Electronic Supplementary Material (ESI) for Chemistry Education Research and Practice.
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Appendix 1: Teaching material

Drawing distinctions

The following pairs are written on lolly sticks and given out, one lolly stick per pair. Students are asked: 'can you state the way(s) in which the following pairs are the same, and the way(s) in which they are different?'

1. Tunnel / Cave
2. Molecule / Compound
3. Reason / Excuse
4. Smart / Intelligent
5. Teaching / Training
6. Medicine / Drug
7. Debate / Discussion
8. Mind / Brain
9. Theory / Hypothesis
10. Risk / Danger
11. Analysis / Argument
12. Memory / Identity
13. Cure / Enhance
14. Repair / Improve
15. Memory / Identity

Appendix 2: Teaching material

Identifying philosophical questions

If a philosophical question is a question to which answers are in principle open to informed, rational, and honest disagreement and which require reasoning to be answered, which of the following are philosophical questions? Why?

- Who discovered oxygen?
- Are atoms fundamental particles?
- How many grams are in a kilogram?
- What is an electron?
- Can a carbon dioxide molecule be bad?
- How did life on Earth begin?
- Is it possible to know how life on Earth began?
- What would a Hippocratic Oath for chemists contain?
- If you take a drug to make you happy, are you happy?
- What is the evidence for anthropogenic climate change?
- How many types of bond exist?
- Can theories about the origin of life on Earth be tested?
- Is there hydrogen in the sun?

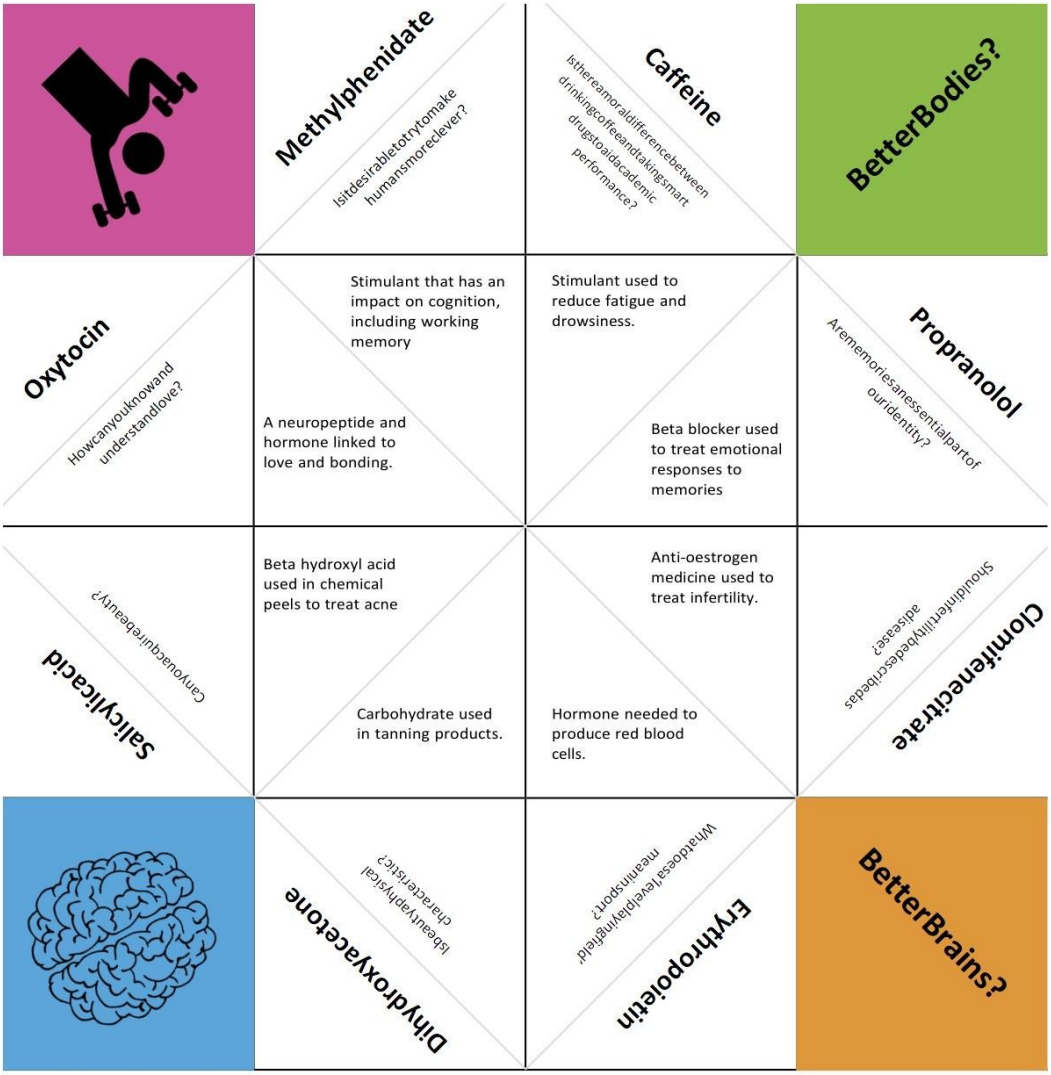
Philosophy Loft exchange your views on a philosophical question in exchange for a drink.

