Rideout, V., Lauricella, A., & Wartella, E. (2011). Children, media, and race: Media use among white, black, Hispanic, and Asian American children. *Center on Media and Human Development School of Communication*. Chicago: Northwestern University.

Shamburg, C. (2009). *Student-powered podcasting: Teaching for 21st-century literacy*. Washington, DC: International Society for Technology in Education.

Share, J. (2015). *Media literacy is elementary: Teaching youth to critically read and create media*, 2nd ed. New York: Peter Lang Publishers.

Tornero, J. M., & Varis, T. (2010). *Media literacy and new humanism*. Moscow, Russian Federation: UNESCO. Retrieved from http://tinyurl.com/j4nrtve.

# Chapter 7
# Using Drama and Gaming to Address Climate Change

> Games are natural tools for climate change education and engagement . . . In this way, games provide "designed experiences" where players can learn through doing and being, rather than absorbing information from readings and traditional lecture formats. . . . They allow for visioning—for example, being able to envision oneself in the future—and seeing consequences of actions at different points in time. . . . Finding new, more effective solutions often involves a trial and error process, and games can make it easier and less intimidating to identify new strategies.
>
> Jason S. Wu and Joey J. Lee (2015, p. 413)

In this chapter, we describe how engaging students in drama and gaming activities provides them with simulated experiences of the effects of climate change, and opportunities to creatively practice formulating arguments and taking action.

Drama activities allow students to interact with peers in improvisation, role play, or creating skits. Drama provides a "*living through* experience" (Pirie, 1997, p. 52, emphasis original), assuming roles, addressing problems or dilemmas, responding to others, and/or inventing imagined spaces in dialogic, open-ended ways. Drama offers a valuable way to involve students in the "social drama" of conflicts and social debates about climate change (Smith & Howe, 2015). As the interaction unfolds, students experience emotions and adopt perspectives on events, norms, or policies. Drama can take place using familiar formats, for example a radio or television talk-show, trial, legislative hearing, conference, community meeting, etc.

As with the drama activities, games allow players to go beyond simply learning about climate change to actively engage in missions or projects involving decision-making processes (Wu & Lee, 2015). Games can transport students into complex systems requiring an understanding of contingencies and factors shaping climate change (Pitfield, 2012).

An essential component of any drama or game activity is to have students debrief or reflect on their experience in the activity reflecting on their emotions and perceptions in roles and what they have learned from the activity (Boldt et al. 2015; Pitfield, 2012).

## DEVELOPING AND PERFORMING SCENES AND PLAYS

Drawing on their reading and research, students can begin by establishing the characters, events, and locations where the scenes will take place. A simple three-scene approach, which can easily be made more complex, involves: a first scene to introduce characters and "set the stage"; a second scene that introduces a problem, crisis, or event, and perhaps additional characters; and, a third scene which either resolves the problem or sets forward a dilemma to be contemplated by the audience. Students can then collaborate on writing dialogue and a script. Center Stage has a helpful pdf guide to *Teaching Playwriting in Schools* at http://tinyurl.com/zepmnd8.

A powerful approach to drama work around climate change can be found in the theater activities of Augusto Boal (1993), particularly what he called "forum theater" and "invisible theater." Forum theater attempts to overcome the separation between actors and spectators. As a performance is taking place, or at certain prearranged key moments, or when the drama is being replayed a second time, members of the audience can tell the actors to behave differently or they can step forward and involve themselves in creating a different conclusion. For example, students might perform a conversation between teenagers starting a climate change club at their school and adults, either school personnel, parents, or community members, who object. At certain key points the audience could give directions for replaying the action differently or become involved themselves. Students could perform a high-level meeting of business people and elected government officials to plan new power plants or transportation systems.

A forum theater performance could be built around protesting environmentalists, police, and bystanders. A forum theater could be as simple as a family Thanksgiving Dinner discussion about climate change. Forum theater performance can be pretty much spontaneously created and developed entirely in the classroom setting. Given a setting, students can brainstorm ideas for dialogue before getting up to perform. Forum theater events focus on moments when critical discussion or action is taking place during which spectators and actors improvise strategies and solutions. Forum theater is a great starting point for discussion and writing.

Invisible theater is a kind of street performance that can take the issue of climate change beyond the cocoon of the classroom. Invisible theater takes place in a public space and the performers attempt to disguise the fact that what is happening is a performance. People who happen to be present and, thus turned into observers and bystanders, may even choose to participate. Thus during the invisible theater event or "happening", spectators are given every encouragement to view it as real.

Secondary students could design performances to take place at school in the hallway, lunchroom, or on the school grounds that would raise questions about climate change. Students might stage a climate change protest outside the school disrupted by deniers. Or carbon police could arrive in the cafeteria to arrest students eating meat, or in the parking lot to take into custody people not carpooling. Or students could stage heatstroke collapse caused by rising temperatures. Or . . . ? The possibilities for educating about climate change through "invisible theater" are endless. Obviously it would be wise to plan carefully, alert administrators and, after the performance, provide spectators with a page of information about the issues. Alerting the local press in advance might disseminate knowledge to the community. Invisible theater can also provoke discussion and writing, and plans for taking more action.

