

Experiential Learning for Training Future Science Policy and Diplomacy Experts

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<https://doi.org/10.38126/JSPG210103>

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Keywords: science diplomacy; experiential learning; Diplomacy La, training; science policy; Mekong; negotiation simulation

Executive Summary: Experiential Learning is a useful tool to prepare negotiators and politicians in the art of diplomacy and can have a unique value in Science Policy and Diplomacy training. This workshop review summarizes two EL activities undertaken in a University of Arizona SPD course. The first was a semester-long project in conjunction with graduate and undergraduate students from a UA climate change adaptation course and the United States Department of State's Diplomacy Lab. For this project, students researched issues and potential policies to address climate change effects on water, energy, and food resources in the Lower Mekong river basin. The second activity was the Mercury Game, a negotiation simulation that challenged students to represent interests of various countries to tackle an international environmental issue. Student survey results and other feedback demonstrate that EL is a valuable tool for SPD education and preparation for practice. Insights into how faculty, staff and students can facilitate EL in coursework are also discussed. This paper is authored by the student participants and documents their outcomes and perceptions after completing these activities.

I. Introduction

Science Policy and Diplomacy (SPD) is a complex field that exists at the intersection of science, engineering, policy making, and diplomacy. As a result, SPD can be difficult to define, but is generally described along two axes: 1) Science for Policy/Diplomacy: Using scientific collaborations and scientific research to further policy or diplomatic goals, and 2) Policy/Diplomacy for Science: Using policy and diplomacy tools to further scientific endeavors (AAAS 2010). Although SPD has been practiced since the early 20th century, only in the last decade has it been formalized in foreign policy spheres (EUEA 2022). As a result, formal training opportunities in SPD are rare, leaving an educational gap for those interested in SPD. We

believe that Experiential Learning (EL) is a useful tool for bridging this gap and providing more educational opportunities to students who wish to enter SPD. In this workshop report, we discuss the implementation of such EL activities at the University of Arizona (UA) and how they furthered SPD educational opportunities at our university.

New tools to further SPD education opportunities are necessary. Although SPD is seeing growth as a new field of interest, it exists at the intersection of many fields and the exact role of a science diplomat as well as the skills needed to be successful remain ambiguous, particularly to scientists, engineers and health professionals without policy backgrounds (Melchor 2020). As a result, when it comes to

training science policy experts and science diplomats, formal curricula, program goals, and desired student outcomes are still not defined (Mauduit and Gaul Soler 2020). Therefore, few students are aware of SPD as a career option, fewer can articulate the function and responsibilities of an SPD professional, and even fewer have access to a standardized curriculum to prepare them for an SPD career.

Currently, there are only a handful of formal programs focused on SPD education. At the undergraduate level, SPD tracks are available within foreign policy or public policy programs, such as at the Harvard Kennedy School of Government (Harvard University 2022). Single courses are also available at some universities, such as Dartmouth College (Dartmouth College 2022). At the graduate level, some universities offer certificate programs that focus on specific issue areas or on science, technology, and innovation. For instance, Tufts University, MIT, and George Washington University all offer such programs for Master's Degree students.

In addition to courses, some institutions have graduate level workshops and seminars focused on the development of specific skills. For example, UC-Irvine and UC-Riverside offer workshop certificates in communication and policy making. Non-academic organizations such as the Utrecht Young Academy also provide opportunities for students to engage with SPD (Science Policy-Utrecht 2022). Finally, at the postgraduate level, there are several workshops, seminars, and fellowships aimed specifically at training SPD experts, such as the AAAS Science and Technology Policy Fellowship. AAAS also has other training programs (Hobin et. al. 2012, Maudit and Gaul Soler 2022); however, these opportunities are highly competitive. Thus, even though formal education in SPD does exist, it has limited availability and accessibility, making it difficult for qualified and motivated individuals to enter the field.

As identified by Mauduit and Gaul Soler (2020), one tool for bridging this educational gap is EL. EL is an engaged learning model where participants learn by actively participating in an activity. Through hands-on experience, problem-solving, and reflection, participants connect the theory and knowledge learned through classroom learning to

real-world situations. EL has been known to provide a better understanding and a holistic view of the topic, as well as offering opportunities to work together with peers and collaborate with diverse organizations (Kolb and Kolb 2005). Participants gain insight into their skills, strengths, and interests and grow their network by interacting with people who share similar interests. **Exercises such as role-playing simulations and working on projects examining real-world challenges can be a key tool in gaining practical knowledge on developing policy solutions** (Stokes and Selin 2016). These immersive opportunities provide a platform for students to learn about the different methods for framing policy recommendations by experiencing the process directly. Such opportunities also allow students to hone their debating and argumentative skills, and to better understand the need for and value of stakeholder engagement.

An example of an extended policy-based EL experience is the Schuman Challenge, organized by the European Union's (EU) delegation to the United States (US) (EU 2022). The challenge is an annual foreign affairs contest for undergraduate students to develop, present, and defend transatlantic policy initiatives. The US Department of State's (DOS) Diplomacy Lab (DiploLab; see Section 2: Diplomacy Lab) offers similar semester or year-long opportunities based on needs of existing projects identified by DOS staff.

Role-playing simulations are another EL activity that can provide clarity about the SPD field, are more generally available, and can be completed in a relatively short period. The AAAS Science Education Network gives a summary of these activities (AAAS 2022). For example, a space mining role-playing scenario was incorporated in a graduate course on Space Politics at Tel Aviv University in Israel (Paikowsky and Tzezana 2018). The scenario was designed with the help of space professionals from diverse backgrounds in space engineering and technology, space politics, and international law. It aimed to raise student awareness around the major issues at the intersection of space and politics, including political economy, environmental issues, power and security of states, diplomacy, and international relations, and to encourage creativity as students searched for potential solutions. The students expressed that this experience was very

insightful in examining international relations, understanding the roles and relationships of different players, and mutual dynamics – both overt and hidden – in determining desired outcomes.

Although EL has been demonstrated as an effective learning tool, few opportunities currently exist to apply and document its value in SPD training. We believe that incorporating EL activities into existing courses, particularly activities focused on extended, immersive experiences, can help students interested in SPD better understand the required skills and opportunities in the field. **To test this hypothesis, we present a discussion of two EL activities incorporated in an SPD course and Climate Adaptation course at the UA.** The first activity was the Diplo Lab project with the DOS examining the climate issues in the lower Mekong region. The second EL activity was a negotiation-simulation scenario where students worked to resolve an issue with global mercury regulation. Section 2 elaborates on these two activities, the participants, and the ways these activities were executed in the two courses. Section 3 details the outcomes of these two activities in the form of student presentations, formal recommendations to the DOS, social media posts, and poster and article submissions. The effectiveness of the activities and their impact on students is evaluated through student feedback. We summarize and discuss these outcomes and the implications for EL in SPD education in Section 4.

II. Methods

Our workshop review consists of two classroom activities implemented by the SPD and Climate Adaptation Science (CAS) classes at the UA. The first semester-long activity combined nine students from SPD and three students from CAS to take part in a public-private partnership that connects university students with the DOS DiploLab (<http://diplomacylab.org/>). The students were divided into three groups to study food, energy, and water (FEW) relationships in the Lower Mekong region. The second activity took place over two hours and was only open to the SPD students. This negotiation activity, called the Mercury Game, split the students into individual groups vying to pass regulations related to Mercury contamination. The authors of this paper were on the water and energy teams for the DiploLab project and participated as

the United States, Tanzania, and Brazil during the Mercury Game.

i. Diplomacy Lab: Climate Adaptation in the Lower Mekong Region

To be chosen for a DiploLab project, the SPD course professors bid on a public project that the DOS staff identified and publicized. The UA professors became aware of DiploLab in spring 2021 and applied to participate late in the spring term. The application was accepted in early summer, with the novelty of our interest in science diplomacy recognized as a unique characteristic for our inclusion in the program.

We were selected to work on the project entitled “Sustainable Water Development and Infrastructure: Develop data-driven policy recommendations to promote Mekong countries’ climate resilience.” This region in Southeast Asia encompasses five countries: Cambodia, Lao People’s Democratic Republic (PDR), Myanmar, Thailand, and Vietnam. As this region has continued to develop over the previous decades the effects of climate change have become more pronounced (Weatherby, 2021). The Mekong River spans nearly 5,000 km from the Tibetan Plateau to the Mekong Delta. Water resources supplied by the Mekong River support food production, energy supply, and water throughout the river basin, and broadly impact local ecosystems and economies. Regional FEW systems are currently stressed, and climate change will exacerbate these conditions as water supplies become increasingly diminished (Hijoka, 2014). The DOS requested that we make recommendations on how they could help the region develop sustainably, with the involvement of women and youth. The goal was to therefore identify policies the DOS could push to help address these issues. These policies could be policies designed to be implemented by the DOS through aid programs, by the national governments of the region, local governments, local groups, or international partners.

