EconSim - 11.127 Virtual Game

MIT Student - Programmer and content generation
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Target Audience: High school students
Setting: Introduction to Economics classroom.
Mechanics: RPG with data collection phase and argument formation phase
Engine: Client-side javascript with Twine-generated HTML pages for dialogue
Learning goals:
  ● Understand on a macroeconomic scale how basic supply chains work and how
    interdependent complex systems are in the supply chain
  ● Understand how to collect evidence to support a stance and how to formulate a cogent,
    evidence-based argument
  ● Understand that compromises and trade-off decisions have to be made and realize the
    social, financial and environmental impact of those decisions

Project History

Initially, we intended to make a game that had some underlying social message combined with
learning about processes. There was a fervent discussion over the type of game we wanted to
create and the topic of the game. The types we talked about were augmented reality,
alternative reality, and virtual world simulation. All of these were analyzed for feasibility and
implementation considerations. Given the relatively short time frame and the content areas we
were discussing, the plan was to abandon AR and alternative reality games. We did like the
idea of EcoMuve and the virtual world in which students can navigate and learn about the topic
at hand. Eventually we discussed topic areas.

Topics that were explored included fossil fuels, overpopulation, and manufacturing. We settled
on the idea of having students understand where common things are made and the resources
and interplay that exists to produce these. One member of the group had experience with
supply chain and this fed into our decisions. We settled on jeans making as it was a common
product here in the U.S. and that few know how they are made. We all researched jean making
and quickly realized the integral interplay of world markets, financing, and environmental
considerations that are involved in making a simple pair of jeans.

Premise

Jeans are essentially made of cotton, indigo dye, steel (for zippers and buttons), copper (rivets),
and leather or fabric (labels). All of these raw materials come from different parts of the world.
Cotton is the most important part of jeans making and requires a tremendous amount of water.
It can take around "20,000 litres of water to produce 1kg of cotton; equivalent to a single T-shirt

and pair of jeans." (WWF report: *The Impact of Cotton on Freshwater Resources and Ecosystem).* Jeans also have by-products of dye, starches and sulphur. These waste products cannot be dumped into streams or lakes because of high uptake of biochemical oxygen. Essentially, these materials would take up so much oxygen that nothing else could live. We thought that the considerations of pollution and water were sufficient to our learning goals for students.

We decided - given the recent California drought - that a water shortage would be a good way to introduce a crisis event for players to respond to. We wanted to explore the social, environmental and financial implications of jean-making in such a crisis event that would require "players" to understand the process and take action in direct response. Through gameplay, students also can learn how to make cogent, evidence-based arguments to defend their action plans.

In the classroom these scenarios can be varied depending on the learning goal. Another potential crisis event would be the EPA cracking down on pollution and the jeans company having to react appropriately. A number of scenarios, personas and data points can be utilized to emphasize different content, messages, environments, play and learning goals.

Personas/Roles

The structure of the game was to have "players" or students taking on certain personas or perspectives on the process. This role play allows students to take on a problem through a certain lens that is not their own. This forces students to embody the values and thoughts of someone else, which we felt was a valuable lesson in and of itself. The students will have to critically analyze issues and data from that perspective and understand how those issues impact different people differently. Students would inevitably have their own projective identities for their characters making the interplay more interesting.

Initially we constructed several roles for the game including:
- Suppliers
  - Metals/Machinery (steel, copper, machinery)
  - Fabrics (leather, dyes, cotton)
- Government employee (EPA)
- Consumer
- Human Resource/Labor Union
- Retailers
- Manufacturing CEO

In order to demonstrate this in class we fully built out 3 of them (Labor, EPA, CEO) that included names, demographics, and values. We felt it was important to include as much backstory and information as possible to help students take on that role. The roles are attached at the bottom of the report.

<u>Solutions to Crisis</u>

There are 6 options given to the students for the given California water crisis. Three of the scenarios are built to benefit one of the roles very well and three are considered compromise solutions. They are:

3 Perfect Packages:
1. Cotton production shuts down (good for EPA)
2. Cotton Production continues as is and company pays fine (good for workers and CEO)
3. Mechanized Production (good for CEO)

3 Compromise Packages:
1. Produce organic cotton with water saving measures
2. Outsource cotton production
3. Introduce GMO cotton (less water required)

<u>Discovery Phase</u>

The discovery or data collection phase is characterized by "choose your own adventure" style dialogues with different virtual world players as data access points. Those players give varying information depending on the type of interaction you have with them. Students have to prioritize their discussions with the data access points as there is a set time limit and it would be impossible to obtain all the data in a given time. The discovery phase is different for each persona/role and is prioritized by the student based on perceived utility of those interactions. Students as their persona have to choose who to talk to, what specific information they are looking for, and what solution they are trying to support. The data is important as it informs their position for the negotiation phase and is the evidence base for their argument. This leads to interesting decisions that students have to make and requires them to understand the viewpoint of their role and predict what data would be useful for a given argument.

