UNIVERSITY of LIMERICK
OLLSCOIL LUIMNIGH

STeP INTO SCIENCE

EPI·STEM

Science and Mathematics Education Conference
17th June 2016
Session 10

Continuous Professional Development in Scientific Argumentation: *STeP into Science* Project

Presented by

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Step into Science Team

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An tSraith Shóisearach do Mhúinteoirí Junior CYCLE for teachers

sfi Science Foundation Ireland

Presentation outline

Brief overview and rationale for argumentation in science education

Activities to support argumentation in science lessons

Initial Findings and Summing up

Socio-Scientific Issues

THE IRISH TIMES

Mon, Jan 26, 2015 Dublin 4°c

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Food & Drink › Recipes | Restaurants | Drink All Life & Style

Food safety head calls for an end to irrational fears over GM technology

Prof Alan Reilly says no one has died from eating GM food

Prof Alan Reilly of the Food Safety Authority of Ireland: said genetic modification was one of a number of promising tools for improving nutrition and increasing food production "yet Europe remains sceptical and reluctant although nobody has become ill or died from the effect of eating food derived from GMOs". Photograph: Cyril Byrne / The Irish Times

Alison Healy

Topics: Life & Style Food & Drink Prof Reilly Eu European Food Safety Authority Food Safety Authority of Ireland

Thu, Aug 28, 2014, 01:00 Recommend 103 Tweet 10 +1

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Argument

Justification of knowledge claims with evidence

Important aspect of scientific enquiry and process of science

Shows that science is more complex than '*doing experiments and finding patterns*'

Value of Argument

Fosters a commitment to evidence

"The rationality of science is secured by its commitment to evidence; the fostering of a commitment to evidence is a fundamental educational aim. Science's rationality thus makes it particularly well suited to the general task of education, and science education can, and should be seen as a central component of an education dedicated to the fostering of rationality and critical thinking. The commitment to evidence is basic both to science and to education"

Siegel, H. (1989). The Rationality of Science, Critical Thinking and Science Education. *Synthese, 80*(1), 9-42.

Argumentation at Junior Cycle

Strand One: Nature of Science Learning Outcomes (NCCA, 2016)

NOS6. "*conduct research relevant to a scientific issue, evaluate different sources of information including secondary data, understanding that a source may lack detail or show bias*"

NOS7. "*organise and communicate their research and investigative findings in a variety of ways fit for purpose and audience, using relevant scientific terminology and representations*"

NOS8. "*evaluate media-based arguments concerning science and technology*"

NOS10. "*appreciate the role of science in society; and its personal, social and global importance; and how society influences scientific research*"

Argumentation at Junior Cycle (NCCA, 2016)

JUNIOR CYCLE SCIENCE AND KEY SKILLS

Key skill	Key skill element	Student learning activity
Being creative	Exploring options and alternatives	As students engage in scientific inquiry, they generate and seek to answer their own questions. They try out different approaches when working on a task and evaluate what works best.
Being literate	Expressing ideas clearly and accurately	Students will plan, draft and present scientific arguments, express opinions supported by evidence, and explain and describe scientific phenomena and relationships.
Being numerate	Developing a positive disposition towards investigating, reasoning and problem-solving	As students engage with science, they will come to appreciate the fun of exploring mathematical problems in the context of a scientific idea and the satisfaction of arriving at a solution.
Communicating	Using numbers and data	Students will interpret, compare, and present information and data using a variety of charts/ diagrams fit for purpose and audience, using relevant scientific terminology.
Managing information and thinking	Being curious	As students research socio-scientific issues, they will ask questions to probe the problem more deeply and to challenge how they think about the issue.
Managing myself	Making considered decisions	Students enjoy a wide range of collaborative discussions, providing them with opportunities to listen to different perspectives when considering their options.
Staying well	Being safe	Students will engage frequently with planning and conducting practical activities: they will learn to recognise when their personal safety is threatened and respond appropriately.
Working with others	Contributing to making the world a better place	Students enjoy frequent opportunities to discuss and debate issues relating to sustainability. They will learn to think critically about the world and its problems and propose solutions.

