

Expert Perspectives & Methodological Excerpts:
A Creative Semi-Fictionalised Epistolary
Describing A Student Voice Led Study
Of Irish Teens' Engagement With
Earth Science & Climate Change

E. E. Neenan

Submitted for the degree of Doctor of Philosophy to
Trinity College, the University of Dublin
2020

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A handwritten signature in cursive script, reading "E. E. Neenan". The signature is written in black ink and is positioned above a horizontal line.

E. E. Neenan

This is a work of fact.
Any resemblance to real people, living or dead, is entirely intentional.

Expert Perspectives & Methodological Excerpts:
A Creative Semi-Fictionalised Epistolary Describing A Student Voice Led Study Of
Irish Teens' Engagement With Geoscience & Climate Change

Emer Emily Neenan

Today's teens have seen the writing on the wall, as oceans rise and global superpowers fall. Schoolchildren take to the streets and make crucial pleas, challenging the powers that be. Meanwhile, in Ireland, Junior Cycle Science widens to define, for the first time, Earth and Space Science as a fundamental strand. This study planned to examine if students understand Earth Science / geoscience concepts and if they are interested in the topic. As the study progressed, it was decided to widen it to explicitly include the climate crisis in addition. The methodology was founded from the first in feminism; it's essential to minimise the power differential between researcher and researched. Therefore, Children's Research Advisory Groups (CRAGs) were convened with representative teens, who co-designed the research instrument, a survey; they had input on the language, the layout, the length, etc. The survey included questions to assess students' opinions, and items from concept inventories to explore their conceptual understanding. There were more than 100 respondents, from five separate schools. The sample was skewed towards girls. The results were discussed and analysed with CRAGs, who provided perspective as experts on the experience of studying Science in secondary school. We, these CRAGs and I, found firstly that students are interested in Earth Science, and more interested still in climate change. There's enthusiasm and engagement, and there's fear and frustration. They generally found the concepts difficult, with an average of four, of fifteen items, correct. The findings are clear; teenagers fear what they'll face as the pace of this crisis outstrips the response. They ask to be equipped with knowledge and power. The choice to centre student voice in this research was fundamental; the depth of analysis achieved was made possible by the positioning of the teens at the core, listening to them allowed so much more to be gleaned from the answers. This thesis presents this project's context, methodological progression, results and discussion, limitations and successes, in an epistolary format that puts more emphasis on the research processes.

Summary

the purpose of which is both increased access to scholarship and long-term preservation.

SUMMARY

108 A succinct summary of the methods used and the major findings of the thesis must be bound into each copy of the thesis following the declaration page. It must not exceed two pages of typescript.


ACKNOWLEDGEMENT

109 A formal statement of acknowledgements must be included in the thesis.

Since my thesis is an epistolary, I'm gonna do the summary as a collage. A collage is like a visual epistolary! \^(^)/

TCD School of Education

What Irish school students can tell us about geoscience and why we should listen



The goal is to answer the questions
As best as restrictions allow
And how will my project be best done?
A mixed methods process is how.

Interest & Understanding

1. A mixed methods study founded in a children's rights based methodology; a survey supported by Children's Research Advisory Groups (CRAGs)

AND TEENAGERS!

Emer Emily Neenan
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@e3neenan

It's Our Future, Ask Us!!

Centring Children's Voice In Geoscience Education Research

CRAGs!!

Children have the right, under the United Nations Declaration on the Rights of the Child, to give meaningful input on research that concerns them¹.

That means you have to actually listen to what we say.

Children can contribute to all stages of a research project: designing research questions², data collection³, analysis⁴, and dissemination⁵.

(THIS MEANS TELLING PEOPLE ABOUT THE RESEARCH)

they would work for anyone, actually! even adults?!

Children's Research Advisory Groups are used in an ongoing research project undertaken by Emer Emily Neenan in the School of Education, Trinity College Dublin. This project investigates Earth Science education in Irish secondary schools.

LOL IT'S A SURVEY

In this project, the "research instrument" was co-designed by CRAGs, composed of representative students from two participating schools. The CRAGs will be convened again to give input on the results of the survey.

we're gonna video chat!

It is especially important to give children a voice on issues relating to climate change.

Their opinions must be taken into account in education and policy.

WE WON'T BE SILENT!

Survey

AND it's something important!

It's going to be in a published report so we take it very seriously.

actually we called it a "Questionnaire" cause it sounded more professional haha

This!!!

Trinity College Dublin
School of Education
Geoscience Education Research

IRISH RESEARCH COUNCIL
SchoolStrikeForClimate

2. CRAG groups of teenage student co-researchers helped design the survey & analyse the results, e.g. giving input on language & direction.


GCI (dzi: si: ai): ac. Geoscience Concept Inventory, a list of multiple-choice items designed to measure understanding of concepts key to geoscience

Earth Science Questionnaire

* Required

This is a research questionnaire for a Trinity College Dublin project on how people learn about the Earth and Earth Science.

My name is Emer Emily Neenan and I'm a researcher working at Trinity College Dublin. I'm a geologist (a scientist who studies the Earth's crust) and I also teach classes about Earth Science. At the moment, I'm researching what makes people interested in learning about Earth Science and how much they learn. This questionnaire will ask you about your experience learning about the Earth in school.



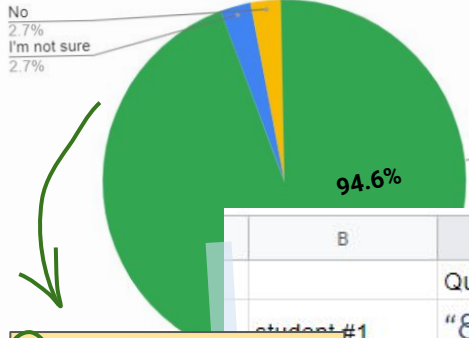
THIS IS ME

3. Survey aimed to measure attitude towards (via open field questions) & understanding of (via concept inventory questions) Earth Science & climate change topics.

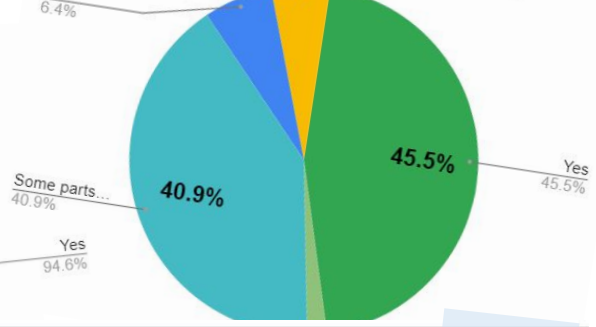


4. Results were clear, with many responses echoing sentiments expressed during the School Strikes for Climate taking place in 2019/2020.

Do you feel it's important or useful to learn about climate change in school?



Are you interested in learning about the Earth?



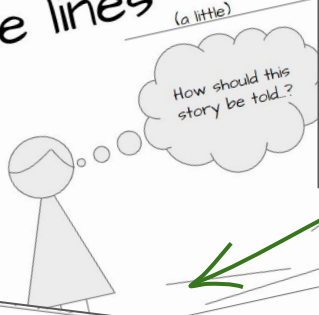
5. Overwhelmingly, the students agreed that Earth Science and climate change are both interesting & important. Even students with criticisms agreed on importance.

B	C
	Quotable opinions
student #1	"Earth science is the study of the Earth."
#2	"We need to know how the earth functions and how we can take care of it, also the earth is beautiful why not learn about it"
#3	"A lot of teachers just teach us about it they don't tell us how to prevent it from happening."
student #4	"It's not good enough to just listen to other people or hear it on the news we need to understand"

6. The study resulted in useful & interesting findings, supported & given greater depth by the CRAGs' perspective. Use of CRAGs was highly successful.

Writing outside the lines

- For yourself
- For your audience
- ★ For the values of your research

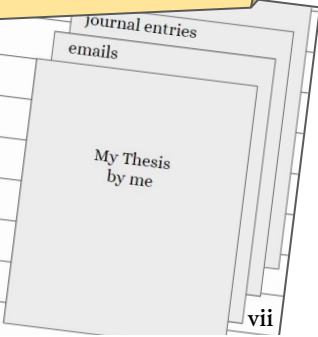


This project frames a practical methodology for including CRAGs in all aspects of geoscience & climate change decision-making.

