

**Lesson Plan: The pedagogical affordances of game-based learning - “Getting to Zero” and pro-environmental action**

Background

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| Description of Tool | The “Getting to Zero” card game aims to enlighten student players on the various strategies (and their corresponding trade-offs) that can be employed in striving for net-zero emissions on a largely national scale. The card game consists of game cards, game currency and a scoring sheet for competitive gameplay. To complement this card game, lesson plans for two one-hour lessons have been developed for educators.  |
| Target Audience | Upper secondary students studying Variable Weather and Changing Climate or the Climate Cluster of the following Geography syllabuses: * 2236/2279 O-level Geography
* 2246 NA-level Geography
* 2272/2260 O-level Humanities (Geography)
* 2175/2125 NA-level Humanities (Geography)
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| Unit / Topic  | [Variable Weather and Climate]: Anthropogenic factors leading to an enhanced greenhouse effect, responses to climate change, mitigation strategies USG 2023 Geography (Express & Normal Academic Syllabus)[Climate Cluster] Topic 3: Climate Action |
| Relevant Big Idea(s) | * The implementation of climate change mitigation strategies in the form of policies/initiatives on a national-institutional scale requires various stakeholders to work together.
* There are economic trade-offs that are involved in achieving net-zero emissions.
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| Concepts | * Sustainability
* Net-zero (emissions)
* Scale
* Trade-offs
* Cause and effect
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| Lesson Objectives  | Students will understand the advantages and trade-offs involved in the implementation of various climate change mitigation strategies on a national/institutional scale.  |
| Success Criteria | Students should be able to explain at least two policies or initiatives that are aimed at climate change mitigation on a national/institutional scale.  |
| Prerequisite knowledge  | Students should know that* An enhanced greenhouse effect (which is human-induced) results in global warming.
* Climate change threatens both natural as well as human systems and that these risks vary across space and time.
* Climate action is essential to sustainable development.
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**Lesson 1: 1 hour**

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| **Time** | **Lesson Development** | **Rationale** |
| 10 mins | **Trigger Activity:** The previous lesson is presumably on the negative impacts of global warming.The teacher provides a brief recap of why countries have to work towards reducing their greenhouse gas emissions. The teacher will first establish the key idea of net-zero carbon emissions in class. The teacher shows an animated choropleth map on the global distribution of carbon dioxide emissions or how carbon footprints can vary across countries. The teacher poses some quick questions:What spatial patterns can you observe on the choropleth map? (e.g. where are countries with a high carbon footprint located?)Why do you think some countries have a larger carbon footprint than others?Do you think it is possible for a country to achieve net-zero greenhouse emissions? How so? The teacher can make a link between this question and climate change policies that will be featured in the “Getting to Zero” card game.  | **Resources needed:** https://worldpopulationreview.com/country-rankings/carbon-footprint-by-country |
| 40 mins | **Main Activity: Game instructions (10 mins)**The teacher provides instructions for playing the “Getting to Zero” card game as well as allocate students into their groups. Students will play this game in groups of four or five and will be asked to clarify any doubts that they may have.The teacher reminds students to pay special attention to the different policies/initiatives featured in the game cards (not so much the power cards with endangered species and the causes of global warming – covered in an earlier lesson). **Main Activity: Playing the ‘Getting to Zero’ card game (30 mins)**The students proceed to play the card game while the teacher plays the role of the main facilitator while keeping a look out for common misconceptions that students may have. The teacher could quickly document parts of the game-play (e.g. actions taken, consequences) on the white board for a debrief later.  | Game-based learning offers a more student-centered experience. The teacher may wish to ensure that there is one ‘expert’ facilitator in each group to guide the other members along the way. **Resources needed:** Getting to Zero: How to Play Slides |
| 10 mins | **Debrief and consolidation** The teacher conducts a debrief on the game-play by focusing on the key learning takeaways (dependent on the classroom or group dynamics, e.g. tendencies for certain actions to be taken despite their trade-offs and consequences, an ambivalence around the right decisions or trade-offs to make etc). If time permits, the teacher can foreground the concept of scale which has been addressed in this lesson - Getting to Zero spotlights climate action policies on a national scale. The card on “Car-free days” in Singapore is not strictly enforced and is dependent on personal/individual choice. As such, the teacher can explain how individual efforts at adopting climate-friendly practices can be compounded and scaled-up to make a larger difference on a national level. The teacher can reinforce the key learning take-aways from this lesson by provide students with an exit ticket to complete at the end of the lesson. **Exit ticket: 3-2-1 Thinking Routine**1. State three main types of climate change (mitigation) policies that you have come across today.
2. Explain two specific climate change mitigation policies/initiatives you have learnt today.
3. Ask one question you still have about Singapore’s climate ambition of achieving net-zero emissions eventually.