Through Boalian techniques, students can in essence practice taking action in their world. Boal was determined to break down the "fourth wall" that separates performers from audience, in order to help spectators break out of passivity and have theater take responsibility for social justice. Students using these techniques would gain from learning more about Boal's philosophy, approaches, and experience.



Another way to develop drama activities is to have students learn about innovative, real world climate protest actions or performance events to inspire them to create their own productions/events that address climate change (Kershaw, 2009; Lavery & Finburgh, 2015; Arons & May, 2016). For example:

- The Otesha Project www.otesha.ca that lasted from 2002 to 2015 involved a group of young people riding their bikes around Canada to perform plays about consumer choices and climate change (O'Shea, 2016).
- The Climate Change Theater Action project http://tinyw.in/zx3M involved people from throughout the world staging short productions associated with supporting the 2015 Paris Climate Conference.

Students could also read, view, and/or produce plays based on climate change:

- *The Heretic* (Bean, 2012) http://tinyw.in/rSeT, a comedy about debates on the science of climate change.
- *This Clement World* http://tinyw.in/5HPW by Cynthia Hopkins combines documentary film about an Arctic expedition, a folk opera for solo voice and chorale, and portrayal of a ghost of a Native American woman, a neutral alien observer from outer space; and a child from the not-so-distant future who has traveled back in time.
- *Mr. Burns* (Washburn, 2014) based on *The Simpsons* portrays a group of young people attempting to escape massive fires in a time in the future.
- *The Great Immensity* http://thegreatimmensity.org/about is a musical about a young woman traveling from Panama to the Canadian Arctic who meets people, scientists, indigenous community leaders, and tour guides coping with climate change.

## ROLE-PLAY ACTIVITIES

One approach to engaging students in a drama or simulation activity involves providing them with a context and scenario that include a specific dilemma or challenge for them to solve. To help her students adopt different cultural perspectives in her literature class, Amanda Hagood (2016) has them focus on alternative points of view in a text. For example, students read T. C. Boyle's (1996) novel, *The Tortilla Curtain*, which portrays the worlds of two different couples living in the Topanga Canyon area of Los Angeles—an upper-middle-class couple and two undocumented Mexican immigrants who are camped out in a ravine next to the other couple's home. Students respond to differences in how these two couples perceive daily challenges associated with the same locations where the upper-middle-class couple is concerned about fear of distant urban violence and coyotes preying on their pets and the immigrant couple is coping with heat exposure, prejudices, actual violent crime, and dangerous working conditions.

This leads her largely middle-class students to reflect on the perspectives of disenfranchised people coping with climate change effects. Hagood applies this activity to her students' own lives, having them write about an environmental justice issue in their home towns; bringing environmental justice activists into the classroom for face-to-face conversation; arranging a "toxic tour" with local experts who can demonstrate, firsthand, the impact of environmental burdens on nearby neighborhoods; or engaging students in a long-term service project that allows them to connect with an environmentally disenfranchised group.

Linda Christensen (2009) has her inner-city language arts students engage in role playing "tea parties" in order to explore and understand complex and conflictive problems and issues. Students studying climate change can hold a "tea party" where they take on the persona of different actors,

perhaps including oil company executives, representatives from coal producing states, Greenpeace activists, farmers who lost their crops from a drought, South Sea islanders losing their home from sea-level rise, Africans living in the Sahel region fleeing the expanding Sahara, etc.

In the similar Climate Change Mixer game (Bigelow, 2014), each student in a class adopts a different role based on actual people representing a range of perspectives on the impact of climate change—lawyers, scientists, corporate CEOs, politicians, farmers, Native Americans, activists, etc. The goal of this role play is to help students understand that "climate change affects everyone, everywhere. But not equally" (p. 92). Students then interact with each other to discuss questions regarding:

- Who is hurt by or benefits from the impacts of climate change and in what ways?
- Who will experience similar effects to that of the student's own role?
- Which role has narratives similar to the role's narratives?
- Who will need to make major life changes due to climate change?
- Which role lives on a different continent and how is the impact for that role different or similar to the student's own role?
- Which roles have ideas for how to address climate change and what are those ideas?
- Which roles are taking actions and how would the student take the same action?

Bigelow (2014, p. 94)

Some role-play activities described in *A People's Curriculum for the Earth* (Bigelow & Swinehart, 2014) are Climate Change Mixer, The Thingamabob Game, the Indigenous Peoples' Summit ("Don't Take Our Voices Away"), and the Climate Change Trial ("Who's to Blame for the Climate Crisis"). The Indigenous Peoples' Climate Summit role play was designed to help students consider issues of eco-justice related to the adverse effects of climate change on indigenous peoples in places such as the Pacific Islands given that 20 percent of the world's population are responsible for 60 percent of climate change emissions (O'Neill & Swinehart, 2010) (see the PBS Documentary Paradise Lost about the effects of climate change on the South Pacific islands http://tinyw.in/QR09).