7. The thesis has been written in an epistolary format, highlighting the researcher process throughout, & using creative writing to describe the study in detail.

Similar to an epistolary novel, an epistolary thesis would take the form of a series of documents which, when read together, would form a narrative.

In this case, taking the reader from the early conceptualisation of the research project, through the execution of the project, and into a discussion of the field and future work.



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Many thanks too to my co-supervisor, Professor Colette Murphy, for offering certainty and stability when I wobbled, and curiosity and glee when I was ready to jump into the unknown. Her office is a haven, her casual conversation so interesting I often feel like I should be taking notes, and her wisdom generously imparted.

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Speaking of my family...

To Áine & Frank, for the support and the spare room and the sanity checks. For jam in the morning and whiskey at night. For beta-reading, proof-reading, paper-reading, and reading back over again. For providing the baby with walks and dinners and giggles and distractions, and providing me with the same. For always, always believing. I can't thank either of you enough.

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To Stuart. What can I say? For putting up with this! For carrying the baby, and the chores, and a full-time job, during a global catastrophe, while I wrote and panicked and abandoned glasses of milk and cups of tea in weird places, and for still finding time to sit and watch *Gintama* and laugh with me. For talking things out with me and offering a hand or a push or the promise of chips when I'm stuck. For being exactly who I need. You're great!

And to Kai. I'm not going to thank you, because frankly you didn't help at all; you can't read and you keep just trying to climb on me. But you were part of this story too, a very important part. I can't wait to share more stories with you!

- E



Kathryn, Barry, Stuart, Kai, Joseph, the author, Laura, Áine & Frank
06/08/20

I dedicate this work to my parents,
Áine and Frank.

Look, I did it!

From the desk of Emer Emily Neenan
Government of Ireland Postgraduate Scholar
School of Education
Trinity College Dublin
Ireland

6th August 2020

Dear Reader,

In lieu of a traditional introduction, allow me to address you directly in order to briefly explain the structure of this thesis. Instead of a typical structure, it consists of 30 “documents”, creating an epistolary thesis. You’ll recognise these documents from the Table of Contents, and you’ll be able to tell from the length of the thesis that most of these documents are short; some are under 1,000 words and the longest by far is still under 8,000 words.

Following this introductory letter, I outline the **rationale** of the project (and introduce my supervisor) in semi-fictional emails. Then the **background** to the project is presented as a (published) position paper. The fourth document of the thesis lists **definitions** of the vital terms used within the thesis. The fifth document covers the **aims and research questions**, via an excerpt from my successful funding proposal, and this is followed by a short **summary** of the project that takes the form of a talk I gave at my university. Altogether, these six documents can be thought of as the Introduction.

Documents 7 and 8 deal with geoscience education in the **international context** (as a short story) and the position of geoscience in the **Irish junior second-level school classroom** (as a spoof second-level exam question), respectively. These could be described as the Context documents. This thesis doesn’t contain a traditional literature review, but the literature in this field is covered in detail throughout the documents that form the Introduction, Context, and Methodology.

The next group of documents is the longest, and broadly forms a Methodology.

The first group of seven documents here cover the theoretical grounding and structure of the project. These are, in order, the **philosophical basis** (document 9, a journal excerpt), the justification of the choice of a mixed methods **research approach** (a poem), the **research tradition** I have drawn on, written as an email to my mother, and the research method I have used to incorporate student voice, **Children's Research Advisory Groups** (CRAGs), written as another talk, with discussion. I include details of my **ethics** submission as the 13th document, and then more emails covering the research method used to measure student understanding (**Concept Inventories**).

The second group of documents in the Methodology cover the practical aspects of the research methods, and open with the 15th document, a short story on the **implementation of CRAGs**. Following this is an annotated survey describing the **survey design process**. Document 17 is a group of emails and social media posts covering the **survey rollout**. Document 18 was unplanned, but became vital. It is a group of chatlogs that discusses the reorientation of the project due to the **effects of the COVID-19 global pandemic**. Document 19 then details the use of **student voice in data analysis** as another short story. The final document in this group is a methods paper on the **use of CRAGs** (submitted for review at the time of submission).

The longest single document is the 21st; a full breakdown of the **survey results**, presented with the analysis of the student representatives. This is the core of the thesis. This is followed by a **reflection** on this process. These two documents could be described as the Results section.

After the Results, I present the **key findings** in the form of an academic journal letter, document 23. Another letter immediately follows; a missive to the current Irish Minister for Education, discussing the **implications for education policy**. Then comes a short (fictional) zine explicitly discussing **gender** in the results. The 26th document is a Wishlist of things I might have done differently, given more time and money! This covers the **limitations**. Following directly on from this is the final short story, covering the **avenues of further research**, and then another proposal excerpt as the 28th document, taking one of these potential avenues and laying it out in detail as the potential **next steps**. These documents are the Discussion.

The final two documents, 29 and 30, are the Conclusion. The penultimate is a poem, a **self-reflection** of how I have developed as a researcher and person over the course of the PhD. And then I will address you directly one last time, dear reader, in a final letter of **concluding remarks**.

There are also two short Appendices. One is a *Thesis Personae*, so if you want to check who anyone is, what their role is, or if they're real or fictional, you can do so at the end of the thesis. The other is primarily a collection of (real, not fictionalised) emails and chats wherein I ask various people if I can write them as “characters” in this thesis!

But before you get to reading all that, I wanted to briefly explain my decisions behind the composition of the thesis, since it is so different to the norm.

Initially, when planning my thesis, I thought I would simply like to write in a straightforward, active style. The traditional academic style prioritises objectivity and preferentially uses the passive voice, but the traditional style is not the only way to ensure the writing is good, the research was rigorous, or the document is of high quality. The writing must be clear and precise, but I began to think about what more it could be.

A PhD project is intensely personal; no one else would do the same research in exactly the same way, or describe the results in precisely the same terms. It is, of course, important to address any personal bias we bring to our research, but attempting to address our biases doesn't have to mean excising any hint of personality completely.

“A particular narrative style is privileged in academic research and publishing, one that removes the protagonist (the researcher) and her values from the “facts” that are produced.”

Katherine Carroll, 2015

In thinking about the way I want to present my PhD research, I began to consider alternative formats to the traditional thesis. Professor Aidan Seery talked to us newly-minted PhD students about thesis formats early in the first year of my PhD research, and suggested that, in a deft pair of hands, research can be effectively and engagingly presented in unusual

styles. He gave an example of a student in Trinity, Lisa Maria Reilly, who wrote her thesis as a semi-fictionalised narrative; essentially an embellished memoir.

“I’m writing a story, drawing on my own experience of teaching and researching in Irish higher education. The data is real [...] but the conversations described in each chapter are inventions, used as a means of introducing the reader to the topics discussed.”

Lisa Maria Reilly, 2016

During this period of consideration, I also read Bram Stoker’s *Dracula*, a classic epistolary novel, and began to consider the suitability of the epistolary format as a means of describing the process and results of academic research. I found an academic journal article by Carroll (quoted above), in an epistolary format, but no epistolary theses.

Similar to an epistolary novel, an epistolary thesis takes the form of a series of documents which, when read together, would form a narrative. In this case, taking the reader from the early conceptualisation of this research project, through an exploration of my own thoughts on relevant literature and methodology, then through the results of the research, and finally into a discussion of the project and future work. As the name suggests, the typical document is a letter (from the Greek for letter, *epistole*, which lingers in English as a formal letter, *epistle*), but for this epistolary thesis, the documents include emails, journal entries, annotated research instruments, and, most particularly, published and unpublished articles. Where necessary, these documents are semi-fictionalised; they are closely based on my experiences or data, but not taken word-for-word from my journal or email inbox.

The advantages I see are in readability, writability, and flexibility.

I want my writing to be engaging as well as accurate, and ideally to be enjoyable to read. A well-crafted epistolary novel allows the reader to feel a closer connection to the action in the narrative, and I believe a similarly carefully created epistolary thesis allows a reader a closer connection with the research and particularly with the research process. While the writing is still precise and accurate, I don’t adhere strictly to the highly formal academic writing style throughout. An epistolary format “offer[s] a novel and accessible means through which research-based knowledge can be made available to the community at large” (Carroll, 2015).