Example from PISA Assessment Framework on Interpreting Scientific Evidence & Conclusions

Science Example 2.2

Suppose that on one stretch of narrow road Peter finds that after the lane lines are painted the traffic changes as below.

Speed Traffic moves more quickly

Position Traffic keeps nearer edges of road

Distance apart No change

On the basis of these results it was decided that lane lines should be painted on all narrow roads. Do you think this was the best decision? Give your reasons for agreeing or disagreeing.

Agree: _____
Disagree: _____
Reason: _____

Scoring and comments on Science Example 2.2

Full Credit

Code 1: Anaswers that agree or disagree with the decision for reasons that are consistent with the given information. For example:

- agree because there is less chance of collisions if the traffic is keeping near the edges of the road, even if it is moving faster;
- agree because if traffic is moving faster, there is less incentive to overtake;
- disagree because if the traffic is moving faster and keeping the same distance apart, this may mean that the drivers don't have enough room to stop in an emergency.

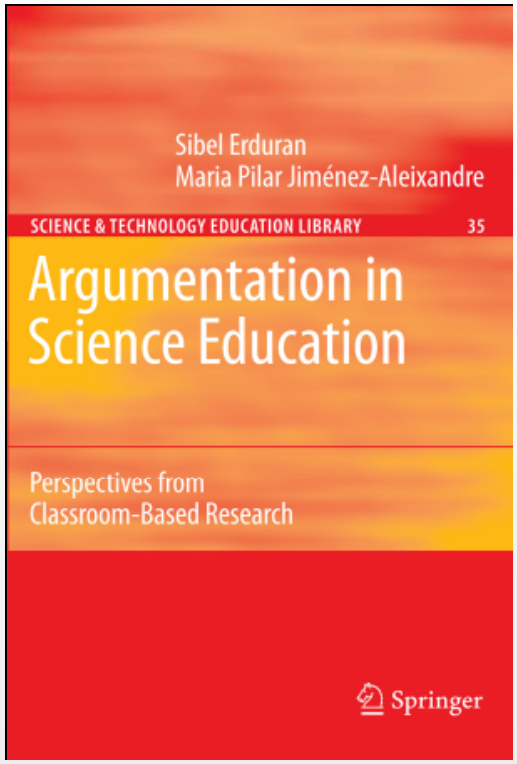
No Credit

Code 0: Answers that agree or disagree without specifying the reasons, or provide reasons unrelated to the problem.

Item type: Open-constructed response
Process: Interpreting scientific evidence and conclusions (Process 3)
Concept: Forces and movement
Situation: Science in technology