The role play was based on the actual Indigenous Peoples' Global Summit on Climate Change, held in Anchorage, Alaska, in April 2009, in which representatives from eighty different countries met to address climate change effects on their countries http://tinyw.in/DtAm. In the role play, students adopt the roles of representatives of six different groups: the Dine (Navajo); Alaska Native (including the Yup'ik and the Iñupiaq); the Bambara of sub-Saharan Africa; and indigenous groups from Kiribati (central Pacific islands), the Caribbean, and the Amazon (for specific descriptions of the role play: http://tinyw.in/oxon). Students adopt different roles within their groups as indigenous peoples to then formulate positions on how their regions were being impacted by climate change to inform other groups.

In the Hot: One World, One Planet http://tinyw.in/5pgk role-play, "Aubrey" uses Google Hangout to interact with five other adolescents from around the world: "Natasha" from Russia, "Luiz" from Brazil, "Will" from Bangladesh, "Albert" from Kenya, and "Jia" from China. Each of these adolescents is experiencing similar impacts of climate change on their region. When "Aubrey's" grandfather discovers her interactions, he decides to create the simulation which involves students adopting the roles of the six adolescents (for a description of the six roles: http://tinyw.in/knCY) each of whom has a different perspective on climate change.

Students playing the game engage in five quests:

- Developing Climate Crisis: Join the challenge.
- Push and Pull of Energy and Carbon in our Lives: Learn about your role.
- $CO_2$ Balancing Act: Reduce atmospheric carbon dioxide.
- Say Goodbye to Business as Usual: Cut fossil fuel use.
- Powering the World: Find energy solutions to mitigate climate change.



To prepare for participation in the game, students view videos http://tinyw.in/pa3V, including "The Big Climate Change Experiment: Calling All Climate Doctors" to acquire information for use in their quests. A key aspect of engaging in these quests is accessing and connecting with scientists, engineers, journalists, government officials, and citizens to gain their perspectives on developing solutions (Harris et al., 2016). Students then adopt their different roles to engage in panel discussions about issues in each quest and propose possible solutions from each of the six roles' different perspectives.

Based on a simulation of the UN Climate Change Conference, Zach Zeichner's (2015) students wrote speeches addressed to world leaders, for example, arguing that wealthy nations need to assume greater responsibility for addressing climate change while other students argued that all nations need to equally share responsibilities.

In another role-play activity that involved 2-day conferences in Barcelona and Berlin (http://barcelonaprotocol.blogspot.com, http://berlinprotocol.blogspot.com) students from two universities adopted roles as delegate representatives of various countries, as well as fossil fuel industry lobbyists or observers (Paschall & Wüstenhagen, 2012). Members of the different countries' delegations were each given 20 minutes to make their presentations about

1. Geography, including how the country/countries would be affected by climate change.
2. Economy, including key sectors that could help or hinder efforts to address climate change and the availability of funding for climate-related projects.
3. Politics, including past stances in climate negotiations and current opinion polls.

Paschall & Wüstenhagen (2012, p. 519)

The delegation teams then created "position papers" identifying goals for reducing greenhouse gas emissions by 2020 and 2050, recommending the use of alternative energy sources, and funding for developing countries that are being adversely impacted by climate change. Next, the delegates drafted resolutions to present to the conference. Some students also assumed the role of the media who interviewed delegates and reported on the deliberations through live news presentations and a blog. Delegates also gave interviews, submitted press releases, and, for the Greenpeace representative, staged protests. This led to final votes on their resolutions that required a three-fourth majority to pass. As in any effective role play, students engaged in verbal debriefing using mind-mapping about their experience. Students also wrote their own reflection papers.

In his high school IB geography classroom in central Ohio, John Jordan employed a role play to have his students address their skepticism about effective governmental action on climate change (Beach, 2015). The students assumed the roles of members of an advisory group who were asked to draft policies and proposals for a major piece of legislation to present to a Senator, as played by the teacher, for feedback. To draft their proposals, the students conducted research in teams to synthesize and critique information, taking into account physical, legal, economic, and political dimensions of climate change.

One student, Keegan Flaherty, noted that participating in this activity "caused me to think more about what the real threat of global climate change is, because it gave my ideas

more importance—we were actually going to do something with it, so it had to be more than just my opinion" (Beach, 2015, p. 12). Another student, Hayden Shenefield, learned that "policies can be put in place that don't require everything to change but can still be effective at slowing global climate change" (p. 12). And another student, Jordan, "came to think of the issue as a problem to be solved rather than a political issue to take sides on" (p. 12).

Middle-school students in Greeley, Colorado engaged in a mock US Senate committee debate regarding the need for funding of alternative energy sources (Redmond, 2016). Students assumed the role of Senators supporting funding of tidal energy versus solar power; hydroelectric against wind power; and geothermal opposite biomass, while members of the Greeley community assumed roles as members of the US Senate Committee for Energy and Natural Resources and as judges. Students were asked to justify their alternative energy choice based on startup costs, long-term sustainability, public sentiment, reliability, and more, with the group proposing tidal energy making the most effective presentation.