Students from the combined courses were introduced to the DiploLab concept on the first day of class. Based on their interests, students were grouped into food, energy, and water teams. The three teams developed and followed the timeline of activities given in Figure 1.

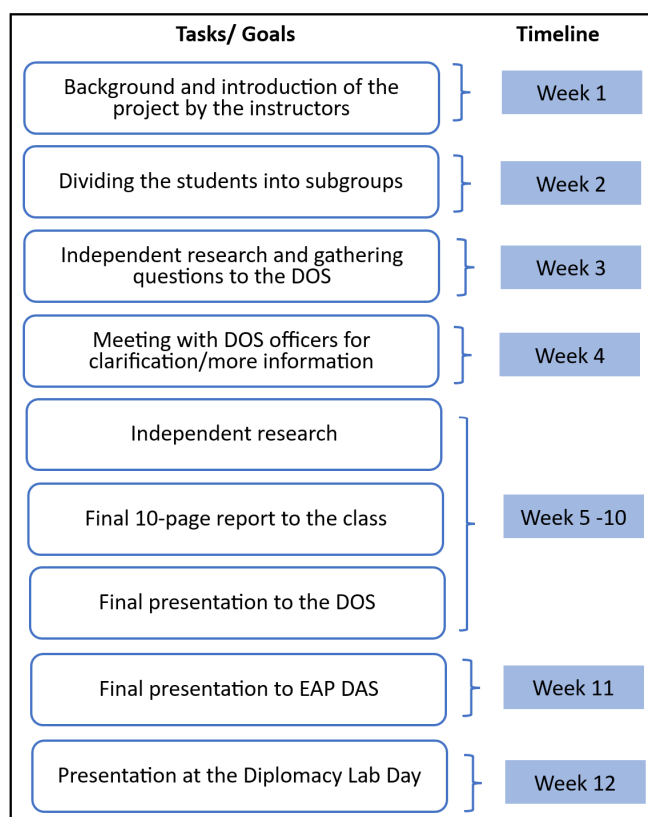


Figure 1: General timeline for the tasks and goals necessary to ensure that the Diplomacy Lab project was completed on time. DOS and EAP DAS stands for United States Department of State and Deputy Assistant Secretary for Multilateral Affairs in the Bureau of East Asian and Pacific Affairs, respectively.

The class met weekly to align the project goals and deliverables. We formulated questions for the DOS to clarify the project goals. We also met with experts on the Lower Mekong to get more information about the region and its people. Based on feedback from this outreach, we identified available data and key problems to be addressed. We reviewed case studies of how similar challenges have been addressed in other areas globally, evaluated the success of those solutions, and identified how they could be implemented in the Lower Mekong region. We posed a set of recommendations (Section 4.1 and A1) and assigned priority rankings based on our confidence that the solutions would be easily and successfully implemented. We presented these findings and dissemination strategies to the DOS during a presentation to the Deputy Assistant Secretary for Multilateral Affairs in the Bureau of East Asian and Pacific Affairs (DAS EAP).

ii. Negotiation Simulation: Mercury Game

The second major experiential learning tool employed in our class was the Mercury Game. The Mercury Game is a negotiation simulation developed by the MIT Joint Program on the Science and Policy of Global Change (Stokes and Selin 2016). The purpose of the simulation is to teach students, using EL, about “how science and policy interact in decision-making” (Stokes and Selin 2014), with a particular emphasis on the environmental sciences. The Mercury Game was chosen as a class activity because it is designed specifically to simulate science diplomacy in action.

The Mercury Game is centered on a mock meeting of the Working Group on Mercury (WGM) established by the UN Environment Programme (UNEP) Governing Council. The goal of the negotiations is to determine if global action is appropriate to regulate mercury. In the context of the game, this discussion is spurred by the release of the International Mercury Assessment. During the negotiations, the WGM must decide on the form and scope of any international efforts for mercury regulation. This must be done while accounting for both the available scientific data and each individual nation's goals.

The specific questions the WGM addresses are:

- Does the WGM feel that global action is warranted?
- What form should future collaborative action take?
- What might be the scope of future negotiations?
- What additional scientific information will be necessary to inform these negotiations?

Several options are presented for each of the questions and the participants are asked to decide which options to implement.

During the game, each student is assigned a role representing a different country or Non-Governmental Organization (NGO). The students are asked to fully encapsulate their role and negotiate based upon given instructions, and not upon their own personal knowledge or preferences. The roles available and those included during our play-through of the simulation are listed in Table 1.

Country/Organization	Comments	Included?
Brazil	Also includes Group of Latin American and Caribbean Countries (GRULAC)	Y
Canada		Y
China		Y
European Union (EU)		Y
Tanzania	Also includes The African Group	Y
United States		Y
The Arctic Monitoring and Assessment Programme (AMAP)	A Working Group of the Arctic Council; student plays as a senior scientist from AMAP	Y
Mercury Free Future (MFF)	Global coalition of environmental groups; students plays as a scientist from MFF	N
World Coal Power Association (WCPA)	Association of global energy companies; student plays as a senior scientist from WCPA	Y*
Japan	Chair, non-voting member	Y*

Table 1: List of Mercury Game Roles. The Comments column provides additional explanation and context. The Included column lists whether a given role was present when our class played the simulation. * indicates that this role was included but was not played by a student from our class.

According to the game rules, the meeting structure is divided into four main sections, including opening statements by participants, a formal negotiation, an informal negotiation, and a final formal negotiation period. Eventually a vote is made to come to a decision on the four items. Only the countries (excluding the Chair) may vote, and any decision must be unanimous. In the universe of the game, a unanimous vote agreeing on a course of action allows mercury regulation to be negotiated at a larger UN body.

In preparation for the game, all students were assigned their roles to familiarize themselves with the entity they would be representing. All students were also provided with a copy of the International Mercury Assessment, the rules, objectives, and schedule for the game, and instructions detailing desired outcomes and redlines for negotiation for their roles. The Mercury Game was played only by the SPD class. During the semester, the SPD class received a guest lecture from an expert with

experience running the game. The expert then virtually observed the game as it was played out in-person on the UA campus. After the game concluded we had a period of discussion and sent out a survey dedicated to understanding students' experiences of The Mercury Game (section 4.2).

III. Results

Each of the activities had two main goals. The DiploLab aimed to put science diplomacy into action through efforts with the DOS, while the Mercury Game enabled negotiation practice. The first main takeaway from the DiploLab was a set of four recommendations to promote diplomatic collaboration in the Lower Mekong states (Section 4.1). This activity also required multiple written and oral presentations delivered to both the DOS and at other conferences (Section 4.2). Finally, student surveys assessed learning through the DiploLab (Section 4.3) and general takeaways from the Mercury Game (Section 4.4).

i. Recommendations for Diplomatic Efforts in the Lower Mekong Region for the United States Department of State

As described in Section 2.1, much of the semester's work was spent researching and developing policy recommendations for the Mekong River Basin nations on sustainable food, energy, and water usage in the Lower Mekong region. The goal of these recommendations was to identify policies the DOS could help enact in the region to lessen the effects of climate change throughout the region. The development of the recommendations was done in small groups. Each group prepared recommendations that would directly impact environmental sustainability, technology and development, and overall supply of resources. Each group then assessed the feasibility of enacting each recommendation and its potential impact. Based on this assessment, each recommendation was then assigned either high, medium, or low priority. In all cases, these decisions included both the implementation and economic feasibility of the recommendations. Care was taken to balance the overall impact to the community and ensure that the recommendations could be implemented by the national governments, local governments, or other groups. All recommendations were aimed at having a broad effect.

All of the main recommendations that we suggested to the DOS are given in Table A1. These recommendations were intended to be implemented by the DOS through aid programs, by the national governments of the region, local governments, local groups, or international partners. Recommendations for the FEW nexuses are color coded via blue, yellow, and green respectively with the topline recommendations bolded in the table. These recommendations are all centered around the three main goals of the Lower Mekong Region for each nexus: 1) develop a shared employable hydrologic vision and identify the environmental values the five Mekong River Basin countries can aim to protect, 2) increase electrical grid resilience while decreasing reliability on fossil fuels and hydropower, and 3) decrease food insecurity and undernourishment in the Lower Mekong.

The water recommendations (blue) focused on developing better water quality and groundwater

monitoring to improve regional health issues, environmental health, and finally, promoting long term sustainability. This recommendation focused on water quality issues related to arsenic and agricultural runoff contamination (Try 2020). The ultimate goal of the recommendation was to increase water security by ensuring monitoring of vital groundwater resources. Additionally, the water team focused on improving gender gaps in water management by promoting an increased understanding of how water management plans will directly impact women and youth, especially those from rural communities. Finally, the water team recommended localized disaster response preparedness to mitigate the impacts of increased climate variability (Eastham 2008).

