

Grade 11 Organic Chemistry: Polymers

by Adam Kilner

Tool(s) used:	<ul style="list-style-type: none"> • Sustainability Compass • Systems Iceberg
Purpose of using tool:	<ul style="list-style-type: none"> • Research • Generating Questions • Synthesizing Thinking • Guiding Discussion <p>Overview: All of the above. Students worked through various activities over a small unit on polymers. They initially researched info on the polymers and then brainstormed ideas about the production, use and disposal of each onto a Sustainability Compass. They then developed an Iceberg by filling in the types of questions that could be asked when assessing a problem and possible target areas for their solutions. Using these combined tools they selected leverage points and used the Iceberg model to justify how and why they believed that lasting change would be possible through this approach and used the Compass again to detail the expected changes in each domain.</p>
Context of lesson/case study:	Grade 11 Organic Chemistry - Polymers
Participants (# and description):	All Grade 11 students (20)
Topic, Theme, or Key Understanding of unit/project:	How are polymers made, what happens after their use and why do oil derived polymers dominate the marketplace?
Length of unit/project:	5 x 45 mins
Resources/materials & setting required:	Classroom, poster paper, laptops and shared documents
Lesson Plan/Description of the Project:	
<ul style="list-style-type: none"> • Step 1: Brainstorming I had students in arranged in 5 groups of 4. Each group was given a piece of paper with the name of a polymer on that they previously knew little about. The group then had 5 mins to write as much down as possible about the polymer. Materials, processes, uses, economic factors, industrial processes, waste disposal, recycling etc. etc. After 5 minutes one person took the page to another group and explained (as the expert) all of the information to the new group. The new group then had several minutes to ask questions which collectively they then researched and answered on the same page. Then a different person took the page to the next group and repeated the process until every person had discussed each polymer in some capacity. • Step 2: Compass Each group of 5 then spent 5 minutes at each Compass adding items to the 4 domains and adding questions to a sidebar. After 5 rotations many of the questions had been answered and the compasses filled. Teams had a further 5 minutes to use their devices to answer any remaining questions. • Step 3: The Iceberg I gave each group the hand out entitled “Compass Education Level 1 Course/ Lesson 4: The System Iceberg Model Explained”. Students were divided into levels 1-4 and the final group were the note takers. 	

Each group studied their section, presented to the group and the note takers sketched it all down onto a big Iceberg on the classroom wall.

- Step 4: The concluding assignment had students coming up with 5 regulations or actions with regard to the use of their polymer (each group randomly allocated one). Their actions had to be supported and elaborated in several ways; they had to justify their choice of leverage point, they had to explain where in the Iceberg model was their targeted and resulting change and they had to summarise the final effects on the compass that their change would bring about.

Teaching Tips/Ideas:

- Use the 'nobody talk' to get the compasses filled out. Very interesting talking points for kids afterwards about how they work and it allows them to get filled out much better!
- Working the process forwards compass-iceberg and then backwards Iceberg-Compass enabled my students to really grasp these ideas well – much better than I had predicted actually.

Reflection

Plusses:

- The Compass enabled students to consider a much greater range of factors.
- The Compass kept students focus on each issue for far longer than other formats of brainstorming or research would have.
- The Iceberg really made students consider what the targets (leverage points) of the changes they were proposing were. It prevented the 'band-aid' type solutions that I would have expected from a more traditional approach.

Challenges:

- In terms of my chosen polymers, I would have made clear that TJJIPETIR could be expanded to natural rubbers from the start and I would have specified which biomedical polymers as both of these distracted students.
- I really enjoyed the way the students analysed the Iceberg without considering specific content at first. Perhaps it would have been useful (and I still might) to have the students reflect on the tools as well as the outcomes.

Suggestions for other practitioners and educators:

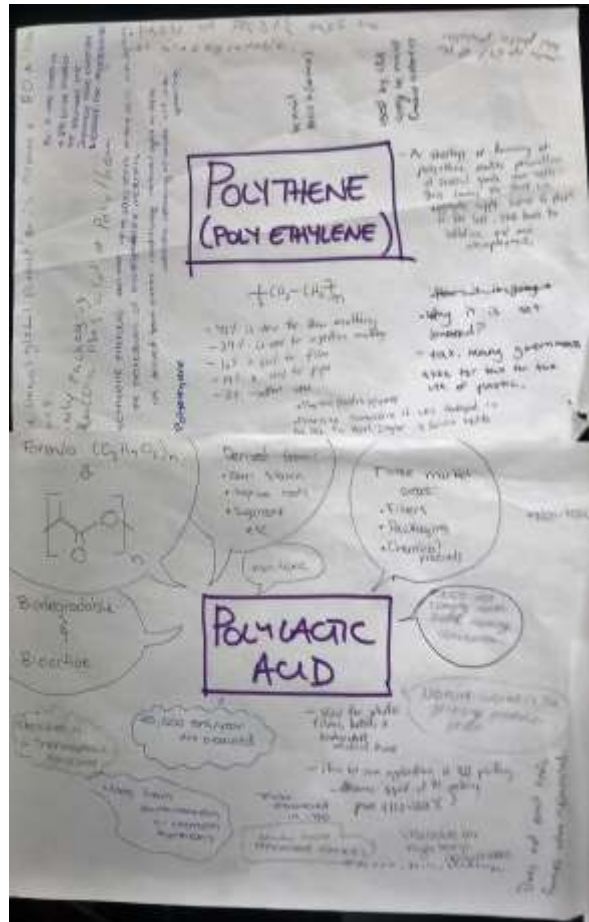
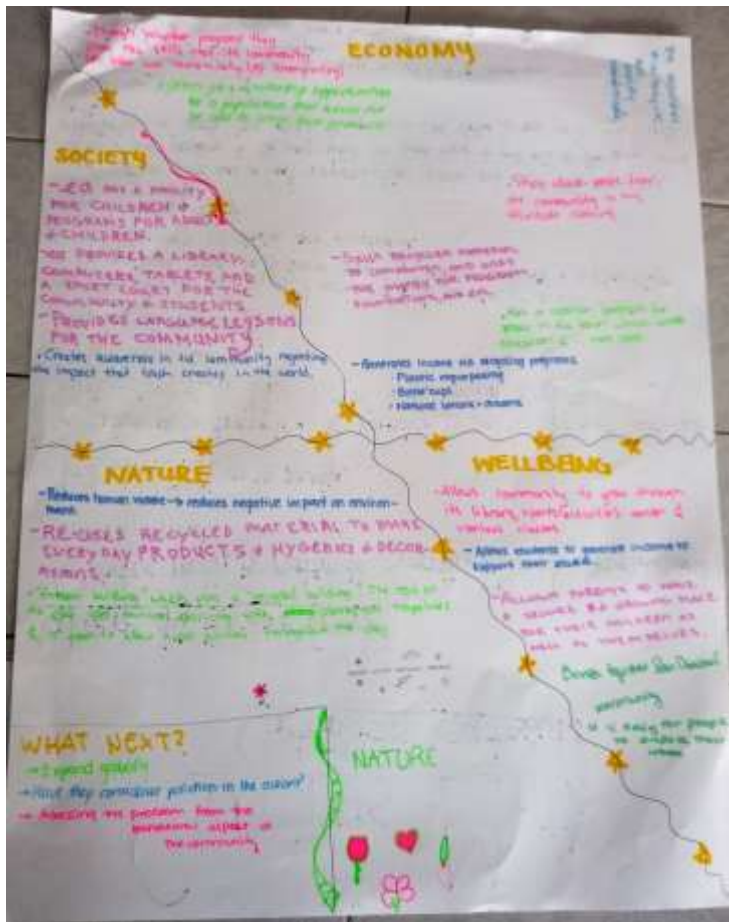
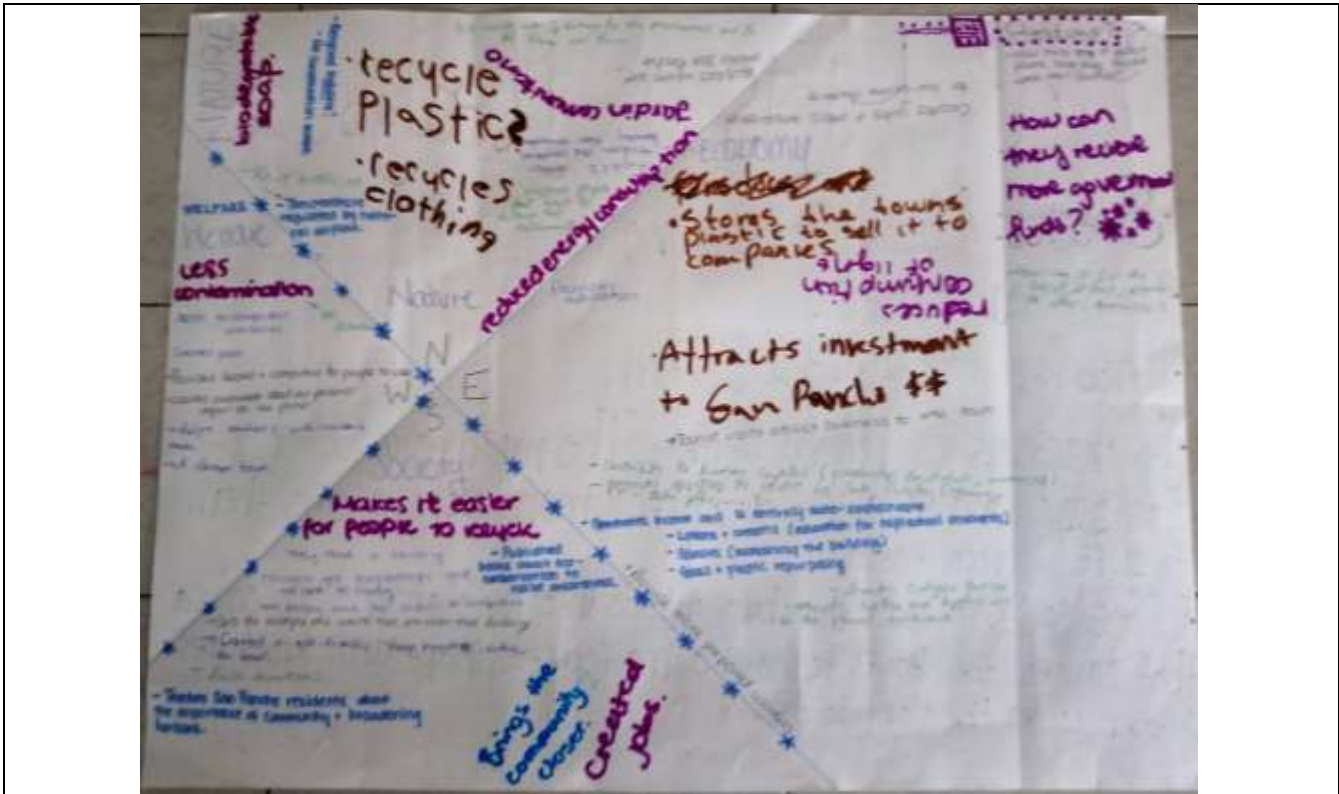
I have been teaching organic chemistry at this school for 8 years. This approach got the most passionate involvement and engagement of any I have tried for this topic. By taking 1 week to do this to introduce these polymers I have gained enough momentum with the group that we will probably end up covering more of the traditional chemistry of these molecules than if I had not. Highly recommended approach. The kids loved it and debates rumbled on long after the lunchtime bell had gone.