As homework, students can be asked to do some reading up in advance on what are some potentials and constraints tied to the national policies (and best practices) that Singapore has put forth in a bid to reduce its carbon footprint, in preparation for the next lesson.  | A consolidation of the big ideas underpinning this game-play is crucial. One important big idea is that of the trade-offs (usually based on a cost-benefit analysis in economic terms) involved in the quest for net-zero greenhouse gas emissions. The 3-2-1 thinking routine allows students to recap the key points in the lesson thereby strengthening their learning. **Resources needed:** Getting to Zero: The Explainer SlidesE.g. Geography Textbook - teacher to specify the pages for advanced reading.  |

**Lesson 2: 1 hour**

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| **Time** | **Lesson Development** | **Rationale** |
| 10 mins | **Introduction** The teacher can briefly quiz the class (via questioning) to assess students’ understanding of carbon neutrality or net-zero, as well as how this forms the basis of climate change mitigation strategies. For example: How can net zero emissions be achieved? What are some national/institutional policies and strategies that have been employed to reduce Singapore’s carbon emissions/footprint? Students share with their assigned group members what they have read about the advantages of and challenges to Singapore’s climate policies. As an extension or continuation of the previous lesson, the students will participate in a class discussion to articulate the challenges in working towards net-zero greenhouse gas emissions in Singapore vis-a-vis the vantage points of various stakeholders. The students will be put into groups and assigned the role of a specific stakeholder, that of a **government official, an environmentalist, an employee of a green-tech company and a residents’ committee (RC) member**.  | The quiz serves as a useful reminder of the last lesson while the sharing can help with making a clearer connection between the last and the current lesson. **Resources needed**“Getting to Zero” - The Explainer slides for detailed information on policy cards.A hand-out on **Resources about/on various stakeholders** based on the group’s assigned role will be provided to offer some contextual background knowledge.  |
| 15 mins | **Group Discussion**The teacher will instruct the students in each assigned group to read the resource hand-out (and do some extra research online if necessary) so that they can familiarise themselves with their role’s vested interests in relation to Singapore’s carbon-zero policies. The groups are then tasked with discussing and preparing a one minute ‘speech’ to introduce their specific roles to the rest of the class. This is to ensure that all students are made keenly aware of the competing interests and inclinations of each stakeholder.  | Group discussions can present opportunities for students to share and refine each other’s ideas. Students in each group could also be allocated different tasks, for example, the role representative, scribe and researcher/writer. **Resources needed:** Stakeholder Resources but students are free to supplement information from the handout with their own internet research.  |
| 25 mins | **Main Activity: Class Debate**The purpose of the main discussion is for the class to come to an agreement on exactly which aspects of net-zero policies Singapore should adopt and why. The teacher will invite any one group can kick-start the discussion by asserting their preferred stance/aspect of a climate policy for example: * Carbon taxation and the trading of carbon credits in a global carbon market (which the state playing a regulatory role, likely to be proposed by the government official)
* Nature-based solutions on biological carbon sequestration, e.g. afforestation or reforestation efforts, especially that of mangrove forests with vegetation acting as a carbon sink (likely to be proposed by the environmentalist)
* Technology-based solutions on increasing energy efficiency, cleaner renewable energy sources, carbon capture technologies to prevent the release of carbon dioxide from power generation (likely to be proposed by the green-tech employee)
* Trade-offs on time, effort/labour discouraging the cultivation of sustainable best practices, carbon taxation and technology-based solutions increasing the cost of living (likely to be concerns raised by a Resident’s Committee member)

The teacher goes on to invite other groups to take turns at explaining why they agree or disagree with the initial proposition while encouraging them to make and justify alternative policy suggestions. The class should try to come a consensus on (or vote for) aspects of climate policies it would like to adopt for Singapore.  | The intention of the discussion is to tease out the complexities of climate policies that might gain the favour of certain stakeholders at the expense of others. The assignment of roles should help students with perspective taking and understanding how invested interests can be competing and contested across various social groups in Singapore. **Resources needed:**Stakeholder Resources |
| 10 mins | **Closure and Consolidation**The teacher summarises the key learning take-aways which are less oriented around content mastery and more focused on cultivating a particular way of thinking - i.e. perspective taking from the vantage point of each stakeholder. The teacher can conclude the lesson by pointing out that national policies in general are implemented with particular overarching state agendas in mind that make or may not take into consideration, the concerns and interests of other stakeholders. The teacher also draw explicit links to the student as a an important stakeholder as a Residential Committee member or a concerned citizen and to prompt them to reflect on how they can incorporate sustainable best practices into their everyday life.  | The teacher as facilitator plays an indispensable role in teasing out the contradictions and contestations among the views of different stakeholders with respect to climate policies. This prompts students to reflect on actionable tasks that can contribute to net-zero emissions. **Resources needed:** Resources for stakeholders  |