The energy recommendations (yellow) focused on energy efficiency and demand management, enabling collaborative pathways for multilateral trade, and supporting energy supply in the region. These adaptations are needed to address the large projected energy demand growth in the region over the coming decades (Zhongming 2019). To increase energy efficiency in the Lower Mekong, the energy team suggested increasing technical assistance to adjust regulatory frameworks and municipal building codes to increase energy efficient technology such as roof cooling systems.

The energy team also recommended providing microgrants to fund renewable energy projects and energy infrastructure projects. The hope is that these grants can be used to remove the region's reliance on fossil fuels and hydropower. This is a critical goal, as currently up to two-thirds of the region's energy supply is expected to come from fossil fuels through 2040 (Zhongming 2019). Finally, an increased and continued emphasis on renewable energy sources that are not hydropower (that also has many negative environmental impacts on fishing, sedimentation, and other functions of the Mekong River (Intralawan 2018)) was recommended to Myanmar, Laos, and Cambodia, as these regions are less energy secure (Zhongming 2019).

Lastly, the food team (green) made recommendations that directly touched on the regulatory aspect of food security and enhancing adaptive capacity and resilience. Two specific regulatory goals involved increasing land use

planning to ensure efficient crops yields across generations and decreasing the amount of land degradation across the region. This planning needs to be carried out on both the national and sub-national level. As food production accounts for a large amount of greenhouse gas emissions in the Lower Mekong region, recommendations also touched on the need for improving feed in enteric fermentation and livestock management to limit negative emissions. Finally, the food team recommended the implementation of training programs to provide farmers with educational resources on sustainable farming practices.

Our final focal point was to develop strategies for the DOS and stakeholders to share the recommendations with invested parties and the public in the Mekong Region. Through research into existing climate and social programs in the region, as well as the use of various media sources in the region, we determined three main avenues for dissemination: 1) reaching out to local partners within the educational, religious, and non-profit sectors, 2) seeking connections with traditional media, and 3) increasing emphasis on social media platforms such as Facebook, Instagram, and TikTok.

We suggested that dissemination strategies should employ partners within the local communities, especially religious and educational sectors, as this would empower community members and reach target populations in rural areas. To further reach urban centers, we suggested promoting the Mekong-US partnership (<https://mekonguspartnership.org/>) and current research into the FEW nexuses via traditional media such as news publications and radio programming that could be targeted towards women and youth. Finally, the increase of social media and the importance it has played in news and information transfer across the world and in Southeast Asia, especially among youth, prompted us to provide example social media campaigns, such as #Mekong_and_Me to promote the US-Mekong Partnership while also inspiring communities to celebrate the natural beauty of the Mekong River (Figure 2).

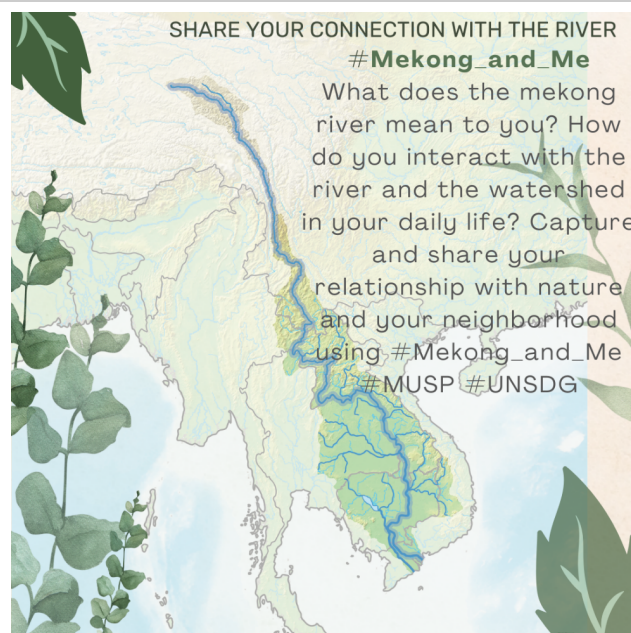


Figure 2: Example Instagram post for the #Mekong_and_Me campaign that allows communities to share the natural beauty that exists within the Lower Mekong region.

ii. Diplomacy Lab: Final Written and Oral Products

The final products for this project were: a report and set of presentations given to the DOS detailing topline recommendations from each nexus group, a presentation at the DOS DiploLab Demo Day (<https://diplomacylab.org/demo-day/>), and two presentations at science diplomacy and environmental conservation conferences. These conferences were the UA Legal Empiricism and Discussion Society (LEADS) and Global Council on Science and the Environment (GCSE). These final products allowed the dissemination of our work into the broader scientific and policy community while also allowing us to develop a better understanding of science diplomacy in action.

From our recommendations, we developed a ten-page summary that included background research into the nexus issues and our recommendations to the DOS. These summaries were then condensed into a one-page summary of background research and recommendations that was presented along with final recommendation tables to the DOS. The week after this presentation was spent finalizing the recommendations, incorporating DOS feedback on feasibility and importance, preparing a one-page report for each

focal area, and prepping the final presentation that was given to the DAS EAP.

In the above two presentations, we had to explain the rationale behind our recommendations, and present them in detail. The feedback we received from colleagues, professors, and the DOS allowed us to prepare recommendations, reports, and presentations that both told the scientific story and demonstrated our ability to distill information down to the most important pieces.

DiploLab Demo Day is a showcase of selected DiploLab projects from the past semester for the broader DOS. **Our project was unique in two ways. First, we emphasized connections between the SPD and CAS classes at the UA. Second, we developed data-driven scientific recommendations and strategies for dissemination in a multinational and multidisciplinary environment.** The LEADS conference was primarily focused on showcasing student research on policy and was put on by the UA James E. Rogers College of Law. For the GCSE conference, we presented on the process of creating recommendations and the case studies that informed our recommendations. Presenting our work to individuals with a variety of educational backgrounds pushed us to express our DiploLab findings in unique, concise, and accessible formats.

iii. Student Takeaways from the Diplomacy Lab

At the end of the semester, students were asked to fill out a survey regarding their experience with the DiploLab project. This survey asked students how working on the DiploLab project changed their perceptions of the Lower Mekong region, climate issues, science diplomacy, and US diplomacy in general. The questions asked and a summary of their responses are listed by category below. Full responses including text comments are provided in the Appendix (A.2).

Foreign Affairs

The first four questions asked students about how the DiploLab project changed their understanding of global issues, including US diplomatic efforts abroad. These questions and the respondents are listed below.

Q1: How has the project improved your knowledge of the Mekong River basin? (N=7)

Q2: How has the project changed your understanding of issues outside of the US? (N=7)

Q3: How has the project changed your understanding of US diplomatic efforts? (N = 7)

Q4: Regarding the above (Questions 1-3), add comments on what or why you responded as you did. (N=7)

The answers to Questions 1-3 are summarized in Figure 3. **Across all questions, the respondents indicated that participating in the project increased their understanding of global issues to at least some extent (Figure 3).**

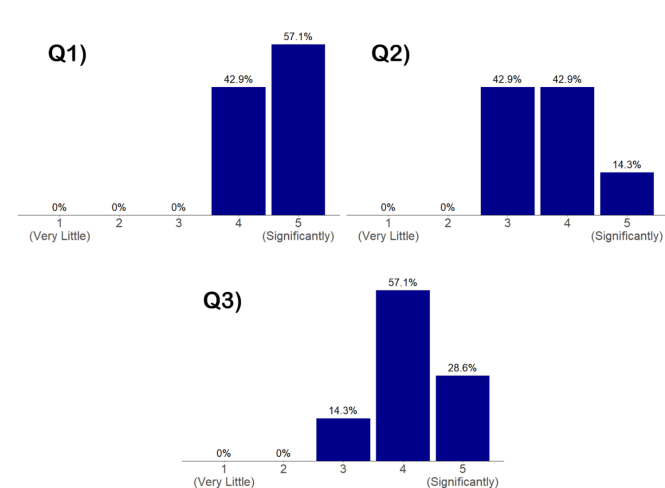


Figure 3: Bar plots showing student responses to Questions 1, 2, and 3. Each chart ranges from 0 (Very Little) to 5 (Significantly). The percentage of students who selected each number is indicated above the bars.

In responding to Question 4, many respondents said that they had very little or no prior knowledge of the Lower Mekong region or US diplomatic efforts abroad. These respondents discussed how working on the DiploLab project gave them insight into these efforts and the complexities of the specific issues faced by the Lower Mekong region. One respondent even said they had extensive prior experience with the region, but that participation in DiploLab still increased their overall understanding of the issues at hand.