The data access points would be scattered across a map so players can "fly" to those locations to interact with them. At each of the locations are dialogues which are driven by the student - created using Twine. The data points were designed to give some useful information and some not so useful information. Again, the onus is on the player/student to prioritize the data access points and the information they wish to gather from them. The conversations have defined tracks through them and once information is given you must fly elsewhere and wait 30 seconds before you can get more information from that individual. This requires collaboration and discussion with your team on how best to go about the data collection. This could also be done in small group settings where the roles are taken on by individuals as opposed to teams. Pieces of information can be stored on each player's in-game notepad, which can then be downloaded as a text file and shared with a teacher.

Negotiation Phase

In the negotiation phase, students collect together the data they have discovered and discuss their findings in a group setting. During this consolidation phase, students, in character, discuss the salient evidence for each solution and debate about constitutes best evidence for their stance. They form arguments based on this evidence to present in the larger group setting. If the group was split into multiple smaller groups then students would form their own argument and discuss with the other roles in their small groups. For the demo, we decided to have each role taken on by a group and the negotiation phase to occur in front of the class.

In the classroom, this negotiation phase can be more robust as students take their roles' vantage points and discuss the data supporting their chosen solutions. This negotiation doesn't necessarily need a resolution phase, but can depending on the instructor's goals.

Reflection Phase

There would be a reflection phase in the classroom where students would discuss how the role affected their priorities in data access, their argument formation and ultimately their decisions. Students could talk about the whole process outside of character to reflect on their own identity, that of the persona and their projective identity affected their interaction with the system and their negotiations. Students would also reflect on how they came to the solution of the compromised solutions versus the unilaterally beneficial scenarios. They could discuss of how their role affected their interpretation of data and if their were a different role how that data point would change meaning for them and their potential solutions.

Gameplay Testing

A great deal of time was spent in content generation and integration into a playable model. Although we did perform some playtesting at the theoretical level, our ideas didn't come into full view until the digital version existed. The most valuable playtesting came in the form of our game demonstration. We gave players 10 minutes for the discovery phase, then had each group discuss the options and delegate one person to come to the front and present their argument and the option they selected.

From this, we received several pieces of valuable feedback. We noticed that the mechanics of our game served their purpose well. Players moved locations frequently and took notes in their notepad when they received pieces of information pertinent to their roles and their decision-making. Restricting the players from immediately revisiting the characters gave them the opportunity to collaborate in their groups and share key pieces of information.

We also noticed that the roles were easily taken up by the players, and that their decisions in the game were affected by the role and aligned with the goals of their persona. The players moulded their strategies to obtain the pieces of information pertinent to the decisions they were considering. This confirmed our expectations for the game, in that players would need to

prioritize the information that they sought out in order to efficiently gather the pieces of information needed to formulate their arguments.

In addition, players demonstrated that they understood the interdependency and the factors involved in the supply-chain system. During the argument formation phase, each of the delegates showed that they understood that compromises and trade-offs would need to be made in order to satisfy the other personas in play. They also demonstrated their understanding that each decision would have certain social, financial, and environmental impacts which directly related to each of the playable roles.

One element that was noticeably missing in our tests was game incentive. While some players may find the roleplaying aspect interesting and/or fun, other players inevitably will not, leading to a disparity if this game were to be used in a classroom. In order to appeal to a wider audience, our game may need to introduce a points system or 'win condition' - a gameplay element that players can strive for during their roleplaying endeavors. Our current game iteration has no ending other than the negotiation and reflection stage, which can be unsatisfying to players who did not connect with the content.

Classroom Application

Our hope for this game is for teachers to build upon in to teach the basics of supply chain, manufacturing, macroeconomics, microeconomics, evidence discovery, argument formation and negotiation skills. Different aspects of the game can be used at different points in the class to introduce the ideas. One idea would be to have a shortened version at the very beginning of the class semester to introduce the basic ideas and take the game to conclusion. Students would then learn more in-depth about the various learning subjects from the instructor. They could revisit the game intermittently to focus on a different aspect of the game.

