Global Engineering Modules that Teach Currency Exchange and International Trade

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This paper presents two modules that have been developed for a junior level global engineering course. These two modules are related to currency exchange rates and international trade. The learning objectives for each of these topics fall within the understanding and applying levels of Blooms Taxonomy. For instance, students should be able to explain factors that influence currency exchange rates and should also be able to convert currencies from various countries to determine the least cost supplier. The first module, on currency exchange rates, uses a scenario-based teaching method in which students work in small teams to determine the least cost supplier of bicycle parts under either a strong or a weak U.S. dollar. Data on bicycle part costs and shipping rates in various countries are provided to students. In addition to identifying least cost suppliers, students calculate the total cost of their bicycle and determine the countries they can sell their bicycle in based on the average in-country sales prices. Students who participated in this module indicate a deeper understanding of both how to convert currency and how currency policy impacts global supply chains. The second module, on international trade uses a whole-class game environment to elucidate the impact of tariffs on international trade. Student teams represent one of five fictional countries who are competing to produce the most sets of six-piece chicken nuggets. The choice of chicken nuggets is arbitrary but gives the class a chance to both expand their definition of engineered products and talk about food preferences in the class's upcoming international trip. Each country is given a starting number of chickens, wheat, boxes, and factories. Some countries are also allowed to "grow" chickens or wheat or make boxes. Each country also has restrictions, like not being able to grow chickens, that limit the country's ability to rapidly produce complete chicken nugget sets, thus encouraging them to trade with countries who can produce the commodity at a faster rate. Countries get points for each complete set of six-piece chicken nuggets they can produce within 15-minutes. The points serve as a metric for the overall productivity of the country and world during the game. The game is played twice within a 65-minute class session. The first game does not have any tariffs imposed and thus represents a liberalized trade environment. The game is then run a second time under a scenario in which one country has invaded another country and in response multiple countries have imposed import tariffs on each other. Students also spend five-minutes reflecting on what they learned about international trade. While the specific results change each time new student teams play the game, the general results that a) there are winners and losers from tariffs and b) that overall productivity decreases because of tariffs due to decreased international trade does emerge from the game.

Introduction

Course

The Global Engineering Course has been a required component of the engineering curriculum since the inception of Engineering at the University of XX in 2010. Except for the Spring 2020 and 2021 trips, which were cancelled due to COVID, every cohort has worked on an engineering project in an international setting for at least a week in countries such as Belize, Nigeria, and the United Arab Emirates [1], [2].

In addition to the engineering field experience, students have sixty-five minutes of lecture and sixty-five minutes of lab per week during a 15-week spring semester. Each of the two modules described in this paper are presented as an in-class activity during one of the 65-minute lecture periods. There are usually two sections of the class offered every year with between 15 and 25 students per section. In addition to these two economics-oriented modules, in-class activities on topics of global engineering ethics, culture, DEIB and mental health issues while traveling, likely experiences in other cultures, and appropriate technology are included. Because lecture only happens once per week and the class covers a wide range of topics, each topic is intended to be an introduction to the material. Students who are interested in any of the topics are encouraged to seek out additional courses or minors in the area of interest. The following modules are therefore intended to introduce two topics within the complex field of global economics and the scenarios are therefore simplifications of these fields.

Effectiveness of Interactive Learning Methods in Engineering and Economics

The effectiveness of interactive learning methods, including simulations and games that have been used in this paper, have been studied by researchers for many decades [3, 4, 5]. Most meta-analyses of interactive teaching methods, when compared to standard lecture, show increases in student achievement [6, 7, 8, 9]. Within the engineering literature, interactive learning methods include project based learning [10], open-ended problem based learning [11], lab-based learning [12], among others. Interactive learning methods, such as those described by Springer [13] strongly support the use of small group, collaborative learning on achievement, motivation, and retention amongst STEM students. More specifically, Merchant [14] found that games and simulations increased student achievement and that games had a greater impact than simulations. They further found that individual simulations were more effective than group simulations while group games were more effective than individual games. On the economic side of the literature, Miller and Rebelein report that the most common forms of active learning are cooperative learning exercises, classroom experiments and games, and case studies [15]. McGoldrick [16] argues that economics students who are in classrooms that use cooperative learning score higher on higher on tests, have increased retention of material, and show increased problem-solving skills than students who experience lecture-based material. Platz [17] specifically looked at the effectiveness of game based learning (GBL) in economics education. She found that GBL