General Research, Analysis, and Presentation

The next set of questions asked students if involvement in the DiploLab project helped them develop new skills related to general research projects, including producing final products. These questions and the number of respondents are listed below.

Q5: Identify 2 or 3 important things you learned in the DiploLab project about doing research on an unfamiliar topic. (N=7)

Q6: Identify 2 or 3 important things you learned in the DiploLab project about analysis of information and data. (N=7)

Q7: Identify 2 or 3 important things you learned in the DiploLab project about writing for a target audience. (N=5)

Q8: Identify 2 or 3 important things you learned in the DiploLab project about giving oral presentations. (N=5)

Q9: What were the most challenging and most rewarding aspects of working collaboratively on this project? (N=7)

In responding to these questions, students touched on several common themes that were identified by observing patterns in the tone and content of their responses. Many respondents discussed developing new skills in data collection, aggregation, and analysis. These included learning new techniques, developing familiarity in finding and working with data, and learning how to approach data collection on new topics. Students also indicated that the DiploLab project gave them an appreciation for the importance of understanding a project's goals and context.

When discussing preparing final products, students said that they learned the importance of understanding the target audience. Many students developed skills in condensing work and being able to communicate to groups of varying levels of expertise. Another common theme was the importance of "clear" and "to the point" messaging. Students also indicated that they learned the importance of preparedness and professionalism in these types of reports and presentations.

Students also observed that they learned new teamwork skills. Many respondents discussed learning how to trust and rely on team members,

how to leverage team member expertise, and the importance of delegating tasks. Related to this point, many students also discussed having a newfound appreciation for organizational skills. **Overall, students felt that they learned important skills while working on the DiploLab project that would be beneficial in their future careers.**

Diplomacy Lab Specific

Another set of questions asked students to provide specific feedback on the DiploLab project process. These questions and the number of respondents are listed below.

Q10: Overall, what were the positive elements of the Diplomacy Lab project? (N=7)

Q11: Overall, what were the negative elements of the Diplomacy Lab project? (N=7)

Q12: What additional support would have been helpful for you to be more successful in this project? (N=5)

Q13: How can the Diplomacy Lab project be improved? (N=7)

Q14: Overall, I thought my experience with this project was... (N=7)

Q15: I will recommend that my friends get involved in a Diplomacy Lab project. (N=7)

The answers to Questions 14 and 15 are summarized in Figure 4. **Overall, students had a positive experience with DiploLab and recommended others get involved as well**, with one exception. A primary source of frustration with the project was the sense of unclear expectations. Many respondents felt that the project goals and expectations of the DOS were unclear and confusing, making the project difficult to grasp, especially at first. A secondary source of frustration was the difficulty inherent in coordinating a large group of people. Some respondents said they felt there were no negative aspects to the project.

In terms of positives of the DiploLab project, many students said they enjoyed being able to contribute to a "real world" issue and having the opportunity to apply their knowledge to a tangible accomplishment. Students also talked about how they enjoyed getting to work with a diverse group of individuals and learn about new topics.

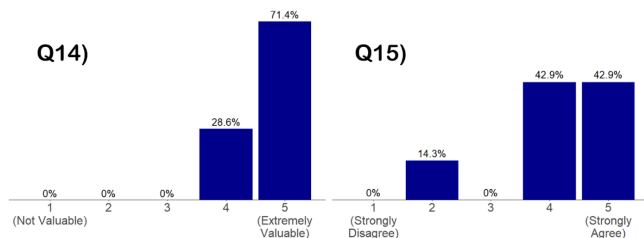


Figure 4: Bar plots showing student responses to Questions 14 and 15. The first chart ranges from 0 (Not Valuable) to 5 (Extremely Valuable). The second chart ranges from 0 (Strongly Disagree) to 5 (Strongly Agree). The percentage of students who selected each number is indicated above the bars.

Other Outcomes

The final questions asked about two different outcomes. These questions and their number of responses were:

Q16: How has the project improved your understanding of climate change impacts and adaptations? (N=7)

Q17: Did participation in the Diplomacy Lab project enhance your interest in policy or science policy as a career? (N=7)

The answers to these questions are summarized in Figure 5. **Students indicated that participating in the DiploLab project improved their understanding of climate change, and generally increased their interest in science policy as a career.** We note that even though one respondent indicated that the project did not increase their interest in science policy as a career, this still indicates that the DiploLab project was useful for clarifying student's future goals.

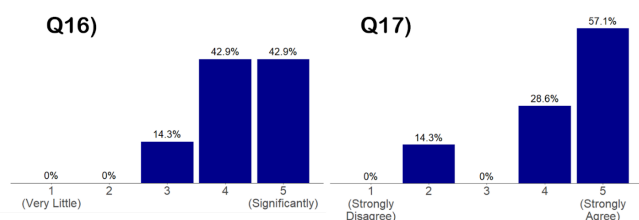


Figure 5: Bar plots showing student responses to Questions 16 and 17. The first chart ranges from 0 (Very Little) to 5 (Significantly). The second chart ranges from 0 (Strongly Disagree) to 5 (Strongly Agree). The percentage of students who selected each number is indicated above the bars.

iv. Student Takeaways from the Mercury Game

Students and other participants in the Mercury Game were polled about their experience after completion of the class. An email survey was sent to participants with the following questions:

- What was your role in the Mercury Game?
- Did the simulated negotiation process unfold as you expected? Why or why not? What most surprised you?
- Did you feel that learning from the Game differed from more standard educational experiences (reading, lecture, etc.)? If so, how?
- What skills did you use during the negotiations that were most helpful?
- Do you feel that the project advanced your understanding of international science-based negotiations? If so, how?
- What was your biggest takeaway/learning moment during the simulation?

Full responses to the questions are listed in the Appendix (A.3).

Five participants replied to the survey. Survey respondents had represented AMAP, Brazil (also representing GRULAC), Tanzania (also representing The Africa Group), WCPA, and the US during the Mercury Game simulation. Analysis of the responses revealed emergent themes in experiential insight, importance of empathy, and essentiality of scientific transparency. Participants gained experiential insight from the experience beyond what they felt they typically gain from standard class assignments or lectures. **Key takeaways were that empathy is key to the international negotiation process, and that scientific transparency is essential for successful science diplomacy.**

Three of the five respondents were surprised by the negotiation skills exhibited by their classmates during the simulation. Four of the five respondents were surprised by the length and disorder of the process, while three of the five felt that the process and resolution – or lack thereof – unfolded as they had expected.

Four of the five respondents felt that the Mercury Game experience was more fun, more engaging, and

provided educational insights beyond traditional classroom learning models such as reading assignments and lectures. Students were also surprised that a resolution was not achieved following brief discussion of the first topic. Survey respondents attested to the value of the experience beyond standard class lectures and reading and writing assignments in that it was more fun and memorable, and provided insight into the nuances of high-stakes international negotiations. One student felt that the scope of the Game exceeded the course, because we were not taught negotiation techniques or intergovernmental processes beforehand, and the class did not cover international law or policy-making procedures.

Three of the five respondents felt that having a solid understanding of all participating entities' perspectives was paramount for a successful negotiation strategy. One noted that they tried to share facts and only facts and leave emotions out of the process; another observed the importance of summative communication skills in successful discussion.

All five respondents acknowledged that the Mercury Game project advanced their understanding of international science-based negotiations. They noted learning why negotiations take so much time, specific challenges of the process, and how the same set of scientific data could be interpreted differently, resulting in disagreement.

Notably, respondents agreed that preparation and empathy were key skills to the negotiation process that unfolded during the Game. They commented on the need to understand the perspectives of students who were representing other nations' interests and that asking open-ended questions about these perspectives was essential to finding avenues for compromise. Similarly, respondents agreed that the simulation helped them understand the complexities of international negotiations, and why such treaties take significant amounts of time to create among multiple parties.

Three of the five respondents noted that their biggest takeaway was realizing the difficulty and challenges of achieving consensus during international negotiations. Two of the respondents

observed that a key takeaway was the importance of transparent, evidence-based science.

Overall, survey respondents identified two main takeaways from the Mercury Game experience: 1) the pivotal role of scientific and data transparency in science-based policy negotiation, and 2) the importance of cultivating empathy and understanding for the perspectives of the actors involved.

IV. Discussion

The emerging SPD field is increasing in importance as there is an increased emphasis on science to inform policy. Many of the larger scientific questions such as incorporation of Artificial Intelligence into the workplace, nuclear proliferation, water scarcity, sustainable development, and even climate change require integrated science and policy solutions. That said, there are still limited avenues to actually train students in the use of science policy (Hobin et. al. 2012, Maudit and Gaul Soler 2022). Therefore, there is a need for freely accessible tools to implement SPD training in educational institutions. This paper demonstrating the learning outcomes from experiential learning in science policy can be a key resource in creating accessible and informative tools to actively engage students in SPD.