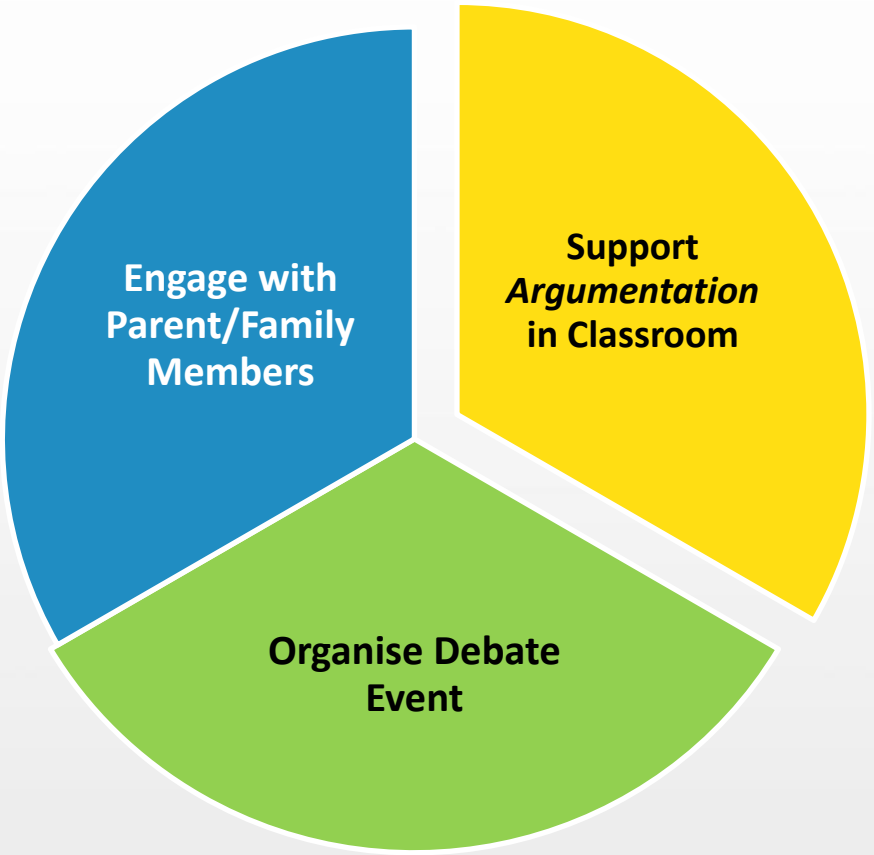
(OECD, 2003; p. 144)

Research in Argumentation in Science Education



Erduran., S., & Jimenez-Aleixandre, J. M. (2012). Research on argumentation in science education in Europe. In, D. Jorde, & J. Dillon (Eds.), Science Education Research and Practice in Europe: Retrospective and Prospective, pp. 253-289. Rotterdam: Sense Publishers.

Aims of STeP CPD



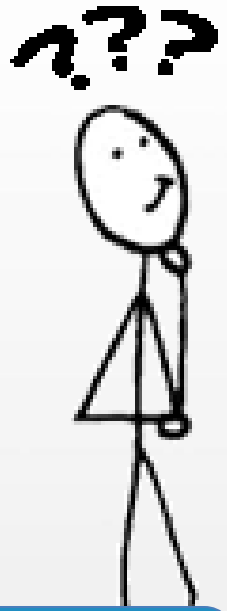
Project Milestones

EPI·STEM

May 5th 2016	• Teacher workshops: Learn how they can implement argumentation into their teaching
September 2016	• Teachers implement into their classrooms. • Homework activities with parents
Science Week- Oct/Nov 2016	• Debate Event • Evaluate at debate event

Discussing Argumentation

Divide into groups of three.



1. Pick a card that contains a statement (All capitals), then identify a piece of evidence that backs it up, identify a rebuttal to refute statement.

2. Discuss whether you believe the evidence to be credible for that statement.

Animal cloning benefits our society

Centre for Research of Endangered Species, in New Orleans say that animal cloning will provide a means of saving endangered species

Donald Trump says that animal cloning goes against the natural order of nature

Argumentation Activities: Badger Culling

Badger culling involves the slaughter of badgers to decrease the population.

In your groups, discuss each claim and use the evidence statements to build up support for your claims.

A study in the United Kingdom, recorded the impact of culling 11,000 badgers. They concluded it had no significant impact on the control of Bovine tuberculosis in cattle.

The Four Areas Project was conducted in Ireland, it concluded that reducing the badger population by approximately 80% in area for several years reduced the number of cattle contracting bovine tuberculosis.

Argumentation Activities: GMO

There is limited evidence to support long-term safety of eating GMOs

Genetically Modified Foods

You are a doctor who often treats patients for vitamin deficiencies, such as vitamin A deficiency which can lead to blindness and even death. But many of your patients are very poor and cannot afford the cost of vitamin supplements or of buying a wider variety of foods. If your patients could buy genetically modified rice "*Golden Rice*" which is fortified with vitamin A, their health would be greatly improved without any additional costs. But genetically modified foods are not available for sale in your country.