techniques aid in domain specific knowledge transfer but that there wasn't any significant difference in student motivation found. Furthermore, the findings indicate that if the students can identify the learning that was supposed to be attained from the game and if the game is challenging to the students, they are more likely to obtain the educational benefit. These studies point to the advantages of interactive learning methods in engineering and economics topics though specifics about the impact on motivation and group vs individual simulations, among other topics, are still under debate. These two modules add to the literature showing the learning benefits of both game-based learning (chicken nugget wars) and simulation-based learning (bicycle exchange rates) when using small group activities but our assessment did not look at the impact on student motivation.

Modules & Similar Published Modules

The two modules described in this paper are part of the global economics theme of the course. These two modules are related to currency exchange rates and international trade.

The first module, on currency exchange rates, uses a scenario-based teaching method in which students work in small teams to determine the least cost supplier of bicycle parts under either a strong or a weak U.S. dollar. Data on bicycle part costs and shipping rates in various countries are provided to students. In addition to identifying least cost suppliers, students calculate the total cost of their bicycle and determine the countries they can sell their bicycle in based on the average in-country sales prices. This module was inspired by a module published by Siler [18] in which students are asked to "work" in a fictional corporation which manufactures power transformers. The transformers are built in the United States, but components are bought from predetermined countries and installed in Germany under both a weak and strong dollar scenario. The module, originally developed by Siler was geared for secondary students and included geography components and didn't provide students with opportunities to choose their supplier or investigate the impact of shipping costs on product cost. The decision to move away from transformer production to bicycle production was made to have the topic more accessible to a broader audience of students.

The second module, on international trade uses a whole-class game environment to elucidate the impact of tariffs on international trade. Student teams represent one of five fictional countries who are competing to produce the most sets of six-piece chicken nuggets. The choice of chicken nuggets is arbitrary but gives the class a chance to both expand their definition of engineered products and talk about food preferences in the class's upcoming international trip. Each country is given a starting number of chickens, wheat, boxes, and factories. Some countries are also allowed to "grow" chickens or wheat or make boxes. Each country also has restrictions, like not being able to grow chickens, that limit the country's ability to rapidly produce complete chicken nugget sets, thus encouraging them to trade with countries who can produce the commodity at a

faster rate. Countries get points for each complete set of six-piece chicken nuggets they can produce within 15-minutes. The points serve as a metric for the overall productivity of the country and world during the game. The game is played twice within a 65-minute class session. The first game does not have any tariffs imposed and thus represents a liberalized trade environment. Students also spend five-minutes reflecting on what they learned about international trade. The game is then run a second time under a scenario in which one country has invaded another country and in response multiple countries have imposed import tariffs on each other. While the authors were not able to find game-based modules that taught the concept of tariffs specifically to engineers, there are a handful of game-based tariff modules within the business community ([19] and [20]). Most of these modules are specifically designed to have students optimize tariffs to benefit country-based industries while most engineering applications require an engineer to work within the constraints of tariffs as they're determined by policymakers.

Learning Outcomes

The learning objectives for each of these topics fall within the understanding and applying levels of Blooms Taxonomy. For the currency exchange module, students should be able to explain factors that influence currency exchange rates and should also be able to convert currencies from various countries to determine the least cost supplier. For the chicken nuggets game module, students should be able to explain what a tariff is, why countries use tariffs, and reflect on the impact of tariffs on both the world's economy and their engineering profession.

Modules

Currency Exchange

Students were told that they work for a top bicycle manufacturing company who buys parts from around the world but assembles the bikes in the United States. Each component needs to be purchased in the foreign country, imported to the U.S., assembled, then exported to other countries for sale. While the goal is to figure out which countries that they can make a profit selling their bike in, this exercises is actually meant to give them practice using exchange rates and understanding the impacts of relative strength of currencies.