From our survey responses and reflections, we were able to look at the direct student outcomes from participating in EL (Section 3.3, Section 3.4) and the lessons we learned from employing EL in a classroom setting (Section 3.3). The direct outcomes support the inclusion of EL in a classroom setting as student understanding of science policy and negotiations were greatly improved through both activities. The lessons learned can be used to successfully implement EL in other university courses.

i. Direct Student Outcomes from Experiential Learning

The above surveys had two main goals: 1) assess if EL via DiploLab and The Mercury Game increased understanding of international science policy practices and 2) determine key takeaways from student perspectives. With these goals in mind, we asked questions that allowed students to self-assess how their knowledge of certain issues such as

climate change, the Lower Mekong region countries, and science negotiations improved over the course of the semester (Figures 3-5).

We also asked open-ended questions where students could write about their takeaways to ensure that students were able to discuss the outcomes they experienced without our input. We do note that significantly more time was spent on the DiploLab project compared to The Mercury Game, therefore this discussion strongly emphasizes the survey results from the DiploLab project.

For our first objective: assessing student learning of international science policy practices, **we found that overall students saw increases in their understanding of science policy in practice and science-based negotiations through both The Mercury Game and DiploLab** (Figure 5). First, the DiploLab increased student understanding of climate change, issues related to the FEW nexuses in the Lower Mekong region, as well as how the DOS employs science to support diplomatic efforts. Second, **students gained technical skills such as the ability to perform literature reviews and data analysis, experience working collaboratively with large teams, as well as presentation and scientific writing skills** (*General Research, Analysis and Presentation*). These concrete skills tied directly into the learning objectives for the course and allowed students to develop necessary skills related to practicing SPD (i.e., memo writing, oral presentation, information distillation, and risk assessment). Finally, **in addition to understanding science diplomacy, The Mercury Game in particular enhanced student knowledge about science-based negotiations** and how empathy and understanding the political, economic, and social bounds countries have in negotiations enhances the ability for collaboration in science negotiations (*Takeaways from the Mercury Game*). All respondents noted that increased empathy, creative problem solving, and the full negotiation periods would have provided an avenue for the Mercury Game simulation to run smoother.

This idea of empathy and understanding another's perspective was a key takeaway that students noted during both the Mercury Game, as mentioned above, but also during the DiploLab, specifically when it came to the DOS (Figure 3, *Takeaways from Mercury*

Games). As most of the students had no previous experience working with the US government, the focus of the DiploLab was ensuring that the key deliverables were met when writing and presenting so we could provide products that were useful for their intended audience. This was especially crucial when developing recommendations and solutions based on literature reviews, as an understanding of who would use these recommendations was a key consideration. Since we were students studying at a US institution, we relied heavily on case studies from similar socioeconomic and international areas to the Lower Mekong to determine the overall feasibility of our solutions. In fact, all students noted that understanding the solutions provided, the intended audience, and the impact on the people using the solution increased understanding of the issues at hand.

ii. Lessons Learned for Implementing Experiential Learning in a Classroom Setting

Our survey results also highlighted students' challenges in implementing EL in the classroom. Students expressed challenges such as time commitments, lack of local involvement, and lack of direction as to where the DOS saw the recommendations being implemented. Some of these frustrations resulted from late acceptance into the DiploLab program and the fact that this was the first DiploLab project granted to the UA. While our meeting with UA experts who worked in the Lower Mekong region countries helped increase understanding of the local political and social climates, most of the science work was done through literature review without speaking to local experts, which could be improved upon in future projects. Finally, workshop meetings with the DOS were viewed as extremely helpful (*DiploLab Specific*), yet there was a desire to see more of the diplomatic process of implementing these recommendations and what it might look like on the ground, especially with the social media campaign. Despite these challenges, students still gained a plethora of skills and knowledge surrounding science diplomacy and negotiations and would recommend this course to their peers (*General Research, Analysis, and Presentation, DiploLab Specific, and Takeaways from the Mercury Games*).

The SPD course demonstrated that EL requires a significant amount of time (both in preparation and practice) to ensure success. It is necessary to structure EL activities so that students have clarity on the projects and overall timelines. Timing, scheduling, and planning are key components of this and the more planning and scheduling that happens on the front end, the easier it is to fulfill curricula and ensure positive outcomes.

In employing semester-long components of EL in a classroom setting, we highly suggest implementing a timeline as seen above (Figure 1) with specified dates marked at the beginning to ensure students stay on track. We also highly recommend allotting specific time during class for students to touch base on their deliverables and check in with instructors and collaborators.

We believe this can be implemented with pre-reading for class discussions or external lectures that relate to class material. Additionally, free EL materials are readily available to simulate negotiation that can be used in a variety of settings (Stokes and Selin 2016). This makes it easy for students, faculty, and staff to pull material that will be useful for gaining experience in science policy and diplomacy.

This said, **we highly recommend that faculty apply for DiploLab projects, utilize the numerous**

resources for science-based negotiations, and work on relating class projects to current world issues. Not every EL tool requires the involvement of the DOS, as instructors can and should employ final projects that focus on building skills through EL by using model UN negotiations, DiploLabs, and class projects that employ recommendation-building and presenting. Some of these tools, such as the Mercury Game, are already freely accessible online (Stokes and Selin 2016), while others may require faculty and staff to develop scientific questions or create their own resources.

Multifaceted and challenging problems in the world such as climate change and sustainable development require diplomatic involvement to ensure the policy implementations can be aligned with current scientific research. The results of our surveys demonstrate that EL is beneficial for increasing student awareness and participation in SPD. Since SPD is a relatively new field of study, although not a new field of work, this increased awareness and participation is vital to the field's growth. In fact, almost all the students in our survey stated that they would be interested in working with the DOS on other SPD efforts. To better integrate scientists into important foreign policy decisions. Therefore, **we believe that higher education institutions should prioritize EL in SPD courses and students should seek out EL to practice SPD.**

Appendix

A.1 Full Diplomacy Lab Recommendations

Table A1: Table denoting all the high priority recommendations for the water (blue), energy (yellow) and food (green) nexus as presented to the DOS. The highest priority recommendation is bolded in each section.

Type of Solution	Issue	Solution	Indicator	UN SDG	Priority	Confidence
Environmental	Arsenic, Carbonate, Fluoride and other contaminants in water resources	Increase water quality testing in appropriate intervals and create a database to upload water quality	Centralized water quality database that is updated biannually	Clean Water and Sanitation; Life on Land	High	High

		measurements. Educate farmers and villagers on eco friendly farming (less usage of pesticides and fertilizers)				
Infrastructure	Lack of groundwater monitoring leads to over extraction of aquifers	Develop monitoring wells within each aquifer to measure water levels monthly/bi-annually	Real time pumping data for each aquifer based on the biannual values	Sustainable cities and communities; Clean Water and Sanitation; Life on land	High	High
Management	Gender gaps in water management	Increase understanding of gender discrepancies in water management plans by developing task force to investigate current water management practices to see how to make them more equitable; include local women's groups and non-governmental organizations into the dialogue when creating future water management strategies	Detailed report on current and predicted water management plans and their impact on women and youth	Gender equity; Life on Land; Good Health and Well Being	High	High
Community Based Resilience	Increased severity of climate-driven disaster	Localize disaster response planning by utilizing/reinfo	Town-specific assessments of existing communicati	Sustainable Cities and Communities; Industry Innovation and	High	High

	affecting rural communities	encing existing communication networks in rural communities to transmit disaster warning; Training local leadership in evacuation planning and running of drills in rural communities	on networks; Improvements to speed of disaster event reporting/community information transmission ; Number households with disaster plan in place	infrastructure; Life on Land		
Energy Efficiency and Demand Management	The low energy efficiency of appliances, particularly cooling devices (AC), is driving energy demand growth.	Technical assistance for adjusting sub-national regulatory frameworks and municipal building codes to increase energy efficiency of buildings, including minimum energy standards, passive survivability, electrification standards, cool roofs, and other best practices	Percent of sub-national provinces or municipalities with codified energy efficiency building standards.	Affordable and Clean Energy; Industry, Innovation and Infrastructure; Sustainable Cities and Communities; Climate Action	High	Medium
Collaboration: Enabling environment for multilateral trade	Current energy mix relies on fossil fuels and hydroelectricity (causing environmental and social damages), despite resource availability and financial	Grant funding for renewable energy and energy infrastructure projects in exchange for executed cooperative multilateral trade agreements	Percent of nations or sub-national provinces with independent electricity regulators, or agreements made toward the establishment	Affordable and Clean Energy; Industry, Innovation and Infrastructure; Sustainable Cities and Communities; Climate Action, Life on Land	High	High (evidence this is happening, lack understanding of the outcomes) Bilateral trade, grid interconnectivity, and power

