
Preferred game + Played game	0.2675*** (0.058)	0.1382** (0.058)
Preferred F2F lecture + Got F2F lecture	0.1237 (0.088)	0.2327** (0.103)
Preferred OL lecture + Got OL lecture	−0.4175*** (0.091)	−0.1471 (0.102)
Score change		0.0170 (0.016)
Initial score		0.0012 (0.017)
Online lecture treatment		−0.1000 (0.085)
Self-selection game treatment		0.2300*** (0.081)
Random selection game treatment		0.267 (0.082)
Female		−0.0362 (0.044)
Age		0.0036 (0.019)
Major in College of Business		0.0576 (0.073)
Major in College of Agriculture		−0.0114 (0.073)
GPA		-0.1199*** (0.041)
ACT composite score		0.0069 (0.006)
Dummy for prior play		0.0262 (0.067)
Dummies for class rank		*included*
Dummies for preferred delivery method		*included*
No. of obs.	213	203
R^2	0.1916	0.3830
F-statistic	16.51	5.35

Note: Statistical significance is presented at the 90% (*), 95% (**), and 99% (***) levels.

5 Discussion

While the multiple regression model with many independent variables (Table 7, Model 3) does not find substantial differences between the two game treatments in terms of learning outcomes when controlling for key variables, it remains noteworthy that random selection yielded higher net returns (see Table 3). While some students are more social and comfortable selecting team members, others will prefer not to have that additional challenge. Those same tendencies may contribute to anxiety in what can be a highly engaged game with intense personal interaction. Removing that initial stressor for those students who may have been less inclined to engage socially may contribute to their gains. Self-selection may also contribute to more socializing outside the context of the game (i.e., decreased focus on learning). That would also have a negative impact on gains. Proctors noted anecdotally that, for the self-selection treatments, social interactions unrelated to the game dominated student focus for many groups, and students exerted less effort understanding and engaging with the content. This study ignores the possibility of targeted group-setting or optimization, whether by GPA, personality type, or other valuable indicators. Part of that was deliberate, as this was used as an introductory exercise with unknown students. Also contributing to the decision to omit group optimization was the limited number of participants and groups by class and college.

Regarding improvements by college major, it is clear that—irrespective of initial assessment scores—students with majors outside of economics, business, and agricultural business increased their knowledge more through all treatments. This result is unexpected but could be explained in multiple ways. Students being exposed to the material for the first time (majors other than economics, business, and agricultural business) may be more engaged with it in order to learn something new, whereas students normally immersed in economics content similar to the treatment content may be less engaged, assuming their knowledge to be more complete prior to the activity. It could likewise be an entrenchment effect, wherein those students routinely exposed to similar economics content in their major have preexisting biases and perspectives that were not sufficiently challenged by the game to impact their post-treatment assessment scores.

Engaging students with material in a meaningful way can be challenging in a traditional lecture format. Most students today are digital natives, and their desire for engaging experiential content fits well with the use of games in the classroom. Using games in the classroom adds another tool to the faculty member's arsenal and can reinforce content. Faculty members may have a learning curve to overcome as in-class games require planning and a different type of classroom management style, with the instructor having a potentially minimized role. However, the use of new experiential techniques in the classroom has the potential to provide better understanding for students and reinvigorate content.

The main takeaway from this research is that games, like lecture, can be successfully used to introduce—not only to reinforce—economics content in the classroom. While face-to-face lecture remains the superior mode of initial content delivery in terms of student learning outcomes, this disregards the long-term benefits and social skills that a game can add. This research has several limitations, and there are extensions under way to more fully understand the current value of classroom games.

Regarding potential limitations to data collection and results, there are a few key points. First, there is always some sample bias in a classroom experiment. If professors offer extra credit, we may end up with students who otherwise would not participate. This could serve to make the sample less representative of the population. Many low-performing students may not be present if there is no credit, so the results might not be as applicable to the whole. Anticipation of a classroom game may also increase attendance among students who may not otherwise attend lecture. In an attempt to avoid such bias, participating faculty were instructed to let students know in advance that they would be participating in an "experiment," but it was clear in practice that some participants had heard about the game from peers in prior treatments. It is difficult to disentangle those impacts of induced participation rates. In our sample, several students participated in this more than one time, all with different delivery methods. Controlling for that and for prior economics coursework did not significantly impact any aspect of the estimation.

One of the main drawbacks to this research involved the inability of researchers to control for in-game success. Students who understand the content better will likely perform better in the game itself, reinforcing their knowledge as well as those in their groups. Groups that collectively struggled may not benefit as much from the experience. Playing the game twice and including two debriefing segments may improve the learning experience, but like the gains from trade, knowledge is not evenly distributed. One way of controlling for this was to conduct treatments for self-selection and random-selection in the group-making process. Students tend to self-select into groups along social lines rather than struggling students finding stronger students to join. This would likely exploit existing disparities. Random selection may lead to a slower start to the game, but anecdotally, there was not much difference in activity by the second round, regardless of the treatment type.