This is a more engaging style to write in, and it allows me to use my journal writing and my article writing more directly. It allows me to be creative, to use the tools of fiction and even poetry to express what I want to express. It's tempting to say forms such as poetry can work "even for complex topics such as climate change". In fact, as Sam Illingworth proves in a 2019 paper on climate poetry, poetry can work *especially* for complex topics. This combination - of academic writing, casual prose, creative non-fiction, fictionalisation, and poetry - allows me to use the writing skills I have to best effect. It also makes the writing process more enjoyable for me and for my editing supervisors.

This approach has allowed me more flexibility. I have written in different styles, to suit different aspects of the thesis. I have crafted the story of the research as a narrative and provided all the necessary information in the format that best suits. I have edited each section separately. If I think that my overview of the field is best expressed in highly formal, technical language, and my discussion of personal biases is best expressed by an anecdote in direct, first-person informal language, I can do both of those things without worrying that the diversity in tone will be jarring or appear to be due to thoughtlessness or incompetency; such diversity is supported by the format. The diversity of language also allows the thesis to stand as a demonstration of my flexibility as a writer, and the epistolary thesis as a whole is a demonstration of innovation and creativity in communicating research.

Two notes, one on chronology and one on pseudonymity.

As far as practicable, the documents comprising this thesis are in chronological order. This has mainly been possible without fudging dates or outright lying - I followed the traditional work pattern for the most part, so early journal excerpts on my ontology and epistemology really were conceived and written before I started doing (or writing short stories about doing) survey design with teenage co-researchers, which obviously all took place before I could tackle the results and write about them. As in real life, as in the thesis. But some things happened in the "wrong" order. For example, the paper on the CRAGs methodology was dreamt up a while earlier than it appears in the thesis, but overshot itself in real life by well over a year as I wrote and ignored and rewrote and abandoned and edited and despaired and finally submitted it for publication. So for the most part, you'll see the dates slowly progressing from April 2016 to August 2020. The earliest emails and the final submission are fixed points for me. But where it would assist your understanding, I have moved or obscured a date here or there.

It will be obvious, reading this thesis, that at least some of the people who appear in it are real. I certainly intend to give every impression that I myself am real. My supervisors, my close colleagues, and my friends and family have not only kindly given their blessing to appear as “characters”, many of them are downright excited about it! On the other hand, it will become obvious that some people aren’t - can’t be - real, or at least, appearing under their real names. Most particularly, I can’t name the teenagers I worked with, for ethical reasons, so the teenagers who appear are fictional, pseudonymised, amalgamated versions of the real teenagers. And a few people in it aren’t real at all, they’re narrative devices to “ask” a question I needed to answer. I considered indicating throughout who is real and who is fictional (wholly or partly), but other readers before you, dear reader, thought it would take you out of the flow of the story. So instead, take this as your “some names have been changed” disclaimer, and if you’re interested in specificity, the full *Thesis Personae* in Appendix I notes who is real along with full names and short descriptions of roles.

As you read through the sections described above, you will read the narrative of the project’s early stages in the form of emails and journal entries, essays and excerpts. Every word (except, of course, cited quotes) has been written by me; the emails “from” my supervisors or colleagues are fictionalised, paraphrased, or otherwise created by me in their “voice”. Be aware that, as there are a lot of small images throughout, the List of Figures includes only major diagrams, graphs, posters, etc., and is not intended as an exhaustive list of every image.

The two long poems are available in an audio format instead, on e3neenan.ie or by request. This is for accessibility purposes, but they’re also there for anyone who might simply prefer to listen to them as spoken word!

I have one request: if you read this thesis, or any part of it, please let me know you did at e3neenan.ie/thesis. That form also has space for you to give feedback if you would like to, but really I would just love to know how the thesis gets on now that it’s being released into the wide world.

I put a lot of myself into this thesis. I sincerely hope you enjoy reading it, dear reader.

Is mise,

A handwritten signature in cursive script that reads "Emer Emily Neenan". The signature is written in black ink and is positioned above the printed name.

Emer Emily Neenan

Carroll, K. (2015). Representing ethnographic data through the epistolary form: A correspondence between a breastmilk donor and recipient. *Qualitative Inquiry*, 21(8), 686-695.

Illingworth, S. (2020). “This bookmark gauges the depths of the human”: how poetry can help to personalise climate change. *Geoscience Communication*, 3(1), 35-47.

Reilly, L. M. (2016). *Cliques, conflicts, clairvoyance: The emotionality of the university classroom for 'non-traditional' students* (Doctoral dissertation, Trinity College Dublin).

01 April 2016 at 12:34 pm

From: Emer Emily Neenan

To: Joseph Roche

Dear Professor Roche,

My name is Emer Emily Neenan and I would like to enquire about your research.

Specifically, I am interested in pursuing research into geoscience education in Ireland, and I hope you might be able to advise me.

My rationale for studying this topic is threefold.

Firstly, no research has been published on the engagement of post-primary students in mainstream Irish schools with geoscience (or Earth Science). Earth Science is included in the new Junior Cycle Science curriculum, and anecdotally it seems Earth science outreach programs are popular in Irish schools, but so far, no one has studied how well Irish children and teenagers understand Earth Science, or if they find it interesting or important.

Secondly, the current cohort of Irish students entering the Junior Cycle will be the first to be introduced to Earth Science as an official part of the Junior Cycle Science curriculum (the Earth and Space strand). This is the first time Earth Science has had a defined place in the curriculum at primary or secondary level in Ireland.

Thirdly, and perhaps most importantly, Ireland, and the world, is facing a future where issues relating to Earth Science are increasingly important. It is unknown whether the Irish education system is adequately preparing students for a future of key decisions on complex geoscientific issues such as climate change, contentious resource management policies (e.g. water supply management, fracking), and rising incidences of natural disasters.

Hello, Joseph ~ Rationale

Therefore, this research area is both important and timely. Ideally, this research will help to improve Earth Science teaching and learning in schools nationwide, so the next generation of Irish voters have the knowledge and interest to tackle Ireland's geoscientific challenges.

I have a lot of ideas, I'd love to research geoscience education at primary or secondary level, maybe focusing on the formal education system or maybe focusing on outreach programs?

If you would be free to meet, I would be really grateful for the opportunity to discuss this with you, at a time that would be convenient for you.

Best wishes,

Emer Emily Neenan

01 April 2016 at 3:17 pm

From: Joseph Roche

To: Emer Emily Neenan

Dear Emer,

I would be interested in meeting up and chatting to you about your ideas. I'm afraid I am not around that much this week - would you be free next Thursday or Friday?

Sincerely,

Joseph

07 April 2016 at 6:37 pm
From: Emer Emily Neenan
To: Joseph Roche

Dear Joseph,

Thank you for meeting with me today, I had a really good time talking through everything with you! I'm very pleased to hear you think I'm in a good position to start. It's hard to know, when you're just putting stuff together yourself, where you are in relation to where you should be!

I was just thinking about specifics on the way home. While I would love to investigate this topic at all levels of formal and informal education, obviously that won't be practical for a PhD project. And while I would probably most enjoy focusing on primary level, it seems wisest to focus specifically on junior second-level. I'm glad you said I should focus on **what** I want to research for now, and leave the specifics of **how** to research it until later; I want to be thorough and choose the most suitable methods.

I'll work on doing a review of the area and putting together a formal proposal. I'm looking forward to meeting you again!

Best wishes,

Emily.