	feasibility of renewable energy. Differences in disparate national regulatory frameworks impede electricity trade.		t of an independent regional oversight body.			purchase agreements help fill gaps in energy supply and demand but may create influential power dynamics in terms of power generation investment decision making (Stimson).
Energy Supply	Although the region is expected to increase its amount of renewable energy, it will also increase use of natural gas and have a fossil fuel trade deficit.	Continue investments in non-hydro renewable energy projects. Should be localized to countries such as Lao, Cambodia, and Myanmar that are less energy secure than the more developed countries in the region. Broad scale and distributed for meeting 100% energy access goals	Percent of power generation from renewables / Projections for future natural gas reliance	Affordable and Clean Energy; Industry, Innovation and Infrastructure	High	High
Regulations	Land degradation	Land use planning and other regulations to ensure crop cultivation is sustainable in the future	Planning is being done to ensure the sustainable use of land for agriculture purposes	Zero Hunger; Clean Water and Energy; Sustainable Cities and Communities; Responsible Consumption and Production	High - Land degradation directly affects the sustainability of food production	Medium - while this is promising and has been implemented in most of the countries, there is little data about whether or not these

						programs are "successful"
Regulations	Food production accounts for a significant percentage of GHG emissions in the region	Improved feed in enteric fermentation; livestock management; dome digesters in manure management; incorporation of off-season straw in rice cultivation; demand side changes such as change in eating habits and reduction of food waste.	GHG emissions by percentage	Zero Hunger; Good Health and Well Being; Industry, Innovation, and Infrastructure; Responsible Consumption and Production	High - CO2 emissions increase the rate of climate change, creating greater vulnerability.	High - with proper monetary resources, there are new technologies that could provide alternatives, i.e. Fossil fuels
Enhancing Adaptive Capacity and Resilience	As farmers will be forced to adapt, they may lack the knowledge or skills to transition to new crops or alternative methods	Provide training and learning opportunities to farmers in various sustainable agriculture practices	The adaptive capacity of farmers is increased and communities become more resilient	No Poverty; Zero Hunger; Gender Equality; Decent Work and Economic Growth; Industry, Innovation and Infrastructure; Sustainable Cities and Communities	Medium - It is important to increase knowledge, which can occur over time.	Medium - while many countries are implementing this solution, little data exists showing whether this type of solution is successful on a large enough scale

A.2 Diplomacy Lab Survey Responses

Responses have not been edited for spelling or grammar.

Q1: How has the project improved your knowledge of the Mekong river basin? (N=7)

- See Figure 4

Q2: How has the project changed your understanding of issues outside of the US? (N=7)

- See Figure 4

Q3: How has the project changed your understanding of US diplomatic efforts? (N = 7)

- See Figure 4

Q4: Regarding questions 1-3, add comments on what or why you responded as you did. (N=6)

- When I took the course I didn't had heard of Mekong river, haven't seen diplomacy in action. This gave me the opportunity to explore and research an issue in the world and come up with recommendations. The whole process was full of learning experiences, briefing, presentation preparation understanding what's the state department needs. Catering our findings to what they need was super insightful.
- I did not know anything about the Mekong going into this project, so this was a great opportunity to learn about the region and the problems they face. It really helped me contextualize greater geopolitical concerns in East Asia and gave me a better understanding of the region. It was very information to see how some of these State Department efforts work and how they approach these foreign policy issues.
- I have visited the region and volunteered with the Peace Corps, so while the project increased my understanding in many areas, this wasn't entirely new.
- I understood a little bit about the developmental challenges with hydropower and the outreach work the US had done in coastal management in southeast Asia, but before this class I didn't have a strong understanding of the larger US mission or who they employed. I also didn't fully understand the complex geopolitical issues in the Mekong region or exactly how the food, water, energy nexus could be a diplomatic mission.
- I had only a very general awareness of the Mekong region and it's challenges prior to this course. The diplomacy lab gave me an opportunity to learn much more about all of these topics.
- I was ignorant on diplomatic relations topics and thought sparking change is easy if you really wanted to do it. But being put in such a project where we had to focus on three different areas (energy, water, food), I could see how solutions to one area could be a problem for another. Very interesting class.

Q5: Identify 2 or 3 important things you learned in the Diplomacy Lab project about doing research on an unfamiliar topic. (N=7)

- 1) Not to get overwhelmed by the information out there, but to narrow down and gather the information you need from large amount of resources. 2) You need to talk to the people who are familiar with the topic as a start to get an idea on what you are about to dive in. 3) team work and having proper plan on what each person should do and frequent meetings to see whether we are on target on planned action items. and fill in every one to bring them on same page on what you have researched in order to avoid repetition of work.
- I gained some important skills in learning how to break up large questions into manageable chunks that make it much easier to get started on researching a completely novel topic.
- It can be really overwhelming to dive into such a huge topic area. Working with others can help divide the work but can be challenging too. Starting with trusted research institutions is a good place to start.
- Sometimes you have to do research to determine the research question and having teammates you can trust and rely on is really important
- 1) How to prioritize what research to do first and what was extra (i.e. looking at water management across the region vs site specific areas). 2) Understanding the larger geopolitical elements and how each area is interacting with the surrounding 3) The importance of sharing responsibilities and tasks.
- 1) Cast a wide net and filter for relevance; 2) Skim source material to determine topic and depth and only dive in on particularly relevant items; 3) Look at multiple source types (for example, watching video tours of the Mekong helped me develop a mental picture of the cultures and place that I did not get from reading peer review papers).

- I learned that it takes a long time to do quality research on an unfamiliar topic. You first just have to dive in to the topic and figure out what the important facts are that need closer attention to detail. I learned its easy to fall in to biases with unfamiliar topics because you don't know any better about the topic anyway.

Q6: Identify 2 or 3 important things you learned in the Diplomacy Lab project about analysis of information and data. (N=7)

- 1) find reliable sources. 2) many cases we didn't have continuous data in a particular source. 3) Different resources had it in different units might be or researched on different conditions which is harder to compare
- I feel like I strengthened my skills in aggregating information from many sources and organizing it in a way that made it possible to use that information to address specific questions. Specifically, I was able to improve my organization and note taking techniques to make this easier.
- case studies are considered data
- I had never done a literature review before so I learned a lot about research methods and organization of collated data.
- 1) Looking for trends between articles to see how one factor (i.e. climate change) can affect others (i.e. water scarcity). 2) Really diving into the analysis done to see what broader implications it might have on security in the region as a whole.
- 1) Check dates - old data isn't very helpful; 2) Cross-reference sources to ensure consistency and determine causes of inconsistent information; 3) graphics are great.
- I learned a lot about comparing statistics across various platforms. Since we were studying a region out of the US it was important to get US found data, but even more important to get data from other countries as well. This leads to less bias and more accurate data. I also learned that it can be quiet hard to get the data that you need to make suggestions due to the lack information being provided by a specific region. Sometimes you can only infer but you don't know for sure.

Q7 Identify 2 or 3 important things you learned in the Diplomacy Lab project about writing for a target audience. (N=5)

- 1) summarizing your 10 page report to a 1 page summary was a challenge. Had to 1st identify what is our key message that we want to deliver, and what area he key information that is important to support that recommendation/idea. 2) Have levels of information within the 10 page document. Understanding the audience will be not super interested on reading a whole bunch of words, highlighting (bold phase) the key message of each paragraph. 3) short sentence, to the point sentences are more effective rather lengthy sentences in delivering your ideas to another person
- This projected reinforced previous writing techniques I learned such as how to condense information, how to highlight key points, and how to structure a document with a clear narrative to help get a point across.
- 1) Knowing the motivation as well as prior background helped target the information to that audience. 2) Distilling information down to the 2-3 key points that are necessary for understanding and emphasis
- 1) Know who your target audience is and their level of prior knowledge on the subject material; 2) Write at a level and length appropriate for your audience; 3) Don't assume they will take your meaning if you don't spell it out.
- I learned that it can be quite difficult to get the magnitude of your point across when you put it in simpler terms. Also learned that when writing for a target audience, it is important to keep it short and sweet.

Q8: Identify 2 or 3 important things you learned in the Diplomacy Lab project about giving oral presentations. (N=5)

- 1) To manage your time and use it effectively, need to practice. 2) For your talk you have to have your slides prepared by yourself this help to know your material better hand boost your confidence. 3) Professionalism in a presentation gives your audience a good impression on how carefully crafted your presentation is.
- This project reinforced previous lessons I learned such as the importance of practicing presentations multiple times, reducing the amount of text on slides, and sticking to time limits.
- 1) How to make a clean yet concise PowerPoint that encompasses and merges information from a variety of groups. 2) How to include the necessary information but also predict potential questions that the audience may ask
- 1) Prepare and practice in advance; 2) It's common to read from a script for professional statements during a presentation; 3) Presentations even at the highest level are still just organized conversations.
- I learned that when giving an oral presentation, it is important to keep is as to the point as possible. Then when you have visual representations, more pictures/graphs is better than a bunch of words. The words you would put on the screen should be the words that come out of your mouth.