There are two scenarios, the weak dollar scenario has the U.S. Dollar (USD) worth half of its current purchasing strength, while a strong dollar scenario has the USD worth twice its current purchasing strength. Students were placed into teams of three or four students per team so that each team member was given the opportunity to practice using the currency exchange rate with multiple countries for multiple bicycle components.

Students were given multiple data tables to complete the exercise. The first table was the exchange rates between thirteen countries and the U.S. based on either the weak dollar or strong dollar scenarios (Table 1). Students used this table along with the cost of component parts from these countries in their local currencies (Table 2) to determine the cost of components in US Dollars (USD). The prices for components found in Table 2 were estimated by the authors for this academic exercise by scaling the cost to purchase components in the U.S. by the price level index for each country and then converting the cost to local currency using the standard exchange rate for each country.

Table 1: Currency Exchange Rates based on a strong dollar (twice the current purchasing power) and weak dollar (half the current purchasing power).

		(1 USD gets how much foreign currency)	
Country	**Name of Currency**	**Strong Dollar**	**Weak Dollar**
United States	USD	1	1
Brazil	Real	10.00	2.50
Canada	Canadian Dollar	2.66	0.67
China	Yuan	13.34	3.34
England	Pound	1.62	0.41
France	Euro	1.82	0.46
Germany	Euro	1.82	0.46
Hungary	Forint	666.66	166.67
Japan	Yen	268.12	67.03
Mexico	Peso	36.08	9.02
Netherlands	Euro	1.82	0.46
Switzerland	Euro	1.82	0.46
Taiwan	New Taiwan Dollar	60.60	15.15
Vietnam	Dong	46,511.62	11,627.91

Once students successfully calculate the cost of components in USD, they are asked to calculate the total cost to purchase a component and import it to the U.S. by adding shipping costs (Table 3). Most values provided to the students were estimated by determining the number of components that could be packed into a standard freight container and dividing the total ocean freight cost from each country by the number of units that could be packed into each container. Standard freight costs from each country were determined from shipnex.com/ocean-freight. Shipping costs given to students were provided in USD.

Once the students have calculated the total cost to purchase and ship components from various countries, they're asked to determine the total cost of components for a complete bicycle using the least expensive option for each component. Students are reminded that there are multiple tires, wheels, tubes, shifters, brakes, and pedals for each bicycle. Because this exercise is primarily focused on students' understanding of exchange rates, we do not spend significant time calculating labor costs for assembling the bicycle components. Instead, we instruct the students to simply assume that labor costs are equal to the total cost of the bicycle components. They therefore simply multiply the total cost of all selected components as shipped to the U.S. by two to get a rough estimate for the cost to produce an assembled bicycle.

To figure out if they can sell their bicycles in each country, they add the shipping costs for a full bicycle (Table 3) to the total bicycle production cost, convert this exported bicycle cost from USD to the country currency using Table 1 and then compare their production cost to the average cost of a bicycle in the country (Table 4). Average new bicycle prices were estimated by visiting country specific web-based marketplaces like the ebay.com page for each country.

Table 2: Cost of Component Parts. Prices in this table are given in the currency in which they are manufactured. Costs have been rounded to three significant digits for this publication, but more precision was given to students during the exercise.

Country	Name of Currency	Tire	Tube	Wheel	Fork	Frame	Handlebar	Seat	Shifter	Front gear sprocket	Rear gear sprocket	Chain	Brake	Pedal
U.S.	USD	0.150	0.210	0.315	4.95	56.0	1.24	2.96	2.08	1.30	3.45	0.0031	2.36	0.037
Brazil	Real									3.17	8.41			
Canada	Canadian Dollar				6.32									
China	Yuan	0.600	0.840	1.26	19.8	224	4.94	11.8		5.20	13.8	0.0124	9.46	0.149
England	Pound								1.38					
France	Euro	0.099	0.139											
Germany	Euro											0.0021		
Hungary	Forint						178							
Japan	Yen		20.3											
Mexico	Peso							28.2						0.355
Netherlands	Euro					40.0								
Switzerland	Euro												2.39	
Taiwan	New Taiwan Dollar	3.01		6.34	99.5	1,130	24.8	60.0	41.8	26.14	69.3	0.0624	47.6	0.749
Vietnam	Dong			16,000					26,300					

Table 3: Shipping Prices of Component Parts. Prices in this table are given in USD and are given per individual component (e.g., per bicycle tube). Shipping prices have been rounded to the nearest U.S. cent.