Students can go beyond their own national point of view to adopt the perspective of a global citizen. In this way they can better recognize that even if they may not currently be adversely impacted by climate change, there is a moral responsibility to be concerned about how others in the world are affected, as well as future generations.

Drawing on the 2015 UN Paris Conference talks in which developing countries sought to have developed countries pay for damage from climate change, Eleanor Stein (2015) has students engage in a role-play activity in small groups, each representing a different country. For example, while the US group may oppose any legally binding emission reduction target, the Bolivian group proposes creation of a global Climate Justice Tribunal for prosecuting nations who fail to reduce their emissions, resulting in the groups having to negotiate their conflicting agendas. They also study the petition by the Inuit Circumpolar Conference, an indigenous alliance of communities in Alaska and Canada, to the Inter-American Human Rights Commission in 2005 regarding the negative effects of the warming of the Arctic on their communities.

One benefit of engaging in role play is that students learn to empathize with alternative perspectives. In a study of participants engaged in a role-play activity addressing whether to drain or preserve a virtual lake, those participants who engaged in the role-play activity were more likely to opt for preserving the lake and employed more empathy-related reasoning than participants who simply read about the lake dilemma (Schrier, 2015).

For more classroom activities related to eco-justice issues, see online resources on the website, Integrate Environmental Justice activities http://tinyw.in/uU1j, summary of methods for teaching environmental justice from an InTeGrate workshop http://tinyw.in/iZoG, as well as materials for use with the Martusewicz, Edmundson, and Lupinacci (2011) http://tinyw.in/XEGC and Turner (2015) http://tinyw.in/XrPa books on eco-justice education. Having students adopt roles or characters with various national, class, race, or gender differences on environmental challenges can lead them to reflect critically on what may be their own privileged perspective.

## ONLINE ROLE PLAY

Students can participate in virtual, online role plays perhaps similar to those of games to be



management system (Moodle, Canvas, Edmodo, Schoology, Collaborize Classroom, Ning, etc.), Twitter, or a social networking site such as Facebook. One advantage of using online role plays is that students can assume anonymous, avatar roles so that their peers may not necessarily know which students are performing certain roles (Beach & Doerr-Stevens, 2011).

Students can also participate in virtual role-play simulations involving strategies for coping with climate change effects. The HOT: One World, One Climate simulation (see page 102) includes a scenario http://tinyw.in/75N2 in which a hurricane hits Maryland's Chesapeake Bay and the Eastern Shore destroying homes, schools, communities, and businesses requiring the residents of the area to move elsewhere, including "Aubrey Vale" who moved with her family to New York. Her grandfather, "Jack Hanover", is a scientist who focuses on climate change.

## GAMES RELATED TO CLIMATE CHANGE

Another option for engaging students involves use of the many simulations, card/board games, role-playing games, and computer games focusing on climate change (Eisenack & Reckien, 2013; Katsaliaki & Mustafee, 2015; LeBourdais, 2016; Meadows, Sweeney, & Mehers, 2016). While some critics may dismiss video games as not fostering learning, James Gee (2007) explains how video games offer considerable pedagogical potential. In his book *What Video Games Have to Teach Us about Learning and Literacy*, Gee describes thirty-six learning principles that are built into good video games; among them are the ideas that video games promote active learning, risk taking, experimentation, problem-solving, collaboration, embodied experiences, multimodal learning, and more. Students then learn to engage in problem-solving associated with these contingencies and factors to define alternative solutions to reducing emissions or developing clean energy options associated with sustainability and conservation (Sandbrook, Adams, & Monteferri, 2015).

Mendis Condis (2015) notes a number of advantages from playing games associated with climate change given that students:

- Adopt nonhuman perspectives as species, animals, systems, etc., to experience the impacts of climate change by humans on the nonhuman.
- Learn to operate according to rules or language in alternative systems coping with climate change to then formulate strategies and arguments for coping with challenges in those systems.
- Understand how the environment is constructed based on narrative or visual designs to guide their play in a game, leading to critical thinking about how their lived world experience is constituted through narratives or advertising.

She cites the example of *Reus* www.reusgame.com in which players assume the role of the Earth itself. As the Earth, they have no control over humans' intentions, a reversal from the humans attempting to control Earth, requiring players to adopt a nonhuman perspective. Players advance by creating complementary ecosystems which benefit both humans and the Earth.

Fourteen-to fifteen-year-old Swedish students engaged in playing the *SimCity 4 Deluxe Edition* game http://tinyw.in/I9b4 to create sustainable future cities. They had to make choices about different levels of emissions of different energy systems, for example, the pros and cons of selecting windmills as opposed to power plants (Nilsson & Jakobsson, 2011). Some students critiqued the game platform itself as favoring a capitalist model of development through power plants. The experience of playing games can therefore spark further discussions about the game

Two important organizations supporting development of games related to climate change are Games for Change www.gamesforchange.org (for their games on climate change: http://goo.gl/qouHho) and the PoLAR Climate Change Education Partnership http://thepolarhub.org at Columbia University.

Adopting roles in games positions students as active agents imagining that there are solutions to addressing climate change, offering hope instead of disillusionment. Because most games involve working collaboratively, students learn to engage in problem-solving and decision making with others, practices essential to fostering change.

