Young Researchers' Programme

FLASH CARDS
HANDS-ON ACTIVITIES

TASC Wheel (resource for all sessions)

Learn from experience:

a. What have I learned?
b. What knowledge have I gained?
c. How can I use what I have learned?
d. What would I do differently?
e. What have we learned about working together?

Gather and organise:

a. Has anyone got experience of this?
b. What do I know about the subject, and what don't I know?
c. What information do I have and what is missing?
d. What questions could we ask?
e. How / where will we find out?

Communicate:

a. How can I tell or present my work?
b. Who is the audience?
c. What should I say? How can I explain?
e. How do I engage others in my work?
f. How will I know they understand?

Identify:

a. What is the task?
b. What are the goals?
c. What are the main obstacles?
d. What are the success criteria?
e. Does everyone understand the vocabulary?

Evaluate:

a. What have I done / achieved so far?
b. Can I do something different to improve?
c. Did I solve the problem?
d. Have I met the success criteria?

Generate:

a. How many ideas can I come up with?
b. What do other people think?
c. Is there another way to do this?

Implement:

a. Let's do it!
b. How do I check my progress?
c. Am I doing this right?
d. Is my plan working?
e. What do I need to do next?

Decide:

a. Which ideas are important?
b. Which idea is the best?
c. How will we decide?
d. What is my plan?
e. What else do I need to do?
f. What are the pros and cons?
g. What will happen if...?

TASC Wheel (resource for all sessions)

Thinking Actively in a Social Context

TASC stands for Thinking Actively in a Social Context and is a systematic approach to problem solving that encourages cooperative group work and enable Young Researchers (YRs) to focus on one stage at a time when conducting research projects.
The TASC wheel consists of eight stages:

1. Gather and organise: The section involves the YRs doing some serious introspection to determine what they already know about the subject of interest and what questions they would like to answer regarding this subject.

TIP for YRs: Conduct a literature review to identify what is currently known about the topic and potential gaps that need to be filled.

2. Identifying: Now that the YRs area of interest have been fully explored and gaps in literature have been identified, the next stage is to develop a research question.

TIP for YRs: Make sure you define variables in your research question. Also develop a working hypothesis and determine potential obstacles that you might incur on your quest to answering your research question.

3. Generate: This stage is about developing ideas for a research plan in order to answer the research question.

TIP for YRs: Collaborate! Ask for input from peers and mentors in order to create smaller attainable goals that help answer your overall research question. A mind map may come in handy during this stage.

4. Decide: Evaluate each idea for merit and conclude if adequate resources are available to turn ideas into experiments. Will these experiments answer their research question? What else do the YRs need to do to answer their question?

TIP for YRs: Collaborate! Ask your group for input in order to finalise your research plan. You may also want to refine your research question in order to better reflect your plan of action/ experiments.

5. Implement: It's time to start generating data and executing experiments.

TIP for YRs: Monitor your progress and adjust your research plan as needed.

6. Evaluate: Now that the YRs have generated data and completed their experiments, it is time to scrutinise the data using statistical tools to determine if goals were met. Did they answer their research question?

TIP for YRs: Treat this section as a results/ discussion section.

7. Communicate: It's time for YRs to share their results with fellow YRs, mentors, and the community via posters and presentations at conferences.

TIP for YRs: Make sure you communicate in simple language that is suitable for all audiences in order to fully showcase your research.

8. Learn from experience: This stage is all about reflections. YRs will need to determine what worked and why it worked. Also, they need to think about what didn't work and how they can improve upon this in the future.

TIP for YRs: What did you learn about yourself while doing this project? Can the strategies that led to your academic success be transferred to situations outside of this programme?

Nice to meet you

Aim:

• Get to know the programme, other Young Researchers (YRs) and mentors

• YRs select mentors and divide into groups

Key Skills:

• Listening

• Able to build relationships

• Inter and intra personal communication skills

The Exercise:

1. Create a big circle with YRs and mentors

2. Mentors discuss their research with the YRs 

3. YRs discuss their interest to mentors

4. YRs select the mentor they would like to work with and divide into research groups 

Key Reflection:

• Commitment to monthly meetings for duration of programme

• Many opportunities for public engagement along the way

• Introduce the research process and TASC Wheel

1 **Resources** for this session

• TASC Wheel flash card

Make the best paper airplane

The research question

Aim:

- Develop a research question

Key Skills:

- Listening
- Verbal Communication
- Time Management

Resources for this session

- TASC Wheel flash card
- Recycled paper, sissors, tape, colours, and what you think they could use for the airplane
- Flipchart for mindmap

The Exercise:

1. Build the best paper airplane possible 

- Group Discussion:
  - + Create a mind map after airplane is built to discuss why design was chosen
  - + Compare similarities and differences to other groups to create comprehensive mind map

2. Build a new airplane using features from the comprehensive mind map 

Group Discussion:

- What did you learn?
- What was the key aspect for the improvement of the aiplane?