	Tire	**Tube**	**Wheel**	**Fork**	**Frame**	**Handlebar**	**Seat**	**Shifter**	**Front gear sprocket**	**Rear gear sprocket**	**Chain**	**Brake**	**Pedal**	**Full bike**
Brazil									0.07	0.16				13.57
Canada				0.13										10.72
China	0.01	0.01	0.41	0.07	3.37	0.07	0.15		0.03	0.07	0.01	0.01	0.02	6.29
England								0.06						31.30
France	0.01	0.01												3.01
Germany											0.01			3.93
Hungary						0.30								25.62
Japan		0.01												14.52
Mexico							0.26						0.04	10.72
Netherlands					1.61									3.01
Switzerland												0.01		13.89
Taiwan	0.05		2.31	0.43	19.13	0.43	0.85	0.07	0.19	0.43	0.08	0.02	0.13	35.71
Vietnam			0.58					0.02						8.91

Table 4: Average price of a bicycle in each country. Prices in this table are provided in the country denomination.

Country	Name of Currency	Bicycle Market Cost
United States	USD	148.00
Brazil	Real	400.00
Canada	Canadian Dollar	323.05
China	Yuan	800.00
England	Pound	592.05
France	Euro	337.00
Germany	Euro	643.00
Hungary	Forint	98,299.10
Japan	Yen	80,000.00
Mexico	Peso	5,000.00
Netherlands	Euro	1,010.00
Switzerland	Euro	900.00
Taiwan	New Taiwan Dollar	10,000.00
Vietnam	Dong	1,000,000.00

Students are then asked to answer a series of questions to reflect on the impact of exchange rates and the strength of the US Dollar. These questions include:

1. Which countries did you buy parts from? Was there a consistent country supplier? Were any of the parts from the U.S.?
2. How much does it cost to build a bike?
3. Which countries could you sell your bike in?
4. Compare your answers to the other team that was building a bike under the other scenario (a weak or strong dollar).
    a. How were their answers different?
    b. What thoughts do you have on why their answers were different?
    c. From the perspective of manufacturing and selling bicycles, in what ways is it better to have a weak dollar or strong dollar?

International Trade

The Chicken Nugget Trade Wars game is designed to teach engineering students about the impacts of tariffs on country and industry level economic productivity. After a brief introduction, we talk about Professor Robert Baker, from Cornell University, who is credited as the inventor of chicken nuggets through the invention of the “Cornell Chicken” [21]. We also show blueprints

and patent drawings of chicken nugget manufacturing machines to bring students into the understanding that many of our processed foods are engineered products.

The game is then introduced to the students. Students are told that they will be randomly placed into one of five team. Each team will represent a different country. Each country's goal is to produce as many six-piece chicken nugget sets as possible within a 15-minute game play time. To make a six-piece chicken nugget set, six chicken cards, six wheat cards, and one box card are necessary. Also, since chicken nuggets are an engineered product, a country can't make chicken nuggets without a factory. While a factory doesn't get used up in the production of chicken nugget sets, at least one factory is necessary prior to making chicken nuggets. While each chicken, wheat, and box card are worth one (chicken and wheat) or two points (box) each, a complete six-piece chicken nugget set is worth more points (25 points) than the individual cards alone giving students a strong incentive to make complete chicken nugget sets. Each country is given a packet with cards for wheat, chicken, boxes, and/or factories. Initially, the total points from these cards is the same for each country even though each country has a different combination of cards. Team packets also include a reminder of their country's restrictions and supplies for making additional wheat, chicken, or box cards.