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<http://www.scirp.org/journal/gep> <http://dx.doi.org/10.4236/gep.2016.46001>

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<http://dx.doi.org/10.4236/gep.2016.46001>

Geoscience Education in an Irish Context: A Need for Research

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Abstract

Perception and understanding of geoscience in Ireland by non-geoscientists have not been studied in depth, and an improvement in understanding how geoscience is perceived and engaged with will have significant impact on Ireland's ability to meet a range of challenges, including hotly debated geoscience issues such as fossil fuel dependency, raw mineral management, water security, and shale gas extraction (particularly fracking). Geoscience plays an important role in society, and the understanding of geoscience of an average Irish person will be based on formal education (at primary and secondary level) and informal education through public outreach and news media. Geoscience is expanding in formal education and informal education is increasingly delivered online. Geoscience education in Ireland has not been studied in detail, and a better understanding of the state of geoscience education could improve connections between geoscientists and non-geoscientists. This paper discusses the scope of potential research into geoscience education in Ireland that could and should be undertaken in order to best understand and describe the state of geoscience education, and geoscience in society. Mixed-method research should be undertaken to study geoscience education at multiple levels and targeting multiple publics. This research into the state of geoscience education in Ireland would be valuable to both geoscientists and educators.

Keywords

Geoscience Education, Scientific Literacy, Geoscience in Society, Geoscience Outreach, Ireland

1. Introduction

Geoscience is vital for modern society since all our energy sources, technologies, and amenities rely to a greater or lesser extent on the extraction and management of natural resources. The components of a modern mobile phone—metals, rare earth elements, plastic (from petroleum)—and the electricity powering it—delivered by copper wire, and most likely generated from oil or gas—are all taken from the Earth. As individuals, it is not necessary to have a full understanding of all the geoscience behind our smartphone, any more than we need to understand the physics or electrical engineering behind it, but as a society, it is necessary to have a certain level of geoscientific literacy and to produce a certain number of geoscientists [1].

Ireland can only benefit from having a strong foundation in geoscience education, at all levels of the formal education system as well as in informal education, such as via outreach programs, social media and news media. This is both specifically so Ireland produces a sufficiency of graduates in geoscience fields, and more generally so that Irish society can meet the energy and resource challenges of the 21st century. In order to achieve this, geoscience education in Ireland must be understood; yet so far, little research has been done to investigate either formal or informal education in geoscience in an Irish context.

Geoscience education in Ireland must be studied, in order to identify its strengths and weaknesses, so that strengths can be consolidated and expanded, and weaknesses can be monitored and minimised [2]. Research should be conducted into the content and efficacy of both formal and informal education in geoscience, identifying the actual learning outcomes across a broad cross-section of Irish society, from primary-school children, to consumers of news media, to politicians. The place of geoscience in the formal education system—particularly at primary and secondary school—should be examined. This is especially important in light of the introduction of the new Junior Cycle Science curriculum, which includes Earth Science as part of one of the core modules for secondary school students aged 12 to 14 [3]. Alongside formal education, informal geoscience education in Ireland should also be studied. This should include geoscience outreach programs and public engagement—traditional and online—by geoscience institutions and geoscientists [4], and should also include dissemination of geoscientific information via the news media.

The objective of this paper is to provide an outline of the current state of geoscience education in Ireland, demonstrate that the area needs to be more thoroughly researched, and propose how such research may be carried out. This research would aim to provide valuable information to geoscientists on how best to communicate their field; to third-level institutions on how to attract students into the geosciences; and to educators on how geoscience is currently being taught, and the strengths and weaknesses of the current system.

2. The Place of Geoscience in Irish Society

Geoscience plays a major role in society: globally, in the EU, and in Ireland. Geoscience underpins our energy sources, our management of natural resources (including fossil fuels, minerals and metals, water, etc.) [5] and our natural disaster planning [6]. Qualified geoscientists are necessary for energy security; security of the water supply; economic security for many industries; and security of the population in the event of a range of natural disasters, from minor landslides to catastrophic earthquakes.

The European Commission's Horizon 2020 framework identifies "Science with and for Society" as an instrumental area in addressing the challenges facing EU countries over the coming years [7]. These challenges include hotly debated geoscience-heavy issues such as fossil fuel dependency, raw mineral management and shale gas extraction (particularly fracking), mainly under the "Secure, Clean and Efficient Energy" umbrella [8]. Ireland is rising to meet these challenges. In 2014, the Irish Centre for Research in Applied Geosciences (iCRAG) [9] was established, funded by Science Foundation Ireland and the European Regional Development Fund, with the aim of ensuring the security and proper management of Ireland's natural resources [9].

Geoscience plays a substantial role in Ireland's economy and society and lies at the heart of a range of questions facing the Irish electorate. Ireland imports the majority of its energy [5], but has offshore hydrocarbon resources: Ireland is home to "untapped hydrocarbon resources in challenging north-eastern Atlantic deep water environments, and a diverse geological framework with important untapped seabed and groundwater resources" [9]. How to tap these resources is a question for Irish-based geoscientists; whether to tap them and how the output and profit is divided is a question for policy-makers. Ireland supports a range of mining activity; minerals, metal ores, and rocks are mined across Ireland. Certain Irish rocks are sought-after as building materials, such as Connemara marble and Kilkenny limestone. The largest zinc mine in Europe is in Co. Meath, and produced 133 kilotonnes of zinc in 2015, along with smaller amounts of lead and silver [10]. Water is currently a contentious issue in Ireland, with decisions being made about how to maintain and manage the drinking water supply, and how that should be paid for [11]. There is also an ongoing discussion about how best to protect Ireland's unique ecosystems [12]. It is not unreasonable to suggest that an understanding of geoscience would be of benefit to politicians, civil servants, and the electorate.

Of particular interest is the contentious issue of shale gas extraction by means of hydraulic fracturing (fracking), which may be an economically valuable source of hydrocarbons in energy-poor Ireland, but has stirred controversy due to the threats of induced seismicity and damage to ecosystems and water supplies [13]. The level of understanding of the geoscience of fracking—of policy-makers, the electorate, locals in areas where fracking is taking place, and the news media—is based on their levels of geoscience literacy from formal education, and the efficacy of informal education undertaken by geoscientists who are involved with fracking, researching fracking, or who are interviewed on the topic, and the information presented by the

news media. Perceptions and attitudes by non-geoscientists towards fracking have been studied elsewhere, such as in the UK [14], but the perceptions, attitudes, and understanding of non-geoscientists in Ireland have not yet been studied.

3. Geoscience Education in Ireland Is Changing

Geoscience has not historically been prioritised in the formal education system in Ireland, and has also not been studied in an Irish context. An overview of the current state of affairs is presented in this section.

In the primary school system (ages 4 to 12), some geoscientific concepts are covered under the Social, Environmental and Science Education (SESE) umbrella [15], which includes science, geography and history. However, geoscience or geology are not specifically covered in the curriculum and science is allocated only 45 minutes (at ages 4 to 6) to one hour (at ages 6 to 12) per week, which is only slightly more than is allocated to calling the roll (50 minutes per week), and—as is often noted—considerably less than the time devoted to religious education (2 hours and 30 minutes per week) [16]. As geoscience must share an hour a week with the other sciences, it could be expected that the average Irish primary school pupil does not get much exposure to geoscience or geology.

The geosciences are given more attention in the secondary school system (ages 12 to 18); however, geology is not a subject offered at Junior or Leaving Certificate level. Areas of geoscience, including geology, are covered as part of the Geography and Science subjects at Junior Certificate level (ages 12 to 16) [17]. At Leaving Certificate level (ages 16 to 18), Geography is still offered and includes several areas that fall under the broader geoscience umbrella, such as some geological concepts. Meanwhile, Science is no longer offered as a single subject at Leaving Certificate level; instead it breaks into specific science subjects (Physics, Chemistry, Physics and Chemistry, Biology, Agricultural Science), and again, Geology is not an offered subject [18].

At third level, Geology is established as a stand-alone subject and geoscience has a significant place at undergraduate and postgraduate level in four of Ireland's seven universities: Trinity College Dublin (offering Geology and Earth Science Bachelor's degrees, along with geoscience-adjacent subjects) [19], University College Dublin (offering Geology as a B.Sc., along with geoscience-adjacent subjects) [20], National University of Ireland Galway (offering Earth and Ocean Sciences, as well as geoscience-related subjects, as B.Sc. Degrees) [21], and University College Cork (Geology, Earth Science and International Field Geoscience all offered at Bachelor's level) [22]. All of these Geology/Geoscience courses are taken as specialties in later years from a common-entry broader science course. For example, in Trinity College Dublin, students who study geology enter Natural Sciences, taking modules in multiple sciences, including geology, in their first and second year, and specialise in geology for their third and fourth, to graduate with a Bachelor's degree in "Natural Sciences—Geology". Geography and Environmental Science are also widely offered at university level [23].