Key Reflection:

- Frame a research question with defined variables / keywords
- Why is your paper airplane the best?
  - + What criteria did you use to determine this?
  - + How do you evaluate this?
- Create a plan to answer research question in order to use time and resources effectively
- A prototype allows you to test ideas and decide if refinement is needed
- Entire TASC Wheel applies to this activity

Drawing through listening

Listening and trusting

Aim:

Improve active listening and contribution to research group

Key Skills:

- Listening
- Verbal communication
- Attention to detail

The Exercise:

1. YRs will pair up with someone else, it can be another YR or a mentor

2. One person in the pair will be the describer and the other will be the drawer. The describer will be given a picture, to keep hidden, that they will need to verbally describe to the drawer (Make sure you do not use the forbidden words!)

+ The drawer can ask questions and also show their image once to the describer to make sure the are on the right track at the 5 minute point

3. Repeat the activity, but swap roles

4. Create a mind map on what worked and what did not work during this activity

Key Reflection:

- Success of activity depends on establishing trust, communication and active listening between partners
- Listen to advice from supervisors (mentors) and collaborators (other YRs) in order to guide research project
- Entire TASC Wheel applies to this activity

TIP

- Use simple language to describe complex features
- Develop confidence by asking for clarity when needed

3 Resources for this session

- TASC Wheel flash card
- Images from Book #3: The Resource Guide (Page 25)

Reading a journal article

Evaluating sources

Aim:

• To interrogate the information we find while doing the literature review

Key Skills:

• Identify biases in information

• Identify false claims in science

• Identify the structure of a scientific journal article

4 Resources for this session

• Print outs of a junior journal article

• The real article

• Quiz

• Petition

The Exercise:

1. Sign the petition: ban Dihydrogen Oxide.

A mentor announces a petition and asks the YRs who wants to sign it.

Group Discussion:

• Ask each group (the ones that signed it and the ones that didn't) what where the reasons for their choice. Explain the importance of digging deeper and explore more in depth what is the petition really about 

2. Three facts and a lie

Group Discussion:

• Tell them which is the lie and why and have a short discussion about how misinformation can be concealed and the danger of this for science 

3. Reading a journal paper:

• Large group discussion: What is an article/paper? Provide print outs of an article from a credible source to each group.

• Quiz (3- 5 questions) to identify and recognise structure and information within an academic paper, e.g. what is the research question? Identify one of the main aims of the research and so on.

First team to get the right answers wins.

• Present the original academic paper as comparison

• Relate activity to key words for their own research 

Reading a journal article

Evaluating sources

Key Reflection:

- Don't let your self be impressed by complex words and shiny advertisements, look into the veracity of the information you encounter

- Evaluating all the information we encounter when doing research is a key skill at every stage

- If people don't know what to believe, how might this affect their perception of science?

- Why do you think it matters if untrue claims about science are reported?

- Why do you think there are claims in the media that aren't true?

- Who is responsible for untrue claims about science in newspapers and online? Who might have a motive to influence what is reported?

- Gathering and organize stage of the TASC Wheel applies here

More than a potato

Collecting data

Aim:

- Observing and registering what you see

Key Skills:

- Attention to detail
- Written communication skills

The Exercise:

1. YRs select a potato to record detailed observations about their potato.

- What makes it unique? What is a feature that would be key to recognise the potato among many other potatoes?

2. Place potato and sheet back in the table and mix up pile

3. YRs swap observation sheets and try to retrieve the potato that observation sheet describes

4. Create a dialogue highlighting:

- What similarities and differences did you notice in the observations?
- What details were necessary for potato retrieval?
- Discuss subjectivity, ambiguity, importance of clarity, what worked and what didn't

5. Devise the perfect questionnaire to unambiguously identify a potato.

- Maximum 6 questions

6. Test questionnaire out on other groups in order to see if they can retrieve your potato

Key Reflection:

- How does this activity apply to research? Accurate observations with attention to detail are important in the method, results and discussion section. It allows others to repeat your experiment, allows you to properly analyse your data and helps colleagues or the public understand your main findings
- What is unique about your research question and topic of study?

TIP

- Conduct a literature review to answer this question and determine what is known about the topic

- What details were critical in creating a questionnaire?
- Entire TASC wheel applies

5a **Resources** for this session

- TASC Wheel flash card
- Potatoes

The crime scene investigation (CSI) Collecting data

Aim:

• To be able to record data in a sistematic way

Key Skills:

• Systematically collect data

• Attention-to-detail

• Inter and intra personal communication skills

5b

Resources for this session

• TASC wheel flash card

• Potential weapons that can be random materials you have at hand (a banana, a brick, a ruler, etc.)