- Does it matter if Earth becomes inhospitable to humans?
- What is wild about England? About York?
- Should people colonise other planets?
- Is it important to have global sustainable development goals?
- What are the most convincing arguments for veganism?
- Should financial incentives or punishments be used to promote pro-environmental behaviour?
- Are positive imaginings of the future necessary?
- Is pollution unethical?
- Who benefits from current environmental policies?
- Is clean air natural?
- If climate change does not affect you, to what extent is it real?
- What is an inconvenient environmental truth?
- Should people be exposed to the methods of production of consumer goods?
- What responsibility do you have for the pollution you create?

Appendix 3: Student created resource for doing philosophy in chemistry

Discussing philosophical questions

Provide a copy of this 'finger volcano' to a group of 4 to fold and play.



Appendix 4: Teaching activity for chemical enhancement

Better Brains Better Bodies

Read the examples and decide whether or not these uses of chemicals in human bodies are permissible or not. Make a note of the criteria you are using to decide. You will be asked to feedback your criteria, not your answers.

A footballer takes steroids to help them recover from exercise and build more muscle.	*A model uses a chemical peel to remove dead skin cells and stimulate the growth of new cells.*	*A boxer uses a synthetic form of a hormone to increase muscle mass and motivation to compete.*
A cyclist uses artificial EPO (a drug made by the body) to make red blood cells to help them cycle longer.	*A celebrity on a TV programme uses spray tan to give them a bronze glow under the studio lights*	*A woman uses a synthetic form of a naturally occurring hormone to treat infertility.*
A teenager has a dental implant to replace a front tooth lost in an accident.	*A darts player takes beta blockers to help them keep a steady hand and eye.*	*An athlete uses a salbutamol inhaler to relieve the symptoms of asthma.*
A rugby player uses a strong painkiller to endure tougher training sessions.	*A male adult uses a strong painkiller to relieve toothache.*	*.A chess player takes beta blockers to treat a heart problem.*

Appendix 5: One Planet Week Philosophy Loft

Sample stimuli for philosophical discussion at the One Planet Philosophy Loft

Bar area: exchange of ideas not money

Select a question and discuss with the bartender in exchange for a drink. Example questions:

- How do we know that what scientists say about climate change is true?
- Is there a difference between H_2O and water?
- Is nature inherently beautiful?
- How does the environment we live in shape our understanding of reality?
- Is it possible to own air?
- Is nature a resource that should be used to conduct experiments?
- Should all life on Earth be protected?
- What is sustainable living?

Fair trade and consumer choice

Offer a choice of products (chocolate, wine). If the non fair-trade option is selected, ask if the participant would like to change their mind and take the fair trade product instead. Ask reasons why/why not, and what the consequences of this are.

One Planet and Rawls' Veil of Ignorance

- Imagine you are deciding on laws to protect the environment.
- Discuss, then decide on the most just laws from behind a veil of ignorance (i.e. not knowing what position you will have in the world you create).
- Once you have agreed on your laws, open an envelope (each envelope contains a brief description of a role, e.g. a global CEO of a plastic manufacturer, newborn child, inhabitant of a low-lying island nation, pilot, dairy farmer) to reveal your position in your world.
- Discuss how the new 'you' would respond to your laws.
- Reflect: did you create just laws?

Appendix 6: Interview guide

Talking Chemistry: Non-formal education in Chemistry, Education and Philosophy

Expectations, motivation, choice

- What did you expect when you heard about Talking Chemistry? Why?
- What made you decide to take part in Talking Chemistry?
  - Why did this interest you?
  - Why was this important to you?
- Were there any other motivating factors that helped you to decide to take part?
- What, if anything, did you hope to get out of Talking Chemistry personally? Why was this important to you?
- What, if anything, did you hope to get out of Talking Chemistry academically? Why was this important to you?
- What, if anything, did you hope to get out of Talking Chemistry socially? Why was this important to you?

Outcomes and values

- How was Talking Chemistry different to other approaches to education in chemistry/education/philosophy you have had to date?
- What did you gain from being involved in Talking Chemistry?
  - How does this relate to what you expected?
- Was there anything surprising about the project and the approach?
  - Was this important to you?
- What, if anything, did you learn about philosophy (particularly ethics)?
  - What was it that enabled you to learn this?
  - To what extent was this important to you?
- What if anything, did you learn about education?
  - What was it that enabled you to learn this?
  - To what extent was this important to you?
- What if anything, did you learn about chemistry?
  - What was it that enabled you to learn this?
  - Was this important to you? Why?

Capabilities: freedom to do and be

- What were the most significant experiences for you? (Consider workshops, planning meetings, peer and staff interactions and experience in schools)
- Are there things that you have gotten out of participation in the project that you will continue to use or work with?
- What are you interested in doing in the longer term?
- What do you need in order to achieve this?
- Are there any opportunities or experiences you have had through the project that you think will help you achieve this?
- Did anything surprise you about the project or your participation in the project?
- Did anything challenge you?
  - Working across disciplines?
  - Working across phases (school/higher education)
  - Interactions with peers?
  - Interactions with staff?

Concluding questions

- On the basis of doing the project, how would you now describe it to others?
- What would you say were the key outcomes of the project for you?
- Is there anything else it is important for us to know about Talking Chemistry?

Thank you for taking part