There are three extensions currently underway. The first is to develop this as a high school recruitment tool and another to examine the long-term impacts of this type of learning. The second extension is to conduct the same experiment but give the post-training survey after 1 month. The current study administered the post-treatment survey immediately upon completion of each respective treatment. It has been widely demonstrated that students recall lecture material better in the short run and retention rapidly declines over time. The experience of playing the game is more memorable. Students may ruminate on the experience, and it may make a more lasting impression on students than an in-person lecture or prerecorded content. We can compare the results from this lagged-assessment study with the longer-term results to determine whether games have a different impact on long-term retention. Lastly, the material will be delivered sequentially (lecture, followed by the game) to determine whether the game provides more as a reinforcement tool as opposed to an introduction to content. Those student learning outcomes will be compared to the data collected in the current and lag-extended studies.

6 Concluding Remarks

The use of games in the classroom and the matching of learning styles to delivery methods is under-researched. This research examines the impacts of using classroom games—either with autonomous or random selection—for initial content delivery compared with online or face-to-face lecture. The experiment was conducted in economics and agricultural economics courses in the College of Business and College of Agriculture, respectively, though students spanned many majors both inside and outside those two colleges. Overall, student outcomes improved regardless of delivery method, but the highest gains came in the traditional face-to-face lecture treatment. That may be due in part to the immediacy of the post-treatment assessment, and a future project is currently under way to evaluate the long-term-retention aspects of this study.

Students performed slightly better after the random-selection game compared with the self-selection game. While this may not have matched student satisfaction results—students often preferred the game and choosing their own groups—the game itself provides unmeasured benefits in the form of soft skills development. When examining students' self-proclaimed learning types and satisfaction with their learning experience, we find that students felt like they learned the most when they preferred *and played* the game; when they preferred *and ended up in* the online lecture treatment, satisfaction was lower. These subjective assessments did not correspond with any meaningful difference in learning outcomes, regardless of the treatment.

This study supports the use of games as a tool to introduce new concepts in the classroom. This project is currently being extended to examine how retention differs between lecture- and game-introduced content, specifically by varying the amount of time between pre- and post-training assessments. Further research is needed to compare the use of games as a tool for introduction rather as opposed to reinforcement after lecture.

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Appendix A: Proctor Script/Instructions

This is a sample proctor script from the self-selection version of the game. The sample questions to drive the discussion tied to the questions covered in the pre- and post-treatment assessments. These questions were only used as a starting point for discussions. Proctors were instructed to provide certain content and framings to guide student learning.

Proctor Script (Self-Selection Version)

Round 1

Today, you will participate in a game that will demonstrate some of the key factors and impacts of trade between countries. In this game there will be between 4 and 6 groups, depending on how many participants we have. **Students will choose their own groups**, and each group will be randomly assigned as a country. Each country will have an endowment of resources (like iron ore or low-skilled labor) that is different from all other countries. This is meant to mimic real-world resource endowments. Additionally, each country will have different production capabilities; in other words, each country will be able to produce different goods. And each country has different preferences; in other words, each country will want to consume different products. Each country has limited production capabilities. Each country can produce only certain products, and those products may or may not be what those countries want to consume. And to make this more realistic, many final products require intermediate goods. In other words, there are many final products that require intermediate inputs that have already undergone some processing (for example, beer requires wheat and machinery in its production process, both of which are intermediate goods that must be produced from other resources). There is a production station at the front of the room. This is where all production takes place – you will give the proctor your inputs and the proctor will hand you the outputs. **Select your groups now**, and we will hand out your country packets.

[ACTION: Proctor will assign groups and countries. Distribute country packets.]

Open your packets. Inside, you will find a sheet of paper with your country's resource endowments, its production capabilities, and its preferences. The **Endowed Resources**, listed at the top of your sheet, will tell you the type and number of each resource you have at your disposal initially. Every country has different resource endowments. You next have a list of what your country **Can Produce**. Every country has a different list of items it can produce, which demonstrates different technologies between countries. Any products in bold indicate **Intermediate Goods**, which must be produced (or traded for) prior to making some final product. The **Preferred Items to Consume** indicate the points you can obtain during this game. Every country has different preferences and demands, so this list of preferred items will be different for each country. **Production Requirements** are provided for each good that the country produces in the table below. The **General Rules** are also provided at the bottom in case you need to refer to them throughout the game. The **Objective** of the game is to earn as many points as possible. Points are awarded as follows:

- You get **10 points** for each item you acquire with **one star** from your Preferred Items to Consume list (either through production or through trade).
- You get **20 points** for each item you acquire with **two stars** from your Preferred Items to Consume list (either through production or through trade).
- You get **1 point** for each unit of money you have at the end of the trading period.

