Careers workshop evaluation report: Horsham College Year 11 Physics class

Date: 24 May 2022
Location: Horsham College, Horsham, VIC
FLEET members: Jason Major, Ivan Herrera, Karen Bayros

Overview

This workshop was one of several that FLEET conducted with different years levels at Horsham College. This workshop for year 11 physics students explored the discipline of physics and career opportunities for those with physics qualifications.

Workshop objectives

- To increase student awareness of the depth and breadth of career opportunities in physics
- To affect student perceptions about physics and its role in society

Method

The workshop had four main components:

- A pre- and post-evaluation to assess the workshop's impact relative to its objectives
- An introduction to FLEET, its research problem and research, including a virtual tour of the Monash FLEET labs.
- An interactive exercise where students thought critically about the development and acceptability of AI.
- Mock interviews with FLEET volunteers, Karen Bayros and Ivan Herrera that examined their research, their career journey and what motivated them to study physics. Student were encouraged to participate in the interview by asking questions of Karen and Ivan.

Interactive exercise
The activity got students to explore the acceptability of use of physics research used to develop different AI applications. Scenarios were presented and students placed themselves on a line to represent how acceptable they found the AI application in each scenario. FLEET facilitated a discussion about the different student values that affected how acceptable they found each scenario.

Pre- and post-evaluation
To assess the impact of the workshop, students were asked the following two questions:

- What comes to mind when you think of physics?
- What comes to mind when you think of what physicists do?

Students provided their responses using the online noticeboard, Padlet. For the pre-evaluation, students were asked to complete the questions in the week before FLEET conducted the workshop with their teacher. The post-evaluation got students to respond to the same questions at the end of the workshop with FLEET. Student responses to the pre- and post-evaluation were compared to determine any impact the workshop had. Student responses were analyzed thematically. The analysis is outlined in the Outcomes section below.

Outcomes

Pre-test (N=12)
Three core themes emerged from the pre-evaluation responses: Generic, big picture; Minor specifics; and Lots of math. Each theme is defined below.

Generic, big picture
All 12 students described physics and what physicists do from a abstract, big picture perspective that focused on understanding the universe. There was no detail or thinking that went deeper than that.

Three focused codes fit under this theme: Understanding the universe; How/why stuff works; and Proving theories.

Understanding the universe: When describing their thought on physics, student responses under this code were simply that physics was about understanding how and why the universe works, or how it was created.

> *"I think of theories, concepts and calculations to do with the universe"*
>
> *"I think of the entire universe and how it interacts with itself*

How/why stuff works: Similar to the above code, student responses about their thoughts on physics were generic with typical responses being no more in-depth than understanding how stuff works

> *"I think of maths and how everything works"*
>
> *"I think about what makes things happen and why they happen"*

Proving theories: Three students linked physics to developing and proving theories, but again it was a general statement and associated with understanding the universe or how stuff works

> *"...physicists try and disprove or continue to prove what has already been observed"*
>
> *"I think of theories, concepts and calculations to do with the universe"*

Minor specifics
Two students mentioned specific aspects of physics. These were just single words used in the context of how physics helps us understand the universe or how stuff works. These words were singularity, electricity and the Big Bang.

Lot of math
Four students linked physics to math, but in no more detail than the following:

> *"...physicists do lots of Maths"*

Post-test (N=13)
Three core themes emerged from the post-evaluation responses: Shaping tech futures; building depth and breadth; and Learning. Each theme is described below.

Shaping tech futures
This was the strongest theme to emerge from the 13 student responses with responses from nine out of the 13 students coded under this theme. Three focused codes define this theme:

Developing new technology; Shaping our future; and Social role. Together the focused codes represent a strong perception that physicists play a role in developing new technology that will not only shape humanity's future but have a social role to improve society and solve societal problems

> *"Everything that is out there in the world and the ways people are trying to discover and manufacture new devices to develop future technology to improve our world."*
>
> *"When I think of physicists I think of people involved in the research and development of new technologies and the discovery of new concepts."*
>
> *"When I think of what physicists to I believe they are trying to make new leading-edge things that can help shape the future."*

Building depth & breadth

Again, this was a strong theme to emerge with responses from eight students being coded under this theme. Two focused codes define this theme: Broader understanding of physics and Adding depth to physics definition.

Compared to their pre-evaluation responses, students typically provided a more detailed definition of physics and also gave specific examples of the role it and physicists play in society. They integrated terms such as AI, quantum, 2D, logical thinking, computing, atoms and energy when describing what physics is. They ascribed roles for physicists such as using math to solve societal problems, experimenting with atoms to reduce energy loss and its use in industries such as agriculture.

> *"When I think of what physicists do I think of quantum study and atomic material science."*
>
> *"Physicists require mathematical skills and logical thinking to accomplish their job. Computing plays a large role in physics."*

Learning

Some students recalled interesting things they learned from the workshop, for example, superconductors, quantum computers, lasers for cooling and the existence of 2D materials.

> *"I found it interesting to learn about super conductors and how quantum computers can help our future."*

Limitations

The pre-evaluation task was completed in the week before the workshop with FLEET. I am unaware of how long students got to do this task or what sort of encouragement, stimulation the students received from the teacher to help them with this task that may have affected how much critical thought went into their pre-evaluation responses. FLEET was present and oversaw the pre-evaluation task, but we were running short of time and I asked students to focus on the first question, What comes to mind when you think of physics? Most students, however, managed some response to the second question or integrated it with the first. Time constraints, however, still meant there was a limited time to think deeply about a response. There is the potential for the difference in how the pre- and post-evaluation were conducted to affect the student responses and our analysis of the impact. Nevertheless, I have analyzed the pre- and post-evaluation as if they were conducted under identical conditions.

Impact (what does it all mean)

The key impact was that students appeared to gain a greater understanding of the discipline of physics: what it is, the breadth and depth of the discipline and its role in society. Students became more aware that physics is not an abstract field of research, but has real-world applications and implications for themselves and society.

The strongest theme to emerge in the post-evaluation was students' awareness of physicists developing actual technologies to solve problems, improve society and shape humanity's future. Before the workshop, students presented a simple and abstract picture of the physicist working to understand how the universe worked. There was no association with physicists' and physics' integral relationship with society and the technologies we rely on or might need to rely on in the future.

There was some indication from student responses in the post-evaluation that they understood more about the broad nature of physics as a discipline. This is indicated in their recall about topics such as 2D material, quantum computing/quantum research, lasers and AI that did not appear in their pre-evaluation responses.

There was recall also on points of interest such as laser used to cool 'systems', superconductors and quantum computers that suggests there was some engagement with the presentations/interviews with Ivan and Karen, who talked about these topics.

Workshop objectives

Despite the limitations described above, the comparison of the pre- and post-evaluation is indicative that the workshop increased student awareness of the depth and breadth of career opportunities in physics, and affected student perceptions about physics and its role in society.