As with drama activities, it is important for teachers to facilitate and assist students to play the game effectively, and to debrief with them about what they learned (Eisenack & Reckien, 2013). Some computer games can provide their own internal feedback based on students' success in playing the game. At the same time, teacher-led discussion can lead to richer evaluation of the learning.

The following are card and board games as well as computer simulation games designed primarily for middle- and high-school students organized according to the focus of these games on certain aspects of addressing climate change. Based on playing some of these games, Allen's students provided their reviews.

## ENACTING STRATEGIES FOR COPING WITH CLIMATE CHANGE

The following games engage players in collaboratively devising strategies for coping with climate change effects through adopting different roles to devise adaptation and mitigation efforts, requiring them to imagine ways to address climate change in those roles.

- *Act to Adapt* http://climatecentre.org/resources-games/act-to-adapt involves students as either "community members" who are attempting to develop strategies to cope with the effects of climate change or the role of "climate change deniers" attempting to undermine the "community members," resulting in a conflict between the two groups, leading to discussions on how to address climate change.
- *The Incredible Carbon Journey* is a board game that can be created using an attached file http://tinyw.in/19vw in which players experience the world before and after the influence of fossil fuel use as they move through different historical changes in the Earth.
- *Climate Quest* https://earthgames.org/games/climatequest for Mac and PC. Players adopt one of four roles—the urban planner, the ecologist, the agricultural scientist, or the climate scientist to determine which one can most effectively and quickly cope with climate disasters that appear on a map of the United States, based on actual impacts selected from the US National Climate Assessment.
- *Imagine Earth* www.imagineearth.info/gameplay is a role-play simulation involving manipulation of the Earth's resources. Angelo Negrito noted that:

> The graphics of this game are quite astonishing. When you play in campaign mode, the story behind the game is explained. The game takes place in the future after all the resources have been depleted on our planet Earth. Mankind's goal is to find an alternative option and must expand civilization to space. Economy and



> without destroying your planet. The vital stats of your Earth are available in the user interface.
>
> Imagine Earth has great concepts. The player must be obliged to build things and consume energy and resources at the same time. You are able to build infrastructure like power plants to supply energy. But keep in mind you are depleting food, land, and money. So the outcomes of your planet could either lead to global chaos or success. Natural disasters can also occur randomly when you are constructing your planet.
>
> It becomes a constant and deadly cycle of production and consumption. The creators of this game really capture the themes and concept behind consumerism and profit. Many big businesses today forget how they impact everyone on a global scale, as they focus on profit and expansion. Playing this game is an eye-opener because you get to visualize Earth in a zoomed-out perspective.

- *FutureCoast* http://futurecoast.org engages students in listening to audio voicemails of people recorded in 2014, particularly people living in coastal areas, talking about the effects of climate change, serving to model ways for students to create their own descriptive narratives as well as imagining how to cope with the problems identified in these voicemails (for more information, see Pyper, 2014).
- *The Adventures of Carbon Bond* http://trpetersonlab.tamu.edu/carbon-bond focuses on students assuming the roles of people employing carbon capture and sequestration (CCS) as a mitigation strategy for climate change (Feldpausch-Parker et al., 2013).
- *Climate Health Impact* http://playgen.com/play/climate-health-impact http://tinyw.in/IW72 involving players making decisions on how to cope with health effects of climate change through engaging in research on strategies for preventing the spread of certain diseases resulting from climate change.
- *Precipice* http://tinyw.in/0NYt is a 3D simulation game in which students are living in the world of the present and 2032 in which they interact with other characters coping with effects of climate change, requiring them to convince these characters of ways to address climate change. Clara Peeters, describes playing this game:

> Initially you start out in the year 2030, when the world has been ravaged by floods and other various climate disasters. The game lets you go back in time to 2010 and interact with three people, George, Paula, and Marcus. Marcus and Paula are married, and Paula has all these great ideas about climate change and what society has to do as a whole to better the situation. You have three goals in the game, and each one is linked to a character and how your actions and conversation can get them to realize their potential when it comes to climate change and creating a better future not only for themselves but also for future generations. Entering into conversations with these characters, you are given several options for what to say, and your job is to prompt George and Marcus into realizing that their preconceived notions about climate change and how it is not going to affect them in their home is grossly wrong, or trying to get Paula to share her ideas with the general public. Then the game transports you back to 2030 to see how your initial actions changed or did not change the future. I enjoyed this game because it shows that even starting a conversation can change someone's point of view, their

## ADOPTING AND NEGOTIATING POLICIES ON CLIMATE CHANGE

In these games, consistent with the goals of argumentative writing in Chapter 5, students learn to formulate arguments for adopting policies designed to reduce emissions or create clean energy options.