Another idea would be to have the phases of the game more separated. For example, students would take on the personas and go through the discovery phase for a few weeks focusing on the interplay of the systems, the supply chain, the manufacturing, etc. Later on in the semester, they can move on to the argument formation phase, culminating in a whole-class negotiation at the end of the semester. They could bring in outside resources and their own fact finding to bring extra data points to the negotiations, and continue to discuss the negotiations after class via discussion forums or a learning management system.

Literature review and connection to other efforts in learning games

The idea of the game was influenced a lot by previous games we had played or heard about. Our first idea of making an alternate reality game along the lines of EcoMuve influenced our thinking a lot. The premise of EcoMuve was that an ecological disaster has happened (or was happening) and the player needs to move around a virtual space and figure out why. We liked the appearance of this premise and choose a parallel premise (though not quite as disastrous) by having a problem occur in a supply chain. However, instead of exploring why it had

happened, we found it would be more interesting to explore which options should be taken from there on. Similar games based on exploratory actions have been created in the past, such as the BBC climate challenge, an online RPG card game to teach people about climate change in which players need to choose from a plethora of actions to maintain health, climate and economy at decent levels over the next century while also remaining popular enough to keep governing (http://www.bbc.co.uk/sn/hottopics/climatechange/climate_challenge/index_1.shtml) In distinction to the BBC climate challenge, we wanted players to get thinking more in depth about the different options. To do this, we had players go through different dialogue options with different people to personalize the options and what they meant to the different non-player characters they interacted with. This mechanic of the game is similar to a flash game called Caravaneers, in which the player is the leader of a caravan in a dystopian future and can choose different quest - and storylines which will have different outcomes based on the dialogue options chosen (http://caravaneer.gamesofhonor.com/). Another mechanic borrowed from this game is the act of movement between different places - although in our game, this is mainly to create a sense of distance rather than worrying about dying of thirst in the desert. Another game we drew some inspiration from is another flash game called electrocity (http://www.electrocity.co.nz/) in which the player needs to decide how to build their city and increase population while balancing power supply and ecological factors. In the end, we decided against such a build because the role-playing final version of our game was easier to implement and was more relevant to our teaching goals. However, the choice and the research between different options was always an integral part of our game.

In terms of academic literature, our game was influenced a lot by James McGee's book: "What Video Games have to teach us." His chapter on learning and identity was one of the main reasons that we chose to have several different personas for players to choose from, which adds a surprising amount of complexity to the relatively simple game mechanic. This was one of the most surprising parts about playing the game in class - the non-player characters players chose to talk to depended very strongly on which role the player chose in the beginning. It fits very well with Gee's identity principle, which describes how learning in good games involves playing with an identity and making choices based on how the player wants the identity to evolve. In the class, depending on how players saw themselves reacting to a given conversation, their dialogue with the non-playing character changed to reflect that, which gave them this crucial choice in developing their pre-formed character.

Laura Joplin's theory of experiential learning influenced the way we set up the gameplay profoundly. Our game attempts to encompass the 5 - stage model of learning through first giving students personas and defining their values, then showing them to a "home" page that introduced the premise of the game as well as the different options and instructions for how to play the game. This part of the game corresponds to the "Focus" stage. Next, the "action" stage corresponds to the research players need to conduct. While the dialogue choices do not require much skill, it is important to pay attention, as some choices very clearly hurt the NPC's feelings - and will cause them not to talk to you anymore. This can become challenging and requires careful evaluation of choices. The oscillation between feedback and support was difficult to implement well in the limited time that we had, but we attempted to create a supportive group in

which feedback could be exchanged by grouping players that were playing the same persona together. We also implemented a notepad with a text file saver so that players could take notes, which could be used for later feedback in a classroom environment. The debrief was also an important part of the game, though we had a lot of difficulty finding a good way to make this in-game. In the end, we decided to perform the debrief stage as a discussion outside of the game in which players of different personas would talk about their preferred choice and why they think it would be good for everyone. This is in line with Joplin's recommendation of creating a public event to share ideas and experiences from learning at the end of a session.

Game-making Reflection

During the creation of this project, we all learned principles of good game design and how to best include educational elements in a virtual game. We quickly found that virtual games are very different from physical games in terms of building educational content because virtual games afford for different mechanics and allow far more content to be introduced into the same space. We worked to leverage that advantage by providing dialogue with complex trees and outcomes into our game. In doing so, we realized that content generation is a very tedious process involving large amounts of research and creativity. On top of building content, we needed to balance the game so that flipping through dialogue as fast as possible with no rhyme or reason was not a viable strategy.