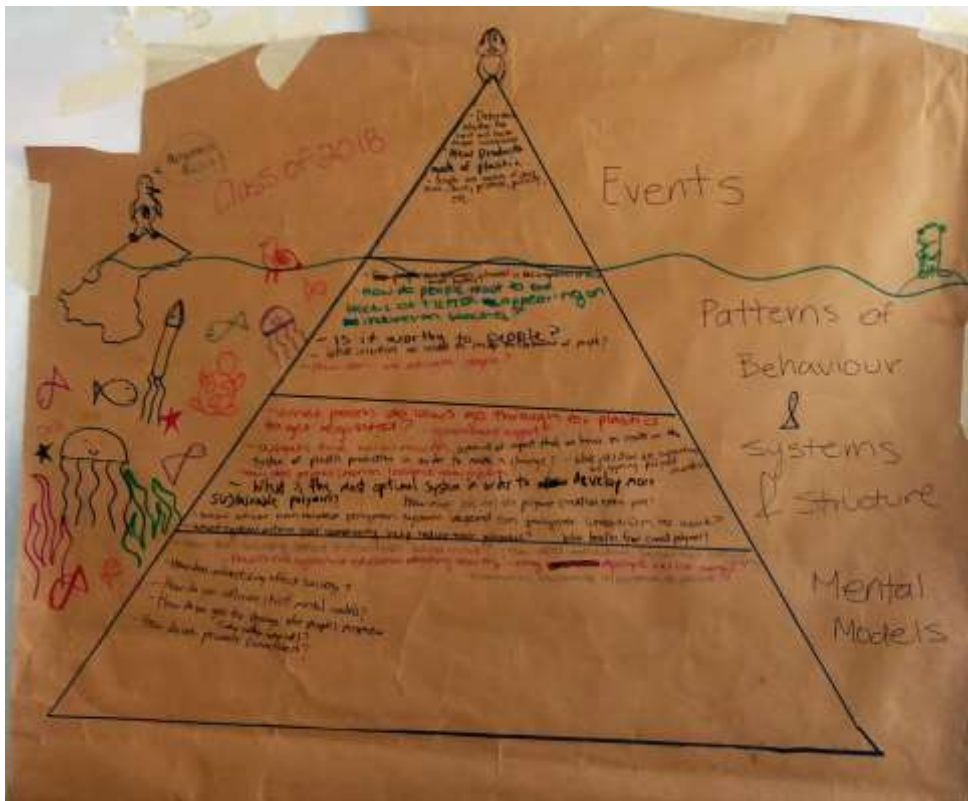
Evidence and Resources:



Compass Education

- Empower & Connect Learning Communities to Educate & Act for a Sustainable Future -





Case study submitted by: Adam Kilner, 2017, while serving as Assistant Principal/High School Science Teacher at American School of Puerto Vallarta