Q9: What were the most challenging and most rewarding aspects of working collaboratively on this project? (N=7)

- challenging - understand the scope of the project and figuring out what's your role is within the team, and as a whole class. rewarding - came to know a really enthusiastic set of colleagues, passionate professors and was able to present to the state department. As an international student I think this is a great opportunity and a reward for my future advancement. It wasn't been possible unless for this Diplomacy Lab. Self satisfaction in putting the final PowerPoint together and to see it was a success.
- Working in groups made the work feel less daunting and allowed us to rely on each other's skill sets. Having a variety of voices also allowed for the inclusion of new ideas that made the work better. However, organizing around people's schedules and making sure people were sticking to deadlines introduced challenges to the work.
- Learning new methods, styles, and ideas from classmates was great! Synergistic brainstorming was fun. Logistics of outside-of-class collaboration time, clearly defining expectations and distribution of work between group members and across classes, and consistent communication with team members were challenging.
- The most rewarding aspect of working collaboratively was getting to meet and work with the other members of my group. We worked really well together and balanced each other out among our personal strengths and weaknesses. The most challenging aspect of the collaborative work on this project was coordinating between the two classes. There was a lack of oversight that led to different types of efforts happening between the groups and because there were two different classes involved, roles were not clearly defined at the outset.
- most challenging: managing all the time conflicts and other responsibilities that everyone in each group had. most rewarding: pulling the project together over the course of the semester into a finished project for the state department
- Most challenging: coordinating schedules for meeting and homogenizing our writing styles. Most rewarding: the breadth of knowledge and perspective everyone brought to the table.
- It was challenging to work with individuals of differing backgrounds because we think about topics in a different way but at the same time that is what made the collaborative project rewarding, seeing how many different backgrounds could come together for a single project.

Q10: Overall, what were the positive elements of the Diplomacy Lab project? (N=7)

- 1) Being able to utilize your knowledge for a world's issue. 2) Learn about prevailing issues in the world. 3) Meet with great people and the exposure to diplomacy in action

- It allowed me to get real policy experience, taught me about climate change, increased my understanding of global issues, and gave me experience with a topic I wouldn't otherwise have engaged with.
- developing a case studies matrix yielded tangible examples of strategies and lessons
- Working collaboratively with the climate group.
- presentation to the state department, developing recommendations that will be accounted for, a sense of accomplishment after noting all the work that was done and how well it came together
- The sense of contributing to a real-world challenge; the opportunity to learn professional skills in writing and presenting; the expansion of my worldview; connections made with classmates and colleagues.
- The positive elements were the public speaking aspect for me, it helped me get out of my shell.

Q11: Overall, what were the negative elements of the Diplomacy Lab project? (N=7)

- None come to my mind
- The timelines and expectations were very confusing, especially at first. This made it difficult to structure the early parts of the project and made it seem way more intimidating than it really was/needed to be. I still think I never fully grasped what the real expectations of the State Department were, especially with regards to dissemination. I got some sense that part of this was that they didn't really know what they wanted from us either, but rather just knew dissemination was an important area they should be paying attention to. It was also difficult having two different classes working on the project, it would have been much simpler logistically if all the students were in the same course, focused on the project.
- out-side-of-class collaboration time, unclear expectation of deliverables and distribution of work
- The lack of guidance, organization, and coordination from professors about how the two classes would collaborate, as well as between the three groups. I think it would have been useful to discuss early on the structure of the papers so they would have been more cohesive in format and the type of information discussed.
- time management for me was hard, determining what information was useful and what information was not useful, finding avenues for the state department to add onto existing research in gender and water
- A strong sense of imposter syndrome (why didn't the DOS just ask the professionals for a white paper on this topic?); not enough time to learn as much as we could have; not enough time to prepare a more streamlined and professional report.
- N/A

Q12: What additional support would have been helpful for you to be more successful in this project? (N=5)

- I know professors asked us whether we need another meeting with the state department staff, and we said no. but after the meeting on 12/10 with [our State Department contact] we realized he intensively wanted to see the dissemination strategies. So it would have been good if had met with them before sending the report to kind of update the progress, or clear up final moment miscommunications/issues.
- Much clearer timelines and guidelines in terms of expectations and deliverables earlier on in the project. Also organizing into smaller subgroups earlier in the semester to get started. More time to discuss dissemination as a group before the project due date.
- more direct feedback from the state department or faculty across the breathe of the project about recommendations and overall presentations/papers
- More time for report-writing and revision; more time to coordinate results between our three teams; a template for white papers and the final report from which to work; suggestions of relevant research sources.

- I think increased collaboration with individuals from the Mekong would have made this project even more impactful, i.e. allow them to lead our project more.

Q13: How can the Diplomacy Lab project be improved? (N=7)

- joining hands with students from the regions of interest (The issue) , to help the students here in USA better understand their local environment and what the challenges are
- Spelling out very clearly the expected project scope, project deliverables, and types of desired recommendations early in the project.
- have expectation of deliverables, roles, and time frames defined as early as possible in the semester. Assign a team lead to each group. Every group should have a grad student.
- I think the work the climate group did addressed the climate change and proposed solutions aspect of the project, however the work from the diplomacy class seemed to focus more on background information that diplomatic relationships in the region. I think the State Department might have benefitted even more if, once explaining climate impacts in the region, implemented solutions, and adaptation recommendations, the project then discussed how these solutions could potentially be implemented within the existing diplomatic relationships between countries and where challenges might lie. The exploration of the political relationships between the Mekong countries seems like something that should have been addressed as well.
- Response about course structure and not Diplomacy Lab specifically
- More writing and editorial review guidance; better explanation of the need and relevance of having students (rather than subject matter experts) prepare these recommendations; a more succinct request from the DOS.
- N/A

Q14: Overall, I thought my experience with this project was... (N=7)

- See Figure 5

Q15: I will recommend that my friends get involved in a Diplomacy Lab project. (N=7)

- See Figure 5

Q16: How has the project improved your understanding of climate change impacts and adaptations? (N=7)

- See Figure 6

Q17: Did participation in the Diplomacy Lab project enhance your interest in policy or science policy as a career? (N=7)

- See Figure 6

A.3 Mercury Game Survey Responses

Responses have not been edited for spelling or grammar.

Q1: What was your role in the Mercury Game?

- I honestly don't remember the name, but it was an arctic NGO acting as a scientific informant.
- I was Brazil, also representing GRULAC.

- Tanzania and the representative for Africa
- My role was to advocate on behalf of the World Coal Power Association (WCPA).
- The United States of America.

Q2: Did the simulated negotiation process unfold as you expected? Why or why not? What most surprised you?

- I did not expect any particular outcome, but I was surprised by the negotiation skills of my classmates because we didn't have much opportunity to get to know each other in class.
- I was surprised by how well some people inhabited their roles. I was also surprised how long we took. I expected the chair to be more forceful in moving the discussion forward and for there to be more structure in terms of what the discussion was about. Other than this, the negotiations, including the difficulties, unfolded about how I expected they would.
- Not exactly, I thought that we would have been able to reach a consensus on the first talking point fairly quickly, but we were unable to. That being said, I definitely gained an appreciation for the length of time negotiations take and the balances needed. I was surprised by how much the person who played China refused to cooperate. In reflecting, we understood his position, but instead of trying to push us to other areas where cooperation could take place, this person appealed to emotions and pushed against any potential collaboration. This is probably how negotiations go in some cases, but it was a little surprising.
- I had never participated in a simulated negotiation, so the whole experience was new to me. I had expected the group to come to some kind of consensus eventually, as that was the whole goal. But as soon as negotiations began, it was clear that each representative had their own clearly defined limits of what they could or could not accept, which made finding any consensus impossible. I was surprised we spent so long discussing, and really didn't make much headway at all.
- The process unfolded more messily than I expected. It seemed negotiators got stuck several times in a repetitive cycle, each restating their positions without making headway toward resolution. I think I had expected more rigidity and timeliness in progression of the discussion, while it felt more like a heated conversation. I was surprised by how emotional the topic became for myself and seemingly, for other participants.

Q3: Did you feel that learning from the Game differed from more standard educational experiences (reading, lecture, etc.)? If so, how?