- *Keep Cool* is a board game www.spiel-keep-cool.de that involves three to six players in negotiations as representatives of different countries attempting to address climate change (Eisenack, 2013). Players select whether they want to employ "black" (fossil fuel) or "green" growth options. During the game, they must determine how to adapt the impacts of climate change such as droughts or floods. Players can also build high versus low carbon emission factories, which then results in changes in the global mean temperatures.
- *Cool It!* http://tinyw.in/VSBN (teachers' guide http://tinyw.in/cCfh) for middle-school students is a card game in which students collect enough "solution" versus "problem" cards in the categories of energy, transportation, and forests, to win the game.
- *World Climate* http://tinyw.in/haRZ (facilitator resources http://tinyw.in/0nNK) (Sterman et al., 2015) is an online game where students represent different countries and stakeholders to reduce greenhouse gas emissions. Working in teams, students formulate their policy positions based on mitigation strategies to gain support from other UN delegates. One advantage of the game is that through use of the C-ROADS (Climate Rapid Overview and Decision Support) computer simulation http://tinyw.in/Tjaa, students receive immediate feedback on the effects of their choices related to reductions in greenhouse gases, increased temperatures, sea-level rise, and other impacts, providing them with empirical data for supporting or challenging their claims. Analysis of students' participation in the game found increased willingness to take action on climate change (Sterman et al., 2015).
- *BBC Climate Challenge* http://tinyw.in/49Ae involves students adopting the role of President of the European Nations who must formulate policies to reduce emissions by 2100. Players choose policy cards from five different categories: National, Trade, Industry, Local, and Household. Each player begins in one of seven regions throughout the world to build cities based on use of alternative energies, recycling centers, and organic farms. Emma Garber noted that:

> This game starts with the player assuming the role of the President of the European Nations, and the task at hand is to stop climate change by the year 2100. The game is set up like an online card game where there are multiple options of what policies to enforce. The cards have rankings based on the supplies they use, the popularity the public has towards them, and the $CO_2$ emissions they release.
>
> The game is played in segments of 10 years per turn, and five cards (or five policies) can be picked to enforce every turn. The results of each turn are explained in a newspaper like form which are quite fun to read and pleasant to look at. The game was set up in a very interactive form, allowing for the player to click on objects to take them to different zones or subjects.
>
> Sadly, I was unable to win or beat the game, due to the fact that I am clearly a terrible leader when it comes to politics. I was constantly voted out of office, because I would tend to lean toward the climate change side of things, which most people were not very happy with. Trying to find a balance between what the people want and what the Earth needs was so difficult that I would only make it past a few



> majority of our population affect it greatly. I would recommend this game to anyone who thinks climate change is an easy fix, or anyone who does not fully understand how our actions are increasing climate change and damaging our Earth.

- *Fate of the World* http://store.steampowered.com/app/80200 (also with an online version http://tinyw.in/tcvQ) involves students in establishing policies related to climate change and issues of economic production and population growth. Jacob Colegio described the game as based on:

> playing cards in certain regions of the globe. Each card does something different, such as implementing emissions taxes, starting vegetarian revolutions, committing to renewable energy sources, establishing research centers, etc. To play these cards, you have to first recruit agents for each region (North America, China, South Asia, Southern Africa, Europe, etc.). Recruiting agents and playing cards cost money, which you have a limited amount of during each turn. You have to manage your resources and prioritize; at the same time, you have to choose which particular cards you should play in each region in order to achieve your goals.
>
> At the end of each turn, you skip ahead 5 years and get to see some statistics about increases in $CO_2$ levels during that time, number of climate change-related deaths, whether each region's expected emissions rate is above or below average, etc. You are also shown news about recent developments in each nation, such as civil unrest, drilling breakthroughs, major milestones in global warming, etc. When you start the next turn, you have more funding and are able to recruit more agents and play more cards.
>
> The actual interface of *Fate of the World* looks kind of like Google Earth, except there is a lot of different buttons and menus to look through. You can read news about what is developing in each particular region or see statistics about various things (annual emissions, agriculture GDP, number of climate refugees, etc.). You can also see each region's "technology tree" and see what technologies that region has been developing, and what it will develop in the future (if you play certain cards). You also can see global statistics such as population change, temperature change, changes in the Earth's geography (such as melting ice caps), etc. (for more details http://tinyw.in/kk0G).

- *Eco Online Ecosystem Simulation Game* www.ucsusa.org/node/4577 involves students in creating policies and laws to support a sensitive ecosystem for their civilization using simulation data as evidence to generate support for their proposals.
- *ecoKoin* (formerly Greenify; iOS app: in beta for 2016) (Lee et al., 2013) includes use for older students of social networking to communicate with others based on specific missions for collective actions associated with choosing green products, making transportation choices, use of water and electricity, debating issues and sharing knowledge with others based on shared news feed and reports, leading to documenting these actions through shared photos or written descriptions to earn points.