Should you decide to begin a lobby group to have them certified for sale on the grounds of your patients' health?

Use of GM crops which are resistant to pests and diseases means less need to use herbicides and pesticides which is better for the environment

Prompts to stimulate the discussion

Why do you think that?
What is your reason for that?
Can you think of another argument <u>for</u> your view?
Can you think of an argument <u>against</u> your view?

Setting up the school debate

Typical Debate Structure

Team A presents their **main arguments** (3 min)
Team B presents their **main arguments** (3 min)

Team A presents their **rebuttal** (2 min)
Team B presents their **rebuttal** (2 min)

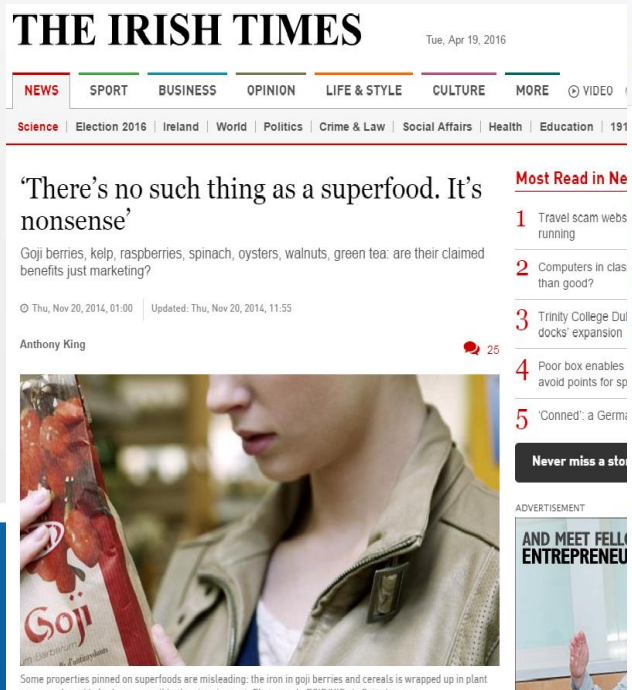
Team A **cross examination** of Team B (3 min)
Team B **cross examination** of Team A (3 min)

Final Statement Team A (2 min)
Final Statement Team B (2 min)

Questions from the audience who can ask either team (3 min)

Debate: Superfoods, super scam?

1. Divide into two teams, "*for*" and "*against*"
2. Assign a role to each member of group, (main argument, rebuttal, cross examination, final statement).
3. Use the articles supplied or mobile phone to complete your section of debate planner worksheet.


THE IRISH TIMES

Tue, Apr 19, 2016

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'There's no such thing as a superfood. It's nonsense'

Goji berries, kelp, raspberries, spinach, oysters, walnuts, green tea: are their claimed benefits just marketing?

Thu, Nov 20, 2014, 01:00 | Updated: Thu, Nov 20, 2014, 11:55

Anthony King

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Some properties pinned on superfoods are misleading: the iron in goji berries and cereals is wrapped up in plant


Green tea: the elixir of life or just hype?

SUPERFOODS THE EVIDENCE

Green tea has been used in traditional Chinese medicine for centuries to treat everything from headaches to depression.

The leaves are supposedly richer in antioxidants than other types of tea because of the way they are processed.

Green tea contains B vitamins, folate (naturally occurring folic acid), manganese, potassium, magnesium, caffeine and other antioxidants, notably catechins.

All types of tea – green, black and oolong – are produced from the Camellia sinensis plant using different methods. Fresh leaves from the


Can beetroot juice give you wings?