The necessity of trade within the game is forced through restrictions on farming or manufacturing by country. For instance, the country called Glutenfreeland, can't grow wheat and therefore needs to trade with wheat-growing countries for their wheat supplies. While students know how many points each card is worth, trade rules aren't specified to the students. This means that the relative value of each commodity is set organically by the class as the game progresses. Two countries have no production restrictions but are not given factories at the beginning of the game. Since factories cannot be made in this game, they are therefore forced to trade for a factory (some countries have excess factories) prior to making chicken nugget sets. The restrictions on production of commodities by countries is listed below:

- Americana cannot grow chickens
- Glutenfreeland cannot grow wheat
- Upper Nepal cannot make boxes
- Savannah has no restrictions, but has no factories
- Islandia has no restrictions, but has no factories

Team member roles are set such that there is a mixture of production, farming, and trade. The minimum team size is therefore three students. With larger teams, the number of farmers and traders should increase in such a way that the proportion of farmers and traders is approximately equal. The traders' role is to negotiate trade agreements with other countries. A typical simple trade would be for one country to agree to trade a set number of wheat for a set number of chickens. A more complex trade might include multiple countries, or agreements by one country

not to trade to another country in exchange for a guaranteed supply of a commodity that it can't produce. Again, there are no restrictions on the students' trade agreements so that the overall outcome of the game is determined, in part, by the relative creativity and negotiation skills of the trading partners. The farmers' role is to grow either chicken or wheat. Growing chicken or wheat means creating nearly exact replicas of the chicken or wheat cards (Figure 1). In each country's packet is a set of pens, markers, and scissors for production of card replicas. Once a farmer has created a wheat or chicken replica, they bring it to the instructor for inspection. If the instructor thinks that it's a close enough replica, the instructor initials the card, and the country has now produced one additional unit of chicken or wheat that they can either use for their own chicken nugget set or trade to another country. Non-initialed cards are not acceptable currency. The instructor can limit the rate of production by being more or less strict on the requirements that the newly created cards be "exact replicas" of those given to the students. The manufacturer's role is similar to that of the farmer in that they can make box replicas that can be inspected by the instructor. They also are in charge of gathering the six wheat, six chicken, one box, and one factory card for inspection by the instructor. If the instructor finds that all cards are acceptable and that the country has a factory, they will exchange the six wheat, six chicken, and one box card for a chicken nugget card. The instructor also returns the factory card to the manufacturer for use in the next chicken nugget set. All chicken nugget sets, and individual cards must be initialed by the instructor prior to the end of the 15-minutes to count for points.

a) b) c) d) e)

Figure 1: Chicken Nugget War Cards. a) Chicken, b) Wheat, c) Box, d) Factory, and e) Six-piece Chicken Nugget

At the end of the 15-minutes, countries add their points and report to the entire class. The number of points across all countries is also tallied. The students report their strategies for farming, manufacturing, and trade – usually with some funny anecdotes about trade agreements or farming mishaps. The instructor then asks them to reflect on what they would do better next time. Finally, the instructor tells the students that this was the first of two scenarios and represents the "no tariff" or free-trade scenario. All countries were allowed to trade with one another, and trade agreements were made in such a way that they were supposed to benefit all countries involved in the agreement. In the next scenario, countries will again be asked to make as many chicken nugget sets as possible, but there will be trade restrictions on most countries.

The second scenario starts with students returning their envelopes and receiving exact replicas of the original envelopes to start the scenario anew. Students are then told that Americana has invaded Glutenfreeland thereby taking half the wealth of Glutenfreeland and gaining the capacity to grow chickens. Glutenfreeland is asked to hand over half its cards to Americana. Americana therefore starts the game at an advantage while Glutenfreeland starts the game at a disadvantage. Luckily, Glutenfreeland is part of the North Atlantic Chicken-producers Organization (NAChO), which is a group of countries who have trade and defense alliances to defend their chicken nugget market share. In this game, the other member of NAChO is Savannah. As part of NAChO's efforts to support Glutenfreeland, Savannah has made trade between their country and Americana illegal. Savannah also controls most of the world banking system so has imposed several banking hurtles on Americana which makes international trade expensive. The game will model these extra expenses as point deductions against both Americana and any other country trading with Americana. Further, as a show of humanitarian support, Savannah has decided to give Glutenfreeland one box, one chicken, and one wheat card. Islandia has maintained its neutrality in this "disagreement" and runs its own banking system, which allows it to get around the added costs other countries are currently experiencing when trading with Americana. There are therefore no penalties for Americana and Islandia to trade with each other. While Americana and Upper Nepal are allowed to trade with each other, because of banking restrictions applied by Savannah, each trade will cost each country 10 points. All other rules for trade, farming, and trade are the same as the first scenario.