Geoscience education in Ireland is in a period of change. Postgraduate-level education is expanding, with initiatives such as iCRAG (mentioned above). The Junior Cycle, ending in the Junior Certificate state examination, is being overhauled, and Science at Junior Cycle level will now include “Earth and Space” as one of its core “strands”, giving geoscience a defined space within the core curriculum for the junior cycle of secondary level education [3].

As there have not been any published studies on geoscience in the formal education system in Ireland, it is not currently possible to explore it in greater depth.

4. Research into Geoscience Education

Science education in Ireland has been studied (albeit perhaps not as deeply as science education researchers would prefer), but geoscience education specifically has not been studied in detail in Ireland. For example, in 2003, Ireland took part in the Relevance of Science Education (ROSE) project, which gauged a range of factors relating to science education in 15/16-year-old Irish students, but only a few questions in the survey related directly to geoscience and geoscientific principles [24].

Geoscience education—formal and informal—has been studied elsewhere. A good overview of the ongoing research in the area was carried out by King (2008) [25]. There is a very broad range of potential research in the area; researching understanding, interest, perceptions and attitudes of primary-level, secondary-level and tertiary-level students, educators at all levels, participants in geoscience outreach programs, social media users, residents in areas where activities such as mining or fracking are planned or ongoing, and so on [25] [26].

Research into the efficacy of geoscience education focuses primarily on the understanding of and interest in geoscience of students in the formal education system, and the level of understanding of geoscientific principles of educators. Tools such as the Geoscience Concept Inventory [27] are used to measure the level of understanding of principles such as geological time and the location and scale of tectonic plates, and can be used to assess, for example, the level of understanding that teachers have of core geoscience concepts.

Outreach and public understanding are no longer minor side-projects for scientific institutions, and as global connectivity and social media expand, scientists—including geoscientists—have unprecedented opportunities to engage with enthusiasts, children, voters, locals and politicians [28]. However, engagement on social media is not always undertaken in an effective manner, and the efficacy of new online informal methods of education is an expanding area of research; for example, Lee & Van Dyke (2015) assess how effectively science institutions are using social media to promote dialogue with interested publics [29].

5. Need for New Insight into Geoscience Education in Ireland

Geoscience education—formal and informal—in Ireland should be studied, ideally as broadly and deeply as possible. There will always be limits on the amount of research that can feasibly be done in an area, but so far very little work has been undertaken to assess the state of geoscience education in Ireland. Geoscience is an important and dynamic area, connected with several contentious issues in current Irish policy, and it would be illuminating and useful to know what the average Irish schoolchild, student, voter, and inhabitant know and think about geoscience generally and about key geoscientific concepts and issues, such as fracking. There is scope for a broad range of future research in this area.

5.1. Study of Formal Education

Research targeting a broad, representative sample of Irish schoolchildren or secondary school students—similar to the ROSE project—could gauge the interest and knowledge of the average Irish schoolchild with regard to geoscience [30]. The understanding of geoscience held by a person leaving the Irish education system is likely to be a strong contributing factor in the general level of understanding of the next generation of Irish voters and policy-makers.

In order for schools to provide a useful and engaging introduction to geoscience, primary school teachers and secondary school Science and Geography teachers need to be equipped to teach geoscience in an accurate and engaging manner. There is no requirement for these teachers to have formally studied geology or any other geoscience subjects at higher level themselves. If there are significant gaps in their understanding of the subject, they are likely to pass misunderstandings and misconceptions on to the students they teach [31]. They can be supported by, for example, outreach programs that operate through the formal education system, such as the Seismology in Schools program [32]. It would be very useful to explore such teacher supports and school-based outreach programs to assess their efficacy and penetration [33], with the aim of facilitating improvements.

Specifically, it would be useful to assess whether outreach programs that operate through the school system are more or less effective than those that operate independently. Independent programs will probably only reach children who already have an interest in geoscience, whereas school-based programs will result in exposure to all children, or all children who have chosen Science or Geography in secondary schools, regardless of interest (although it is probable that interested children will engage with the school-based program more enthusiastically than uninterested children, so the effect may be small) [34]. Evaluative summative research into existing outreach programs, both independent programs and programs connected to formal education, and formative research into the programs found to be the most effective and engaging, could lead to new frameworks and guidelines to maximise effectiveness and scope of geoscience outreach [34] [35].

Children tend to be very interested in geoscience (rocks and minerals, volcanoes and earthquakes) but, as with science generally, many of them lose this interest as they grow older [1]. Studies of students' level of interest in geoscience, involving multiple cross-sectional studies of selected age cohorts, may be able to determine at what point this loss of interest happens and what factors are at play. To extend this research, it would be useful to examine at what point the genders diverge in level of engagement with geoscience, and whether there are ways to prevent this divergence. According to the ROSE study, girls show higher levels of interest across the sciences, including on geoscience-related topics [24]. Yet—again reflecting general trends across the sciences—by the time those interested children have grown up and found jobs, the girls will have disproportionately left the field [36] [37].

5.2. Study of Informal Education

Informal education has been transformed by the Internet. Outreach programs and public engagement need no longer be restricted to the immediate area and designated, scheduled times. A child or adult with an interest in geoscience can watch videos, read descriptions, look at diagrams, and even ask questions of geoscientists, at their leisure from their homes [38]. And modern, online engagement hasn't replaced traditional outreach; school visits, public lectures, open days, etc., are not phased out when an institution starts putting information online, but instead can be enhanced and augmented by the online resources [39]. Research should be undertaken to explore geoscience outreach programs and public engagement policies in Ireland, with a view to identifying and sharing the most effective techniques for dialogue with interested publics. In order for Irish public understanding and engagement with geoscience to be promoted, it must be understood, and in order for geoscientists to communicate the importance of their field, they need information on how to do so effectively [29].

Research into outreach programs should identify their efficacy; particularly whether they typically reach their target demographics, and whether they significantly improve participants' knowledge of, interest in, and/or engagement with geoscience. Follow-up research (as mentioned above under formal education) could include formative research into the programs found to be the most effective and engaging, in order to produce guidelines and frameworks for other outreach programs to use [39].

A very modern facet of outreach is the use of social media, which can be used as a very effective dialogic tool for engagement with interested publics, but research has not been done to determine whether geoscience institutions in Ireland are using social media, and, more importantly, whether they are doing so effectively [29]. Geoscience blogs and social media pages could have a significant impact on public perception and engagement with geoscience, and this should be studied in an Irish context. Scientists are encouraged these days to share their knowledge and research with the public [40] [41], but this needs to be done in a useful way, otherwise it takes valuable time that would be better spent on the research itself. Irish geoscientists could benefit from a better understanding of how the Irish public reacts to and understands geoscience, if they are to share their knowledge [41].

A very particular form of education is education via the news media, which is itself undergoing a considerable shift as people increasingly consume news online rather than through traditional channels. A better understanding of how the Irish news media frames and reports on geoscience-related issues—particularly contentious politically-charged issues such as fracking—would be very useful for assessing how the news media impacts public perceptions of geoscience [42]. Geoscientists undertaking public education or who are being interviewed by the news media may also benefit from such research. It would potentially be illuminating to examine the language used by the news media (e.g. “man-made earthquakes” vs “induced seismicity”, “fossil fuels” vs “hydrocarbons”, “tidal wave” vs “tsunami”) and perform content analysis of the language choices, to assess the impact they may have on the perceptions of geoscience of the average viewer or reader [43]. It is also important to examine who is given a platform to speak on geoscience-related issues to assess what biases might be at play and might be being passed on to viewers or readers; for example, a gender bias, or a bias for or against mining companies, or environmental groups, or academic researchers [44].

5.3. Future Research

Alongside an investigation into Irish geoscience education, it would be natural to examine the effects of education—formal and informal—on attitudes and policies. Even if it is not possible to definitively identify effects, an examination of correlations between level of education, level of understanding, and attitude would be very interesting, and potentially have usable implications for educators and policy-makers in the area. It would also be worth examining Ireland’s place in an international context, for both geoscience education and attitude towards/understanding of geoscience [24]. Similarities and differences between Ireland and other countries could open further avenues of research and potentially help guide Irish geoscience education policy in the future.