You will have a **3-minute strategy session** starting right after we finish the instructions. During that period, you will only be able to talk among your group members. Immediately following your strategy session, there will be a trading period will last **15 minutes**.

In this initial version of the game, you will not have any information about other countries – you will not know what their resource endowments are, what they can produce, or what they prefer to consume. Are there any questions?

The 3-minute strategy session will begin now.

[ACTION: Set timer for 3 minutes. Start timer.]

Are there any questions? If not, then the 15-minute trading period begins now.

[ACTION: Reset timer for 15 minutes. Start timer.]

Debrief After Round 1

Let's calculate our scores for each team. Which country won?

Now that we have completed Round 1, let's debrief for **5 minutes**. While we have this discussion, our proctors will collect your packets, unused resources, and product cards. You will also receive a new packet. Please **do not open this** until you are directed to do so

[ACTION: While this discussion is happening, additional proctors should collect all packets, resources, and product cards.]

Let's go through some discussion questions:

(1) Why do you think this country won?
(2) Was your country able to satisfy its domestic demand without trading? Does this seem realistic?
(3) What stood out to you about your country's ability to produce?
(4) What stood out to you as hindrances or barriers to trade – what stopped your country from being more successful? Did information play a role?
(5) What did you learn about trade?

[ACTION: Additional proctors should distribute new packets for Round 2. Quietly remind participants/groups not to open this as you pass it out.]

Round 2 (Perfect Information and Increasing Returns/Technological Improvements)

You have received a second packet. Go ahead and open it. Inside, you will find the same set of resources and the same country information card. Additionally, you will receive information about other countries' resource endowments, other countries' production capabilities, other countries' preferred goods for consumption, and production requirements for all products. This is the **Perfect Information Version** of the game. We want to add one more change to the game to enhance student learning. For every intermediate good – the ones in bold – there have been technological improvements. Instead of producing 1 unit of each intermediate good with the required set of inputs, you now will produce 3 units. For example, in the prior version of the game Steel required one unit of low-skilled labor and 1 unit of iron ore. Since Steel is an intermediate good used in making other products, the technological advance means that 1 unit of low-skilled labor and 1 unit of iron ore will produce 3 units of Steel. Production for final goods will remain the same as before.

In this round, there will be no additional strategy session. You will have a **15-minute** trading session. Are there any questions?

Now the 15-minute trading period begins.

[ACTION: Reset timer for 15 minutes. Start timer.]

Debrief After Round 2

Let's calculate our scores for each team. Which country won?
Now that we have completed the second round, let's debrief for **5 minutes**.

(1) Why do you think this country won?
(2) What was different about this round with perfect information and technological progress?
(3) What stood out to you about your country's ability to produce and satisfy its domestic demand with perfect information and technological progress in intermediate goods?
(4) What stood out to you as hindrances or barriers to trade – what stopped your country from being more successful?
(5) What did you learn about trade?

Appendix B: Sample Country Packet for Round 1

This is a sample country packet for Group 1: United States. All other groups would receive only similar information about their countries with no information about their potential trading partners. The goal is to collect information about trading partners, endowments, and production capabilities prior to trading. Some resources in this game were necessary in the production process of many intermediate goods but limited globally, making them more valuable.

Group 1: United States

- Endowed Resources: High-Skilled Labor (10), Land (10), Money (15), Oil/Gas (10)
- Can Produce: Beef, Auto Parts, Cotton, Corn, Wheat
- Preferred Items to Consume: Beef*, Beer*, Cars*, Cell Phones**, Coffee*

Production Requirements

Product:	Auto Parts	Beef	Corn	Cotton	Wheat
Inputs:	1 Oil/Gas, 1 Rubber, 1 Steel, 1 Machinery	1 Land, 1 Low-Skilled Labor, 1 Corn	1 Capital, 1 Land, 1 Low-Skilled Labor, 1 Oil/Gas	1 Low-Skilled Labor, 1 Land, 1 Capital	1 Capital, 1 Land, 1 Low-Skilled Labor, 1 Oil/Gas

General Rules: Each country can trade to get Resources (like Capital, Iron Ore, and Rare Earth Metals), **Intermediate Goods** (like **Steel** and **Machinery**), and Final Goods (like Beef, Vaccines, and Cars). Production requires one of each input from the Production Requirements section above (for example, 1 unit of **Auto Parts** requires 1 unit of **Steel**, 1 unit of Oil/Gas, 1 unit of Rubber, and 1 unit of **Machinery**). In the initial version of the game, you can trade with any countries you wish. You can trade inputs (like Resources and **Intermediate Goods**), Money, and Final Goods.

Objective: The goal is to get as many items you want to consume as possible (you can either make them yourself or trade for them). Points are awarded as follows:

- **10 points** for each item you consume from your list of Preferred Items to Consume with one star (*)
- **20 points** for each item you consume from your list of Preferred Items to Consume with (**)
- **1 point** for each unit of Money you have at the end.

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