The game is run again for 15-minutes under this new trade constrained scenario. At the end of the game, countries again report their final points and report out about what happened during the game. The total points across all countries is also tabulated.

The remainder of the class period is devoted to reflection and discussion about the impact of tariffs on specific countries, industries, and professions. Students in countries with highly restrictive tariffs are quick to point out that trade with other countries wasn't productive so they switched strategies from finding trade partners to increasing domestic production. This change in strategy causes a shift in the relative importance of industries within a country and the need for different kinds of skilled workers. Students are then asked how this relates to existing international trade tensions around the green energy sector and national policies meant to protect domestic industries. Finally, students are asked to envision how tariffs and other trade policies might impact their professional lives and future engineers.

Outcomes

Currency Exchange

This module was developed during the Spring 2023 term and has therefore been offered to the students twice. The 2023 offering occurred in response to student requests after their spring break travel experience. Prior to travel that year, students were only told what the exchange rate was between USD and UAE Dirham. The result was that multiple students reported having difficulty in negotiations with local venders. Their verbally reported difficulties included confusion over the cost of an item in USD, and errors in negotiations. One student reported negotiating in the wrong direction thereby increasing the price of the good they purchased after negotiations. To determine whether students were able to calculate exchange rates after the module, a simple homework question was embedded into a larger reading assignment. That homework question was:

> *If the exchange rate for 1 US Dollar is 3.67 UAE Dirham and you brought $100 to the UAE, how many Dirhams would you get when you exchanged your money assuming there are no transaction fees?*

After the currency exchange exercise 88% of the students showed that they could successfully calculate the number of Dirhams they should receive, though some students only received partial credit due to submitting answers with incorrect significant digits. Eight percent of the students did not submit the assignment and four percent of the students (one student) incorrectly applied the exchange rate.

The module was provided to a second cohort of students during the Spring 2024 semester. This time we administered both pre- and post- module assessments. We also wanted to see if students could convert both from USD to other denominations and the opposite direction. The following questions were asked.

Pre-test questions

1. *If the exchange rate for 1 US Dollar to British Pound is 1 USD to 0.80 British Pounds and you brought $100USD to England, how many British Pounds would you get when you exchanged your money assuming there are no transaction fees?*
2. *If the exchange rate for 1 US Dollar to British Pound is 1 USD to 0.80 British Pounds and a vendor wants to charge you 10 British Pounds for fish and chips, what does that cost in US Dollars?*

Post-test questions

3. *If the exchange rate for 1 US Dollar to UAE Dirham is 1 USD to 3.67 UAE Dirhams and you brought $100USD to the UAE, how many Dirhams would you get when you exchanged your money assuming there are no transaction fees?*

4. *If the exchange rate for 1 US Dollar to British Pound is 1 USD to 3.67 UAE Dirhams and a vendor wants to charge you 10 Dirhams for a coffee, what does that cost in US Dollars?*

The results of the pre-test during the 2024 semester were that 100% of the students could convert from USD to British Pounds (Question 1) even before the exchange rate module was offered. When the question was asked in reverse, such that students needed to convert from British Pounds to USD 89% of the students answered the question correctly. All four of the students who answered the question incorrectly multiplied the 0.80 conversion rate rather than divide.