• Measuring tools

• Forensic report Book #3: The Resource Guide (Page 25)

• Instructions

• Excel sheet

The Exercise:

1. Split young researchers into two groups

2. Two mentors present researchers with:

- Crime scene synopsis
- possible murder weapons
- Tools to measure and weigh objects

3. Researchers are given a brief to work with i.e. weapon was between X and X cm/inches long/wide etc. They must work together as a group and record each object to identify the murder weapon

4. Forensic report is provided to YRs to record data and then it is given to the mentor in charge of the spreadsheet

Key Reflection:

• To collect data the researcher needs to be systematic, and pay close attention to every detail

• It is important to transcribe the data with some order in mind

• Entire TASC wheel applies

The faulty questionnaire

Collecting data

Aim:

• To learn about questionnaires and be able to produce one

Key Skills:

• Identify assumptions and biases

• Identifying leading questions

• Oral and written communication

The Exercise:

1. Ask young researchers to select a character profiles

2. Complete the questionnaire in the role of their character selected i.e. if you're character is a vegetarian and question is about their diet select non-meat answers

3. YRs will identify flaws and take notes.

• The group that has identified more flaws wins.

Group Discussion:

• Discuss the idea of leading questions and how to avoid them

• How to ask the right questions for YRs research

Key Reflection:

• Entire TASC Wheel applies to this activity

• What makes a good questionnaire?

• Identify strengths and weaknesses in the questionnaire

5 b

Resources for this session

• TASC Wheel flash card

• Survey sheet questionnaire

• Character profiles

Making posters

Engaging the public

Aim:

• Design a poster as a means to communicate research

Key Skills:

• Inter and intra personal communication skills

• Visual appeal

• Story-telling

• Critical analysis

6 **Resources** for this session

• TASC Wheel flash card

• Poster assessment sheet Book #3: The Resource Guide (Page 25)

• Presentation on how to make a poster

posters around the room

2. Young Researchers (YRs) critique the posters using a marking sheet. They share their thoughts as they are marking 

3. Compare and discuss marks to create a mind map 

• What is the research question?

• Do methods have enough detail to reproduce experiment?

• Has data been critically analysed?

• Have they answered their research questions?

4. YRs draft a plan for their posters 

Key Reflection:

• What makes a poster effective?

+ Design: visuals, colour, layout

+ Content: Key message, error bars on graphs, spelling, clear methods, results, conclusions

+ References are critical in supporting the introduction of the poster

TIP

• Questionnaires are an excellent tool to obtain qualitative and quantitative data

• The segment on the TASC Wheel that applies to this activity is: Communicate

Thinking philosophically about science

Distinguishing science and philosophy is difficult, and these activities intend to reflect that.

Philosophical questions are not about yes or no, right or wrong. Instead, they should open up a space for dialogue where no correct answers are expected. Usually, these dialogues lead to better and more reflexive questions...at least, so we hope!

Any advancement in science raises questions with political, ethical and social dimensions which we need to explore when thinking philosophically with Young Researchers.

These philosophical debates can be used to uncover and dissipate misconceptions about science and challenge 'commonsensical' ethical assumptions.

Questions like: What knowledge should we gain from observing and investigating other galaxies even though we can't visit them? What to do if we found a planet that humans could live on, would we have the right to move there? are important questions, and as said, there is not a single correct answer to them, thus opening up the dialogue for reflection is what we want to do.

We are presenting you with one example of a science and society question, which we have taken from PERFORM (Book #3: The Resource Book, p.25)

Science and Society

(taken from PERFORM resource, CC licensed)

The big question

Should researchers always be responsible for how their research is used?

You are given two scientific scenarios to use with these questions:

1. Scientist often now make their research finding publicly available, meaning the public and other scientists can access their findings. Is this a good idea? How could it affect the way scientists work?

2. As citizens, should we all think about how our work (or behaviour) can have a positive effect on the future of humanity and the planet? What might the challenges be in thinking this way?

3. If you were the researcher, and you found out your research had been dangerously misused, how would you feel? What might you do?

Scientific scenario 1: Chemical fertiliser

You are a researcher working on a process that allows fertilisers to be made, making farming more efficient. However, after you have retired you discover that your research is being used to create explosives.

Scientific scenario 2: GMO crops

You are a researcher working on genetically modified tomatoes to make them have a higher nutritional value and higher yield. Government across the world want to grow the tomato to increase food production. They don't want to restrict its planting which means that there is a risk that it will outcompete and take over native tomato species, dramatically changing ecosystems.

Facilitation questions that can help to focus the discussion:

Can you say why do you think that? What do you mean by ...? Can anyone give an example? Can anyone thing of any exceptions? How does that help us answer the question?