## REDESIGNING CITIES AND HOUSES

Students can also engage in games or simulations that require them to imagine alternative ways to redesign cities and houses in order to employ less energy and enhance density for use of mass

- *EnerCities* www.enercities.eu involves students in building ecologically sustainable cities based on achieving a balance between energy sources, cash flow, economic growth, and environmental concerns.
- *Energy City* http://tinyw.in/4IKs requires students to research use of alternative solar and wind energy sources to provide energy for a city.
- *Future Delta 2.0* (FD2) http://futuredelta2.ca is a video game involving players in coping with climate change effects on the city of Delta in 2100 that includes flashbacks to 2015 when there were limited attempts to address climate change.
- *Electrocity* http://electrocity.co.nz involves making decisions about alternative energy sources (for Shane Stover's extended description: http://tinyw.in/SEp9):

> After you name your city, you are given a 5 x 5 grid with different geographical features. All starting maps will include some combination of rivers, mountains, hills, forests, bushes, ocean, and the town. From this point, it is up to you to decide how to spend your money. Some items like farming and campgrounds increase your population, while others like wind farms and gas plants increase your energy production.
>
> A player then advances through their turns, making purchases with the money they earn, as long as they produce more energy than they use and their environmental meter stays out of the red.
>
> What You Learn: Electrocity is a great tool for teachers to use in order to teach about renewable energy. Some purchases may seem appealing due to their cheap cost and high output, but their negative impacts on the environment certainly outweigh the benefits. Wind farms do not produce a lot of energy, but the cost of air is free and its effect on the environment is zero.
>
> On the contrary, coal and gas plants produce a much higher amount of energy, but they also use more to run and are terrible for the environment. Similarly, as your town grows, you could end up losing money each turn rather than making money. It is important to know whether your town can afford growth or if you need to start choosing your purchases more carefully. Almost all countries around the world can relate to this as we are all power hungry and push for more and more growth every day. Unfortunately, this comes with a big hit for the environment.

- *SimCity EDU* http://tinyw.in/z35E engages students in assuming the role of mayor who must balance the need to provide employment for citizens and also foster sustainability in the city.
- *Plan It Green* www.planitgreenlive.com/en involves students in planning a city through use of energy retrofits, clean energy jobs, and green building. Blaire LaCross explains how the game has players build and upgrade buildings while thinking about environmental impact.

> The game forces you, the city planner, to make tough decisions as you have to power your city while balancing emissions. The game is entertaining enough to play and certainly would be a useful learning tool for a teacher to use in the classroom:
>
> It is more geared toward students in elementary or middle school as it does not have complex moving parts. The game features informational videos about green technology being developed and gives players the chance to learn how such



- *Power Up!* http://sciencenetlinks.com/interactives/powerup.html provides students with choices of adding wind, trash, or solar plants to their city as sources of energy.
- *Mysusthouse* www.mysusthouse.org/game.html has younger students create a house or town based on sustainability criteria. Ali Coutts, a student in Allen's class, describes her experience playing this game:

> This game uses interactive prompts to guide you through building your own energy-efficient house, step-by-step, with you deciding what resources to use. Given a budget, you quickly realize how expensive certain resources can be so you must decide where to splurge and where to cut back to give yourself the most efficient home. The next series in this game takes you to a small town that is looking to expand; you must help them do so with sustainability and environmental awareness in mind. MySustHouse was an extremely educational game meant for middle- to high-school students to explore climate change, energy efficiency, and environmental consciousness.

## COPING WITH ISSUES OF WATER, MELTING ARCTIC ICE, WARMING OCEANS, AND FARMING

- *Eyes on the Rise.* To experience the effect of sea rise, students can also employ the *Eyes on the Rise* app http://tinyw.in/uS9k or VirtualEYES http://tinyw.in/dY4J virtual reality tool to experience the impact of a 6-foot sea rise on South Florida by entering in certain addresses for specific Miami neighborhoods.
- *SMARTIC (Strategic Management of Resources in Times of Change)* www.camelclimatechange.org/view/article/175297 involves addressing changes to the Arctic due to melting of ice and glaciers. Given the need to cope with these changes, students assume the roles of different stakeholders—countries, businesses, organizations, etc., to develop plans for how to address these challenges. Players use a copy of a map covered with clear acetate to then write on the map using grease pencils or dry eraser markers.
- *Earth Primer* www.earthprimer.com an iOS app game that engages students in visually altering geological landscapes to understand the effects of changes in glaciers/ice-melt, sea rise, drought, etc., on the Earth.
- *Water Flow* www.goodworldgames.com/water-flow. Students are assisting people in a village coping with lack of water by completing puzzles on how to capture and share water to different homes in their village, leading to awareness of the effects of drought on the village.
- *Losing the Lake* http://tinyw.in/R7e1 (facilitation guide http://tinyw.in/QFpw) is targeted for students in the Southwest United States, but could be played by any student related to addressing issues of drought and water conservation. Students learn about the loss of water in the Lake Mead reservoir that provides water for the Southwest United States region. They then engage in online computer simulation to acquire knowledge about the effects of droughts and melting ice in the Rocky Mountains related to the loss of water in the Colorado River.
- *EcoChains: Arctic Crisis* http://tinyw.in/031O is a card game in which students learn about the impact of climate change on a range of different Arctic marine species (note, given the $25.00 cost, teachers can obtain the game at a discount).