SUPERFOODS THE EVIDENCE

eetroot's deep, overpoweringly red juice has earned it the eputation as the most bossy of vegetables.

lthough the leaves have always been eaten, historically the beet roo as generally used medicinally for a range of ailments, including evers, constipation and skin problems.

eetroot is a good source of iron and folate (naturally occurring folic cid). It also contains nitrates, betaine, magnesium and other ntioxidants (notably betacyanin).

lore recent health claims suggest beetroot can help lower blood ressure, boost exercise performance and prevent dementia.

Ve've teamed up with the British Dietetic Association (BDA) to

Ideas for Homework Activities

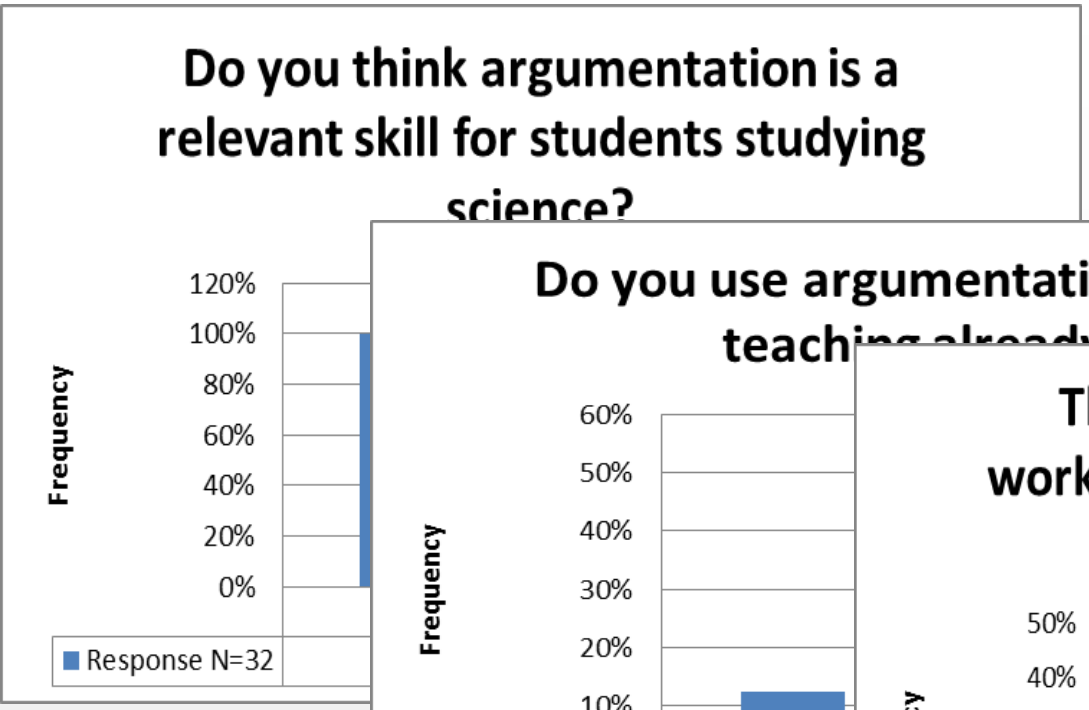
Homework Activity 1:

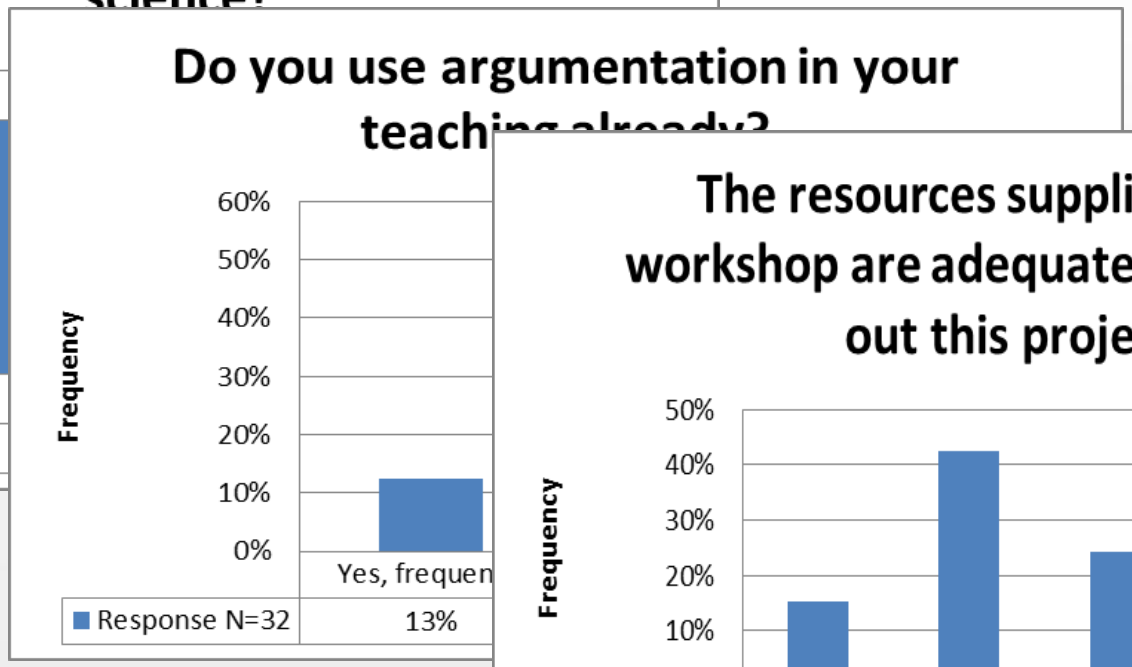
- Student is given a link to article to **read** relevant to their debate title.
- Student must **identify claims, evidence** and if the claim is for or against their motion.
- Arguments for their motion may be used in their debate. Arguments against their motion may be used as potential rebuttals. **Discuss** article with guardian outlining main arguments. (See attached worksheet)

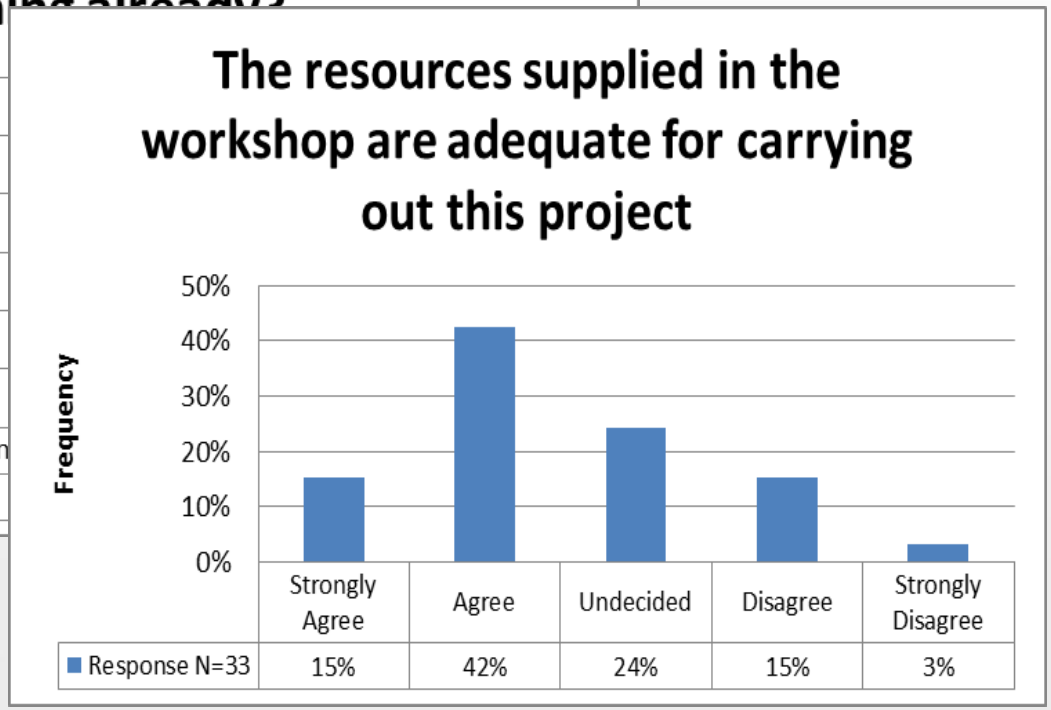
Homework Activity 2:

Complete debate section and **present verbally** to parent. Get feedback from parent about what is good regarding (i) debate content, (ii) presentation skills. Discuss potential improvements in (i) debate content and (ii) presentation skills.

Initial Findings from CPD Evaluation







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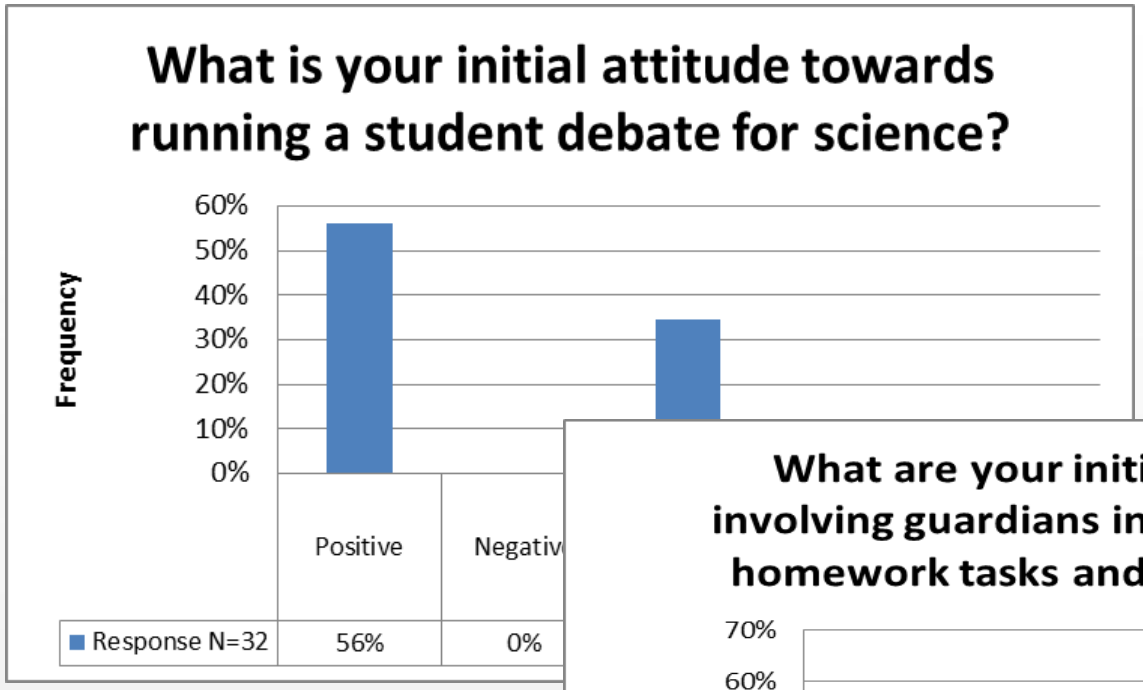
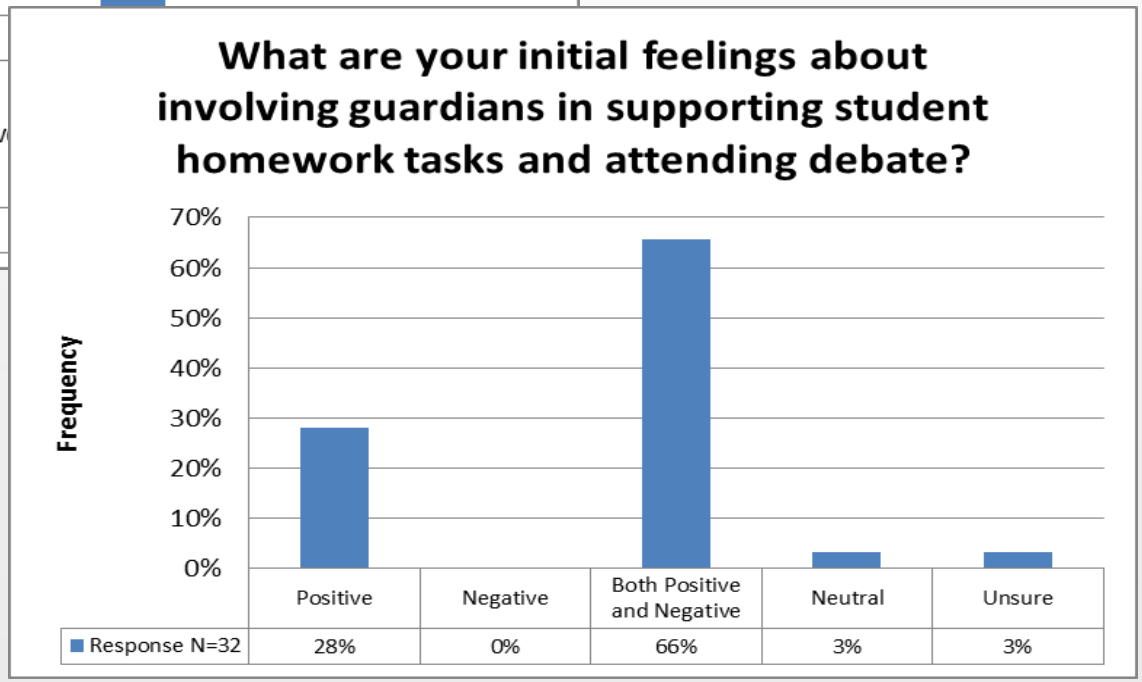
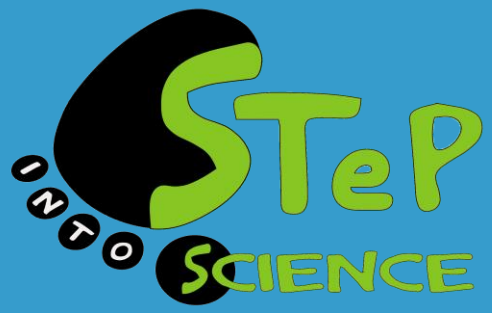


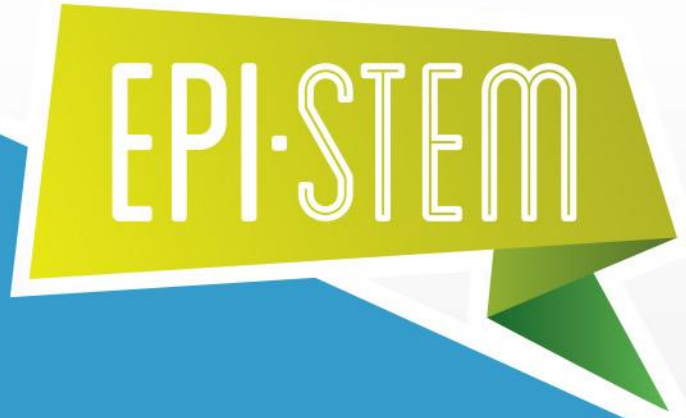


Potential Long-term Impacts

Several potential long-term impacts of the project:

- **teachers**, produce innovative resources and pedagogical strategies;
- **students**, the skills of communication and argumentation that will be fostered through the debate lessons;
- **parents**, promote parental involvement in children's school-based activities and science.





Inquire · **Engage** · Empower

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