During the 2024 post test 100% of the students got both questions (questions 3 and 4) correctly. The results of the pre- and post-test indicate that while students did show improvement in converting from a foreign currency to USD, that nearly 90% of the students were able to correctly make these theoretical conversions prior to experiencing the module. This is in stark contrast to qualitative field observations over the past two years where students reported difficulties both negotiating with street vendors in the UAE and predicting the number of British Pounds that they should have received from a currency exchange company. The disparity between students' self-reported struggles in real life and their near-mastery in the classroom setting seems to indicate that the issue that the students are experiencing is related to the setting. During the negotiations with the street vendors, students were expected to be able to do approximate conversions in their heads to know how much they were being asked to spend for a good. In the U.K., when students were checking to see if they got the correct amount of money from a currency exchange company, many were struggling with it being the first time they had ever seen, touched, or worked with currency that didn't look like a greenback. The results of this year's assessment therefore point to the need to add both a time component and physical currency component to the simulation in future years.

International Trade

The Chicken Nugget Wars trade game was originally created during the Spring of 2017 and has evolved over time. The game, as it is described in this article was used both in the Spring of 2023 and 2024. Across these four sections, in which the game was played, overall production of chicken nuggets decreased when trade restrictions were imposed compared to a free trade environment. Similarly, in each section the country of Islandia, who was not under any trade restrictions during the second scenario scored higher than any other country. In three out of the four scenarios the imposition of trade barriers by the country of Savannah on the country of Americana was not sufficient to counter the benefits that Americana gained from invading Glutenfreeland.

During the post-game reflection students reported reduced trade activity and increased reliance on internal production for the completion of chicken nugget sets. Students whose role was to facilitate trade also expressed frustration with a lack of things to do during the second scenario and lack of ability to help farm or manufacture items. This revelation often leads to conversations about how trade restrictions change how a society produces goods and therefore as

restrictions change that there's a need to rapidly re-educate workers for the modified global economy. Conversations about the use of tariffs to protect domestic industries, such as those tied to green energy, are often the most interesting. Many students initial take-aways from the game are that tariffs reduce overall trade and therefore overall productivity so should be avoided, while other students saw the large scale shift toward domestic production as a net positive. The final reflection, about how tariffs and trade policies might impact their professional lives as engineers is initially done on paper to promote honest reflection. Students are then asked to share their thoughts, if they feel comfortable. The volunteered responses vary broadly with some students feeling like these large macroeconomic forces are beyond their control so there is not much that they can do, while others feeling like they need to learn more so that they can better navigate these complexities.

While students often report the Chicken Nugget Wars to be the most fun in-class exercise of the semester, we want to ensure that students are also learning about tariffs and able to connect tariffs to their engineering profession. After the class, students are asked to read "What is a Tariff and why are they Important?" by Scott Nevil from Investopia.com [22]. The homework assignment from this class period and reading involves three questions.

1. *In your own words, what is a tariff?*
2. *Why do countries impose tariffs?*
3. *What is an example of one item or material that is used in your type of engineering that the U.S. imposes tariffs on? You will need to do some quick research to find this answer so please also provide your source(s).*

Eighty-five percent of the students answered all three of the questions correctly after the in-class activity and reading while 7% of the students didn't submit answers. The remaining 9% of students incorrectly answered on of the three questions. The most common mistake that students made was not including a citation for their answer to question 3.

Conclusions

While the Global Engineering course at the University of XX covers topics ranging from working across cultures to common travel experiences these two modules focus on introducing students to the economic side of the global engineering profession. Section size in this course typically ranges from 15 to 25 students but each of these modules could be scaled by changing the number of students per team and the number of teams per module. The Chicken Nugget Wars trade game needs a classroom environment with space for student traders to move around freely so may not be appropriate for large or crowded lecture halls. Similarly, the requirement that all replicated cards be inspected by a single instructor may not be feasible in large class environments. In these cases, it might be worth assigning a couple student helpers to take on this job during the game. We found that most students already had the theoretical background to correctly calculate currencies using exchange rates in a classroom setting but continued to

struggle while traveling. We propose adding temporal and physical currency components to the exchange rate module to increase the relevance to actual travel experiences. Students who are interested in these topics are encouraged to seek out additional courses, and perhaps minors to learn more about these complex systems and apply them to their engineering professions.

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