- *Never Alone (Kisima Ingitchuna)* http://neveralonegame.com/game is based on the experiences of the Iñupiat, an Alaska Native people, coping with the effects of climate change on their Arctic region. Based on contributions by Iñupiat people, students adopt the role of a young female member of the community and a fox attempting to discover the source of a blizzard that threatens the community. One advantage of this game is that students experience the Iñupiat peoples' cultural perspective related to narratives and myths based on their association with nature.
- *Team WILD* www.arkive.org/education/team-wild (for education resources www.arkive.org/education) involves students assuming the role of scientists who are studying and attempting to conserve and protect coral reefs in Chagos threated by warming oceans, forest restoration in Brazil's Atlantic forests, and species in the African savannah.
- *WhyReef* http://reef.whyville.net is part of the part of the Whyville http://tinyw.in/lHaI platform (Educators Guide: http://tinyw.in/dzUb) in which students are studying and recommending changes to protect and preserve coral reefs by studying virtual reefs impacted by overfishing for food and aquariums, coral bleaching, too many nutrients, buried reef, and tourism, destruction impacting ocean quality and species. Conservation Connection www.hastac.org/node/8546 is an extension of the WhyReef game in which students share knowledge about how to preserve the Fiji coral reefs.

## GAMES ABOUT LOCAL, SPECIFIC CONTEXTS OR REGIONS

- *The Carbon Cycle* http://goo.gl/m6Rxqz is an online interactive game for middle-school students who assume the role of carbon atoms and travel through the carbon cycle. They first read about the carbon cycle http://goo.gl/nD33Y to gain background knowledge. They then move along an online game board map of six different locations—atmosphere, plants, soils, shallow ocean, deep ocean, and marine life that can function as carbon reservoirs or pools for storing carbon leading to discussing their role in the carbon cycle.
- *Millennium Village* http://tinyw.in/eqTU requires students to inhabit a sub-Saharan African village in which they cope with the challenges of surviving with high temperatures, droughts, and diseases.
- *Fort McMoney* www.fortmcmoney.com/#/fortmcmoney; iOS App http://tinyw.in/7Kco uses documentary film to portray the world of Fort McMurray, Alberta, Canada and the Athabasca oil sands development to engage students in virtually exploring the site. Students interact with residents to determine a future direction for an oil-boom town based on an "addiction to oil" associated with extracting oil from sands related to the use of fracking practices throughout the United States and Canada, reflecting the larger issue of how to move away from oil as a means of economic support to alternative energy options. Because the documentary was made in 2013 at the peak of the oil boom, now that the demand for oil has diminished, students may bring that current perspective to bear on their experience with the game.

## REFLECTING ON WHAT STUDENTS LEARN FROM PLAYING GAMES

As with drama activities, it is essential to have students reflect on what they learn about climate



the problems or challenges they faced, the reasons that caused them, the strategies for coping with them, and the degree to which they were successful in addressing the problems or challenges. For example, in playing games involving roles for formulating, crafting, and voting on policies at the local, national, or global level for addressing climate change, students could reflect on what kinds of arguments were effective for achieving political support. In playing games assuming roles of city officials, students could reflect on some of the economic or political challenges they faced in attempting to make changes given lack of tax revenues or political support, as well as opposition from organizations such as the fossil fuel industry.

In reflecting on their experiences, students can also think critically about the larger systems constituting the game space (Meadows et al., 2016). Engaging in such "systems thinking" involves reflecting on how systems themselves are driven by particular goals or specific rules or norms. For example, in playing the *Oiligarchy* or *Fort McMoney* games based on oil production, students assuming the roles as oil company executives or workers are driven by the goal of maximizing profits through extracting as much oil as possible. Students reflecting on the game might consider how they were situated to adopt the perspective of a person who ignores the adverse effects of fracking.

Students can also reflect on the viability of the solutions they developed in playing these games. In playing the *Losing the Lake*, *3rd World Farmer*, *The Watershed Game*, or *CityOne* games related to loss of water or water quality, students could reflect on the degree to which their water conservation and sustainability proposals may or may not have been successful in lived-world contexts. They could also consider real-world trade-offs, for example, that diverting water for use in cities may result in a lack of water for farms.

## IS CLIMATE CHANGE A GAME?

Of course, climate change is not a game or a role play. As with literature, we view role plays and games as extending our students' power of imagination, and from the imagination, to better understand their world and how to behave in it. Amitav Ghosh puts it well,

> Climate change is first and foremost a cultural problem. Everybody thinks it is happening somewhere else. Everybody thinks it is happening on a screen and will not affect them . . . Everything has become spectacle and people think of themselves as spectators, yet we are not spectators.
>
> Ghosh (2016)

Augusto Boal (1993) uses theater to transform spectators into "spect-actors," people who critically understand what is happening in the world and join with others to take action.

As we have already seen in this book, climate change is a topic that is interdisciplinary. The next chapter helps us think more directly and fully about how English teachers can collaborate with colleagues in other disciplines to address climate change.

For additional resources, activities, and readings related to this chapter, go to http://tinyw.in/Z4s1 on the book's website.

## REFERENCES

Arons, W., & May, T. J. (Eds.). (2016) *Readings in performance and ecology*. New York: Palgrave Macmillan.
Beach, R. (2015). Imagining a future for the planet through literature, writing, images, and drama. *Journal*