This process took up the majority of our game development cycle. The actual implementation of the virtual game did not begin until the last week of development. If we were to do it again, we would have programmed the game earlier in the cycle whilst leaving room for more content to be added in on the fly as we generated it. In that way, we could have tested our game earlier in our development cycle (with less content) so that we could incorporate feedback and balance the game more efficiently.

Overall, we believe that the game we generated was balanced and met our intended learning objectives. If we were to do further work on the game, we would include the ability to collaborate information and discuss outcomes in the game itself by using an in-game multiplayer mechanic. We would also introduce more roles and scenarios so that our game could be used over multiple learning sessions in a classroom setting.

Appendix: Roles Constructed for Game Use

Government/EPA

NAME: Mary McCarthy

AGE: 56

HOME: Irvine, California

FAMILY: Married with 2 children

TITLE/ROLE: Director of the EPA

TECHNICAL FLUENCY: High

ABOUT: Mary is staunch environmentalist who values protection over industry. She has lobbied for stopping deforestation and was instrumental in stopping the leakage of chlorine compounds into Eagle Lake in California. She is heavily involved in local and federal zoning laws and has been with the EPA for over 20 years. She is a strict vegetarian and is staunchly against animal cruelty. She has served as a volunteer and advisor for the ASPCA and The Anti-Cruelty Society.

MARY'S VALUES
-Protecting the environment above all else
-Reforestation
-Water protection and conservation
-Animal protection and no testing on animals

Human Resources/Labor Union

NAME: James Murthy

AGE: 62

HOME: Bloomfield Hills, Michigan

FAMILY: Married with 3 children

TITLE/ROLE: President of the AFL-CIO

TECHNICAL FLUENCY: Moderate

ABOUT: James grew up in the suburbs of Detroit and worked in the auto industry for over 25 years. He initially worked the line for 10 years doing hard labor and getting very little pay. He received a serious leg injury while working on the line and was out of work for several months and used up a great portion

of his meager disability. He returned to work and has completely recovered from his injuries. Soon after returning, his years of experience and strong leadership skills got him promoted to floor foreman. After only 3 years in this position he became plant supervisor and was removed from the floor. He helped organize the union movement in his plant and ultimately became the union liaison. His strong work with elevating wages, improving work conditions and revamping benefits for plant personnel did not go unnoticed by the AFL-CIO executives. He quickly climbed the ranks in the organization and was promoted to president of the AFL-CIO in 2009. He continues to work with local and federal labor organizations to help unionize blue collar industries, continually fighting for improved work conditions and pay.

JAMES' VALUES
-Safe working environments for employees
-Helping industries unionize and strengthen those that have already
-Higher wages for blue collar employees
-Better benefit packages including disability, life insurance, health insurance and child care

CEO / Company

NAME: Jordan Malfort
AGE: 50

HOME: Chicago, IL

FAMILY: Married, 2 children

TITLE/ROLE: CEO of Levi's, the largest jeans producer in the world

TECHNICAL FLUENCY: Moderate

ABOUT: Jordan Malfort grew up in Urbana, Illinois and has worked with Cotnet for close to 20 years. After graduating from Cornell with a Bachelors in Agricultural and Health Administration and from Harvard with an MBA, she started as a manager on the agricultural section of Cotnet. After 5 years, she became the general manager of cotton production and procurement at Levi's, but she has always kept a close contact with Cotnet. 6 years ago, she was instituted as CEO of Levi and has led the company to great success. With the new water tax the EPA has put up, she has been considering multiple options for sourcing cotton, since sourcing it from Cotnet may be too expensive.

Jordan's values:
- Maximizing the Profits of the Company
- Preserve the company's positive image.
- Practical Solutions to Problems
- Efficient Sources for Cotton
- Development of the Company

Steel/Copper/Machinery Supplier

Role: Director of Metal Corporation
Location: Pittsburgh, Pennsylvania

Values:
-Wants to sell resources at a high price and expand the profit margin
-Pretends to care about environmental impact
-Wants to spend as little as possible gathering resources (mining, etc)
-Wants better tools for workers to maximize efficiency

Leather/Dyes/Cotton Supplier

Role: Directors of Textile Corporation
Location: Chicago, Illinois

Values:
-Worker treatment is a low priority
-Willing to outsource if it means higher profit
-Genuinely tries to minimize factory environmental impact
-Uses cheap methods to extract materials from animals

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