There is also potential benefit in examining the level of geoscience education and understanding of the politicians and policy-makers who are legislating on issues like fracking, offshore hydrocarbon exploration, and water security. With geoscience playing a significant role in the Irish and global economies, it is important to know whether legislators are equipped to make decisions on these issues, to understand the implications of the choices, and to access impartial and accurate information where necessary [45].

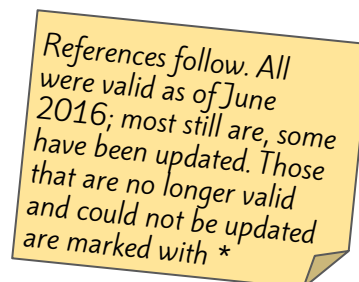
6. Conclusions

A better understanding of the state of geoscience education—formal and informal—in Ireland would be valuable for the geoscience community in Ireland and for Irish society generally. The strengths and weaknesses of geoscience education in Ireland should be identified so that Ireland can best meet the energy and resource challenges facing it.

There is a broad range of potential research in the area that could be undertaken. Studies of the current cohort of Irish primary- and secondary-school students with specific regard to geoscience should be undertaken to assess the understanding of and interest in geoscience of Irish schoolchildren and potential future geoscience graduates. If possible, the factors affecting the decisions by students not to pursue geoscience should be identified, particularly with regard to girls. Research into the efficacy of outreach programs—in and out of schools—and public engagement—online and offline—should be undertaken. Effective programs should be identified and studied with the aim of producing useful information for geoscientists on how to communicate their field. Geoscience as portrayed by news media should be examined, and an attempt should be made to determine the effect education via news media has on Irish people’s attitudes towards geoscience-related current affairs issues, such as fracking and water security. Ideally, all of this research should be extended to examine the effects of formal and informal education in geoscience on perceptions of geoscience and, again, attitudes towards geoscience-related issues.

In order to provide the most accurate overview of the state of geoscience engagement, mixed-method research should be carried out from multiple angles and targeting multiple publics [26]. A particularly good, but resource-heavy, study of geoscience in formal education would involve surveying multiple cohorts of students across primary and secondary school, and following up with the same students over a longitudinal study [24] [46]. Research into effective educational programs and techniques (either in formal education or outside it, and either traditional or online) could, to maximise usefulness, be undertaken in two phases: a summative phase to investigate whether programs or techniques are working as intended, and then a formative phase to determine what factors are responsible for the success of the most effective programs. This research should be quantitatively-led, but a mixed-method approach would allow potential insight from students, educators, etc., as participants in qualitative studies [47]. Content analysis could be a useful tool for research into both formal education (e.g. content analysis of textbooks) and informal education (e.g. content analysis of social media posts by geoscience institutes engaging in public outreach) [48].

A better understanding of the current and evolving position of geoscience in the Irish education system and in Irish society can only improve the ability of geoscientists and educators to maintain and improve Ireland’s good relationship with geoscience.



*References follow. All were valid as of June 2016; most still are, some have been updated. Those that are no longer valid and could not be updated are marked with **

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The Abridged Neenan Dictionary

AGU (er: dʒi ju:): **ac.** American Geosciences Union, a non-profit global union of scientists which aims “to advance discovery and solution science that accelerate knowledge and create solutions that are ethical, unbiased and respectful of communities and their values” (www.agu.org). Hosts the AGU General Assembly annually.

CCCI (,si: si: si: ai): **ac.** Climate Change Concept Inventory, a list of multiple-choice items designed to measure understanding of concepts key to climate change.

child (tʃaɪld) **n.** A person under 18 years of age.

CSPE (,si: es ,pi: 'i:): **ac.** Civic Social and Political Education, a subject at Junior Cycle in Irish second-level schools.

CRAG (kræɡ): **ac.** Children’s Research Advisory Group (Murphy et al, 2013).

Earth Science (ɜrθ 'saɪəns): **n. 1.** The study of the Earth encompassing the internal Earth, the lithosphere, the hydrosphere, the atmosphere, and the biosphere **n. 2.** An umbrella term for the various sciences that deal with the Earth, including geology, physical geography, soil science, ecology, environmental science, hydrology, atmospheric science, etc. **n. 3.** Part of the Junior Certificate Earth And Space strand in the Junior Cycle Science curriculum. (see also: **geoscience**)

EGU (i: dʒi ju:): **ac.** European Geosciences Union, a non-profit international union of scientists “dedicated to the pursuit of excellence in the Earth, planetary, and space sciences for the benefit of humanity, worldwide” (www.egu.eu). Hosts the EGU General Assembly annually.

engagement (ɪnɡeɪdʒmənt): **n.** A multi-faceted construct comprising behavioural, emotional, and cognitive aspects, describing a student’s active interest and participation in a given activity or program (Fredricks & Blumenfeld, 2004).

epistolary (ɪˈpɪstələri): **a. 1.** written or expressed in the form of a collection of letters or other documents **n. 2.** a document comprised of documents, usually letters and other missives.

e.g. an epistolary thesis

feminism (femɪnɪzəm): **n. 1.** The belief and aim that women should have the same rights, power, and opportunities as men **n. 2.** The foundation for a particular intersectional and ethical research approach that aims to dismantle or mitigate inherent power imbalances between researchers and participants, described as a conscious alternative to a traditional, pseudo-objective, “masculine” research approach.

GCI (dʒi: si: aɪ): **ac.** Geoscience Concept Inventory, a list of multiple-choice items designed to measure understanding of concepts key to geoscience.

geography (dʒiˈɒɡrəfi): **n. 1.** the study of the Earth encompassing its surface, physical features, divisions, products, and people **n. 2.** A full subject in the Irish Junior Cycle, offered at Higher or Ordinary level.

geology (dʒiɒlədʒi): **n. 1.** The study of the Earth's structure, surface, and origins **n. 2.** A school science covering the composition of rocks and minerals, the rock cycle, and other geological phenomena.

geoscience (dʒi:əʊˈsaɪəns): **n. 1.** The study of the physical characteristics of the Earth: the core, the mantle, the lithosphere, the hydrosphere, the atmosphere; how they interact and how the biosphere interacts with them; and the study of other planets, asteroids, etc and how they related to the Earth. **n. 2.** Any one of the sciences concerned primarily with the Earth, **geosciences pl.** These sciences collectively.

HEA (hertʃˈi:ˈeɪ): **ac.** Higher Education Authority, the body with the statutory responsibility in Ireland, at central government level, for the effective governance and regulation of higher education institutions and the higher education system.

iCRAG (aɪ kræg): **ac.** Irish Centre for Research in Applied Geosciences, the SFI Research Centre for Applied Geosciences, including research on public perception and understanding of geosciences, based in University College Dublin.

IRC (aɪ ɔːr siː): **ac.** Irish Research Council, a funding body for research undertaken in Ireland, with the mission to support excellence in research talent, knowledge and engagement.

Junior Cycle ('dʒuːniər 'saɪkl): **n.** The programme for the first three years of post-primary education in Irish schools, aimed at ~12 to ~15 year old students, ending with assessment via State examination (the Junior Certificate), comprising 9 to 13 subjects from a choice of 21 subjects, plus optional short courses.

kyriarchy (kɪrɪɑːrki) **n.** A hierarchical system that privileges certain groups and identities (e.g. men, white people, cis and heterosexual people, people who are currently able-bodied, neurotypical people) at the expense of others (e.g. women, people of colour, trans and queer people, disabled people, neurodiverse people).

mixed methods (mɪkst 'meθəds): **n.** A research approach that combines qualitative and quantitative methods for generating data.

OECD (əʊ iː siː di): **ac.** Organisation for Economic Co-operation and Development, an intergovernmental economic organisation of which the Republic of Ireland is a member.

pandemic (pæn'demɪk): **n. 1.** A global catastrophe causing delays, barriers, distractions, and upheaval of academic work, disproportionately affecting women, parents, and ECRs **n. 2.** The reason my baby is not in day nursery right now and why I'm working on a cardboard box on my bed instead of my desk on campus.

participants (pɑːr'tɪsɪpənts): **n. pl.** The people with whom the researcher generates the actual data, whose actions, attitudes, or answers are the focus of the study (contrast: **representative co-researchers**).