- This was more fun than a normal day in the classroom, however, I don't think it necessarily taught me anything more because we didn't discuss negotiation techniques or learn about negotiating in an inter-governmental setting beforehand. Therefore, I didn't know what learning experience I was meant to take away from it.
- The hands on experience of the game definitely provided insights that just reading literature couldn't provide. It allowed me to see the nuances of how these discussions unfold and really understand some of the difficulties in science diplomacy negotiations.
- I feel like I learned more about the nuances of negotiations and the ways in which we have to approach problem solving than if I was simply reading a book. I learn by doing, so this was a great way to get a hands on approach to negotiations and problem solving.
- I think it was much more memorable than hearing a lecture or reading a chapter about negotiations. Once you are in a debate with another person and you are responsible for trying to concede or hold your ground, it's a very different experience. I think simulations like this are very useful, not just for negotiations, but for many other lessons on human interaction as well!
- Learning from the game definitely differed from standard educational experiences! It was much more involved; I felt like an actual participant in the proceedings as opposed to reading about a process. I had the opportunity to understand the complexities and emotions of the process, which isn't typical of standard classroom experiences.

Q4: What skills did you use during the negotiations that were most helpful?

- I tried to present facts and only facts as that was my role. I inserted these facts when I felt they supported what a diplomat was saying. I don't know if this was helpful or not.
- Being able to see an issue from someone else's perspective was definitely key. As was being able to quickly articulate thoughts. Overall, since this was a role playing exercise, improvisational skills were really helpful.
- Asking questions, finding avenues where parties could agree, looking at the tradeoffs between countries and ways to balance those. I did have an idea to reach out to China to see what would be needed to move forward, but I did not implement that in the simulation.
- I found that preparation and having a full understanding of different possible viewpoints were very helpful in conveying the confidence needed to sway others' opinions. Understanding where they are coming from and what they ultimately want as the outcome was so useful in finding common ground, which was really the only hope we had of reaching a conclusion.
- The skills I found most helpful were the ability to paraphrase and summarize in order to communicate my position. The scenario didn't run for very long, but I already knew that patience would be a useful skill as well. It was also helpful to be able to keep track of various parties' positions and stipulations, in order to look for opportunities to compromise or form alliances.

Q5: Do you feel that the project advanced your understanding of international science-based negotiations? If so, how?

- It made me understand how difficult it can be when everyone is representing an entire country, and their criteria can be rigid.
- The project definitely helped me better understand international negotiations. The game showed me the challenges involved in these discussions, the importance of being flexible, the frustrations of dealing with other people's redlines, and how people can twist facts to suit their purposes.
- It gave me insights into why negotiations and science policy take so much time as it may not be that everyone disagrees with the science, but may be unable to reach a consensus based on political, economic or social desires.
- It became clear by the end that the science could be interpreted many different ways, depending on the ulterior motives of the person reading/interpreting them. So even though we had the same data, some were interpreting it as an indicator of something larger, and some were interpreting it as an indicator that more data should be collected—resulting in two very different stances. It also makes a little more sense to me why more doesn't get done at large negotiation meetings, whether on an international or even just a national level (such as Congress); when each person comes with their own agenda (or that of their leaders or constituents) and what they are willing or not willing to agree to, it becomes very hard to have the leeway necessary to find a compromise and consensus.
- Yes, the scenario advanced my understanding of international science-based negotiations. It did this by demonstrating, with a plausible, real-world situation, how negotiations are incredibly complex and involve navigating the intricacies of compromise with competing entities. It also demonstrated the standard process of international negotiation, helping me to learn why it often takes a long time for policies to be agreed upon.

Q6: What was your biggest takeaway/learning moment during the simulation?

- It can be difficult to come to a consensus during international negotiations.
- It gave me a much better appreciation for international diplomatic efforts and the skill and hard work that goes into them.
- I really enjoyed the simulation. My biggest takeaway was how important understanding the different components at play for each party is in negotiation. I think the process would have been a little smoother if we were able to understand the constraints China had as well as other organizations.

- My biggest takeaway from the experience was twofold: that transparency in science and how data was interpreted is key when using it as evidence to base decisions on; and that understanding the motivations, desires, and concerns of the other people in the room gives you the best leverage to find common ground and eventually reach a consensus.
- My biggest takeaway was that in order to efficiently advance science policy, it is essential to have thoroughly researched and data-driven solutions ready at hand, distilled to easily understandable information for non-scientists, and incorporating the requirements of the various parties involved. It would be an interesting challenge to take the problem and requirements of all the entities involved and try to devise a solution that meets all the demands as nearly as possible.

References

- AAAS, 2010. "New Frontiers in Science Diplomacy." American Association for the Advancement of Science (AAAS), accessed 08/11/22, https://www.aaas.org/sites/default/files/New_Frontiers.pdf
- AAAS. 2022. "Science Diplomacy Education Network." American Association for the Advancement of Science (AAAS), accessed 05/22/2022. <https://www.aaas.org/programs/center-science-diplomacy/education-network>
- Dartmouth College. 2022. "ENVS 80.08 The Practice of Science Policy & Diplomacy." Office of the Registrar Online Course Catalog, accessed 05/22/2022. <http://dartmouth.smartcatalogiq.com/current/orc/Departments-Programs-Undergraduate/Environmental-Studies-Program/ENVS-Environmental-Studies/ENVS-80-08>
- Eastham, Judy, Freddie Mpelasoka, Mohammed Mainuddin, Catherine Ticehurst, Peter Dyce, Geoff Hodgson, Riasat Ali, and Mac Kirby. "Mekong river basin water resources assessment: Impacts of climate change." (2008).
- EU. 2022. European Union Delegation to the U.S. - Schuman Challenge (EU) accessed 05/13/2022. <https://events.euintheus.org/events/schuman-challenge/>
- EUEA. 2022. "What is Science Diplomacy?". European Union External Action (EUEA), accessed 07/15/2022. https://www.eeas.europa.eu/eeas/what-science-diplomacy_en.
- Hijioka, Y., E. Lin, J.J. Pereira, R.T. Corlett, X. Cui, G.E. Insarov, R.D. Lasco, E. Lindgren, and A. Surjan, 2014. "Asia." *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* pp. 1327-1370.
- Harvard University. 2022. "Science, Technology, and Public Policy Program Description ". Harvard University – Kennedy School, accessed 05/25/2022. <https://www.hks.harvard.edu/courses/science-and-technology-domestic-and-international-policy>
- Hobin, J. A., and R. A. Galbraith. 2012. "Engaging basic scientists in translational research." *Federation of American Societies for Experimental Biology Journal* 26:2227–2230. doi: <https://doi.org/10.1096/fj.12-0601ufm>.
- Intralawan, Apisom, David Wood, Richard Frankel, Robert Costanza, and Ida Kubiszewski. "Tradeoff analysis between electricity generation and ecosystem services in the Lower Mekong Basin." *Ecosystem Services* 30 (2018): 27-35.
- Kolb, A. Y. , and D. A. Kolb. 2005. "Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education." *Academy of Management Learning & Education* 4:193-212.
- Mauduit, J.-C., and Soler, M. G. 2020. "Building a Science Diplomacy Curriculum." *Front. Educ.* 5. doi: <https://doi.org/10.3389/feduc.2020.00138>.
- Melchor, L. 2020. "What Is a Science Diplomat?" *The Hague Journal of Diplomacy* 15:409-423. doi: <https://doi.org/10.1163/1871191X-bja10026>.
- Paikowsky, D. , and Tzezana, R. 2018. "The politics of space mining – An account of a simulation game." *Acta Astronautica* 142:10-17.
- Stokes, L. C., and Selin, N. E. 2016. "The mercury game: evaluating a negotiation simulation that teaches students about science-policy interactions." *Journal of Environmental Studies and Sciences* 6 (3):597-605.
- Try, Sophal, Shigenobu Tanaka, Kenji Tanaka, Takahiro Sayama, Giha Lee, and Chantha Oeurng. "Assessing the effects of climate change on flood inundation in the lower Mekong Basin using high-resolution AGCM outputs." *Progress in Earth and Planetary Science* 7, no. 1 (2020): 1-16.
- Utrecht Young Academy. 2022. Science Policy- Utrecht Young Academy, accessed 05/22/2022.

<https://www.uu.nl/en/research/utrecht-young-academy>.

Weatherby, Courtney. "By Courtney Weatherby - Stimson.org." *Lower Mekong Power Developments: Drought, Renewable Disruptions, and Electricity Trade*, Stimson Center, September 30, 2021: <https://www.stimson.org/wp-content/uploads/2021/09/Stimson-Lower-Mekong-Energy-Developments-Final-May-2021.pdf>

Zhongming, Zhu, Lu Linong, Yao Xiaona, Zhang Wangqiang, and Liu Wei. 2019. "Southeast Asia Energy Outlook 2019."

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Disclaimer

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