PISA (pi:zə): **ac.** Programme for International Student Assessment run by the **OECD**, assessing reading, mathematics and science knowledge and skills.

pragmatism ('prægmətɪzəm): **n. 1.** A research philosophy that holds that research methods can and should be oriented towards what is measurable and actionable, rather than being bound too strictly by a specific ontology or epistemology **n. 2.** An approach or attitude to problems that looks for a practical solution.

qualitative ('kwɑ:lɪtətɪv): **n.** A research approach that generates and works with open, flexible, uncountable data, via methods such as interviews, open text fields on surveys, drawings, discussions, etc.

quantitative ('kwɑ:ntətətɪv): **n.** A research approach that collects and works with specific countable or numeric data, via methods such as multiple-choice or scale responses on surveys, experiments, statistical analysis, etc.

questionnaire (,kwɛstʃə'ner): **n.** A list of questions or items designed to be answered by a particular demographic in order to learn specific and targeted information, either individually or in aggregate (see: **survey**).

representative co-researchers (,reprɪ'zentətɪv ,kəʊ'ri:sɜ:rtʃərs): **n. pl.** People representative of the participant demographic, who do not generate data with the researcher, but contribute to the research from their perspective and lived expertise, for example, as the members of a **CRAG**.

science ('saɪəns): **n. 1.** The study of the natural and physical world, via the advancement of hypotheses supported by experimental and observational evidence **n. 2.** A full subject in the Irish Junior Cycle, offered at Higher or Ordinary level.

significant (sɪg'nɪfɪkənt): **adj.** Of sufficient magnitude or importance to be worth mentioning or examining, n.b. not indicative of “statistical significance” unless directly stated as such.

SEC (es 'i: si:) **ac.** State Examinations Commission, the body in Ireland that is responsible for the development, assessment, accreditation and certification of the second-level examinations of the Irish state, including the **Junior Certificate**.

survey ('sɜ:rveɪ): **n.** A method of data generation utilising a list of questions or items designed to be answered by a particular demographic in order to learn specific and targeted information in aggregate (see: **questionnaire**).

Transition Year (træn'zɪʃn jɪr): **n.** An optional year at second-level schools in Ireland, taking place after the **Junior Cycle** and before the Leaving Cycle, for students who are usually approximately 16 years of age, with a greater emphasis on project work and self-directed learning and no State examinations.

UNCRC (ju: en si: ɔr si:): **abbr.** United Nations Convention on the Rights of the Child, a convention of articles detailing the inherent rights due to all **children**.

03 October 2016 at 5:54 pm
From: Emer Emily Neenan
To: Colette Murphy

Dear Professor Murphy,

Thank you again for agreeing to co-supervise this project. My registration has all been finalised, and I'm working hard on the Irish Research Council scholarship application.

Please find attached the sections on the aims, ethical considerations, and gender considerations of the research, and let me know if you think they're ready for submission.

Best wishes,

Emily.

ATTACHMENT:

**Irish Research Council
Government of Ireland Postgraduate Scholarship Application
October 2016**

Please provide details of the proposed research.

(a) What are the aims, objectives and central research questions of the proposal?

The primary aim of the project is to study student engagement with and understanding of Earth Science in Irish schools, in light of the new Earth And Space strand of Junior Cycle Science, in order to provide workable information to program developers and to Irish schools to facilitate them to best prepare the next generation for the decisions Ireland faces concerning natural resource management, energy and fuel stability, and rising incidence of natural disasters.

A secondary aim of the project is to study engagement and interest levels of girls specifically, in order to identify any gender-specific obstacles.

These aims will be realised via the following objectives:

- Investigate Earth Science engagement and understanding among students at Junior Cycle level in Irish secondary schools, with gender addressed as a key variable throughout.
- Identify obstacles to student engagement with Earth Science, particularly female students, and use the data and other sources to identify potential solutions.
- Facilitate participating schools to implement improvements to their Earth Science lessons generally, and follow up to measure impact of changes.

The research questions proposed are:

What is the impact of the new Earth and Space Science strand on students' engagement with Earth Science?

How can schools be facilitated to support Earth Science engagement among students, particularly female students?

Or in simpler language: is the Earth And Space strand of Junior Cycle Science effective, is it effective for both boys and girls, and if not, why not?

(b) How has existing literature on the topic informed the proposal?

At the beginning of this process, I carried out a preliminary review of the literature on geoscience education, and science education in Ireland. The product of that initial review of the literature was a position paper:

Neenan, E. E., & Roche, J. (2016). Geoscience education in an Irish context: A need for research. *Journal of Geoscience and Environment Protection*, 4(06), 1

In this paper we discussed the need for more research into geoscience understanding and engagement in Ireland, with a focus on education, including formal and informal educational systems.

This was the first milestone of the project, and has formed the basis of much of this proposal. A bibliography has been included with this proposal, listing the existing literature that has informed and been referred to in the sections on Research

(c) How will the proposal advance state of the art and contribute to existing knowledge?

(c) Earth Science in Irish schools has not been studied at post-primary level and has only been studied as part of the broader Science curriculum at primary level. As Ireland faces climate change, offshore oil exploration, fracking, and other crucial geoscience issues, it's important to investigate the Irish public's understanding and perception of Earth Science, especially that of the next generation. This research will be a valuable contribution to knowledge in this area. It will also further develop methods to facilitate student voice in educational research.

This research will lay the groundwork for future research into Ireland's perception and understanding of geoscience.

Ethical considerations

Best practice will be followed at all stages, and ethical approval will be sought from the Trinity College Dublin, School of Education Research Ethics Committee where appropriate. Particular care and attention will be paid in studies involving minors; it is the aim of the applicant to not only adhere strictly to Trinity College's ethics policy but to facilitate and protect the right to expression of the minor participants as enshrined in the United Nations Convention on the Rights of the Child by following the process defined by Welty & Lundy (2013).

In particular:

- Full ethical approval will be sought whenever appropriate, and an ethical report will be submitted to the IRC.
- Participants in studies will not be exposed to any risks additional to those they may encounter day-to-day, and participation will be fully voluntary.
- Participants will be kept fully informed of the nature and aims of the research. If it is likely that prior knowledge would introduce an unacceptable bias into the data, participants will be fully debriefed as soon as possible after the data collection.
- When studies involve minors, parental consent will be obtained and parents will be kept fully informed of the nature and aims of the research.

- Confidentiality procedures will be fully adhered to at all times. This is of particular importance when gathering data from minors, and care will be taken all at stages of the research to protect minors' confidentiality.
- Trinity College's guidelines on data protection and privacy will be closely adhered to. Collected data will be securely stored and, where possible, kept anonymised. Access to both hard copy and electronic data will be strictly limited to researchers approved to work on this specific project.
- Participants will have access to their data and be given contact information to follow up with the researchers if desired. Participants' access will comply with the Freedom of Information Act (1997, 2003) and the Data Protection Act (1998, 2003).
- Any publications, papers, reports, etc., that arise from the research will be made available to the participants. In addition, a short report explaining the results and outcomes will be circulated to participants, written in lay language and, in the case of minor participants, to their age's reading level.

Sex/gender considerations

Account for sex/gender considerations with regard to research ideas, the proposal, the research itself, and the dissemination

Research ideas:

Exploring the impact that gender may have on geoscience engagement is a vital component of this research, and gender has been included as a key variable since the very first meeting outlining the potential project. There is a gender imbalance in geoscience [Holmes et al, 2008] and, in order for a bias or imbalance to be addressed, it is necessary to identify its origin point. Although there is some indication in the literature that a deterrent effect towards female students in science comes into play at young ages [Archer et al, 2012], there is little in the existing literature examining engagement, and barriers to engagement, of female children in geoscience specifically. I hope to attend the Second Commemoration of the International Day of Women and Girls in Science, to be held in Malta in February 2017, to improve my understanding of current research in this area.

Proposal:

At all stages, gender will be treated as a key variable, and differences between genders will be examined and analysed.

The methodology draws from an intersectional feminist tradition, and sex/gender differences have been specifically addressed in the proposal.

Research:

All questionnaires and surveys will use gender-neutral language and efforts will be made to avoid introducing a gender bias to participants (for example, by referring to a hypothetical geoscientist as “they” rather than “he”, or swapping pronouns for successive examples).

The choice of schools for studies will take into account whether the school is single-gender or co-educational (and, where possible, differences between all-girls, all-boys, and co-educational schools will also be examined). Participant groups will be mixed-gender and gender-balanced as far as practicable, except in cases where this would be impossible or illogical (for example, if a particular group was convened in a single-gender school).

All relevant variables will be divided by gender to examine gender differences.

Dissemination:

Results will be presented in terms of “female students” and “male students”, or “female participants” and “male participants”, except in cases where there is no measurable gender difference; in this case, this fact will be noted.

Should potential or actual obstacles to engagement by female students be identified, this will form the argument for a publication in a suitable journal or magazine. Identified obstacles, along with potential solutions, will be highlighted in the report circulated to schools and participants. It is a further aim to publish an article in the mainstream press (for example, The Irish Times Educational Supplement) describing such gender-specific obstacles and potential solutions, along with an explanation of the importance of geoscience engagement.

04 October 2016 at 9:32 am

From: Colette Murphy

To: Emer Emily Neenan

Hi Emily!

Thanks and well done - it's looking good. Fingers crossed!

Thanks a million

Colette

This is a Calm Inbox: email is checked once in the AM and once in the PM.

Hub Coffee Morning Talk notes

- ★ Jane Ohlmeyer will introduce me
- ★ talk needs to be under 9 minutes
- ★ questions at the end

“Today I’m going to talk about my PhD project, **studying geoscience in Irish secondary schools**.

Because I am a geologist, I’ve brought some of my favourite **rock samples** to show you while I’m talking, because in my experience speaking about geology and geoscience to everyone from gifted six-year-olds, to adults with intellectual disabilities, to TY students, to European science communicators, to strangers in the pub... everyone wants a turn looking at the rocks!

I have three igneous rock samples here, each representing a strand of my PhD project.

This is a pebble of **granite**. I’ll pass it around. Here, Louise, take it and pass it on. This granite is representing **my identity as a geoscientist**. Granite is a hard rock, composed mainly of quartz and feldspar, and its chemical composition is fairly typical of the crust, the hard bedrock we build upon. It represents the foundation of my project: my belief, as a geoscientist, that **geology specifically and Earth Sciences generally are worth studying and worth teaching**.



Figure 1: Hand sample of light grey equigranular phaneritic granite, with visible quartz, feldspar, biotite, and muscovite.

Geology isn't a subject at Leaving or Junior Cert level in Irish schools. The Junior Cert, which, for those of you who aren't familiar, is a State exam taken around age 15 in Ireland, recently expanded to include Earth and Space Science as part of the Science curriculum. But **the vast majority of Irish school students learn very little Earth Science in school.**

I'm hoping my project, measuring interest in and engagement with Earth Science among junior secondary school students, will identify trends and barriers. I hope to be back here next year telling you what I've learned and how we might implement it to improve and expand the Earth Science strand of the Junior Cert, and get Earth Science onto the curriculum at primary and Leaving Certificate level.

Ireland, along with the rest of the world, is facing a future filled with **challenges connected to geoscientific issues.** We're debating about the merits and dangers of fracking, which I think gets so much media attention because it's a fun word to say. Sounds a bit bold. We had a nationwide practically screaming argument about water management. We had another about offshore drilling. Europe's largest zinc mine is just down the road in Tara. We, along with other small island nations, are staring down rising seas and rising incidences of major natural disasters as global climate change slides past the tipping point. These are geoscientific issues, and require geoscientific expertise to be brought to bear. But they are also undeniably **socio-political issues.** I would personally like to see the next generation of voters graduate from secondary school with a solid foundation of understanding of the forces that shape our landscape, our natural resources, our water, our quarries and mines, the very ground we walk on.

My second igneous rock to show you today is a **basalt**, but the star of the show here is the crystalline olivine along one face. The olivine represents **my identity as an intersectional feminist.** Olivine has a chemical composition typical of the mantle, the slow-moving hot layer beneath the crust, which behaves a bit like toffee.



Figure 2: Hand sample of fine-grained dark grey basalt with crystalline chartreuse olivine

The olivine has come from somewhere deep and hot within the earth, and joins the granite on the surface through volcanism. My **feminism is a deep and important part of my identity**, and not something I could put aside as a researcher. Instead, it has been brought to the surface to inform my methodology.

The **feminist research tradition** calls into question the “traditional” and, from this perspective, masculine-coded “objective” approach to research. Instead of an interview, it calls for a conversation. Instead of an impartial scientist studying a participant, it calls for a cooperative dialogue between the researcher and the representative of the group being studied. Feminist research seeks to minimise the difference in power between the researcher and the representative or representatives.

When the group being studied are children, there is an additional challenge in fostering a more equal conversation: **in any interaction between an adult and a child, the adult has a great deal of power**. They’re bigger and stronger, of course; they generally know more about the world; they have money and influence; other adults are more likely to listen to them than they are to listen to a child. Welty and Lundy, in 2013, set out a system for honouring the United Nations Convention on the Rights of the Child for including children’s voices when researching issues that affect children, and in the School of Education here, Colette Murphy and Lauren Boath have developed this children’s rights based methodology further, and specifically a research method called Children’s Research Advisory Groups, or **CRAGs**, which gives children a voice in the research.

The CRAG is composed of **children who are representative of the demographic** being studied. So in this case, the people on the CRAGs are students in secondary school in Ireland. They co-design the research instruments, in this case a survey, giving their input based on **their expertise as people embedded within the context being studied**. They know what kind of things their peers will find boring or interesting, straightforward or confusing, annoying or fun. For example, they might point out that a word used is too long or unfamiliar, or they might say that the phrasing used is too juvenile and patronising. After the results are collected, the CRAGs meet again to review the results and give suggestions and comments.

Along with aligning more closely with my personal moral and ethical beliefs, the Children’s Research Advisory Groups improve the quality of the research. Especially for younger children, who can make connections or use language in ways that are strange to adults, having the wisdom of a panel of “**experts**” to suggest likely interpretations can be invaluable.

My third rock sample today is the volcanic glass, **obsidian**. It represents **my identity as a writer**. Obsidian is formed when basaltic lava flash-cools, usually by hitting cold water. It’s flashy and dramatic, when it happens. Seeing it in real life from a boat off the shore at Kalapana, at the southern end of the Big Island of Hawai’i, is one of the most awe-inspiring things I’ve ever seen. Obsidian is gorgeous, and very compelling, the subject of hundreds of myths and ancient tales, featured in songs and poems and fantasy novels.

Three Rock Samples ~ Summary of Project



Figure 3: Hand sample of black obsidian, exhibiting concentric conchoidal fracture

I believe **academic writing can and should be gorgeous and compelling**. Everyone knows the pain of finding an interesting-sounding study, or a vital one, packed deep in soporific passivity and superfluous jargon. And everyone, I hope, knows the joy of finding an article or a book that **sings its discoveries and lets the personality of the researcher conduct the tune**.

I'm very interested in alternative formats and styles for writing about research. I was particularly inspired by a thesis submitted a couple of years ago written as a semi-fictionalised narrative. **Narrative has a huge power to aid understanding and engagement**. The best science communicators and educators know that. Humans love stories, we communicate through stories and metaphors and touchstones -- speaking of touching stones, do pass those rock samples along so they get back to me!

At the moment, I'm working on writing up the first stages of my project as an **epistolary document of emails, essays, entries in a journal, notes of a talk**, etc., following the narrative of the research process. It may or may not become a full-fledged epistolary thesis, but I'm excited to see where it goes. And if you are too, please do ask me questions, now or later. In particular, I'm very interested to hear of any theses, in Trinity or elsewhere, written in alternative formats or styles of language.

Finally, I'm going to share one more identity with you: I'm also the founder and convenor of the Talk About Education seminar series, and tomorrow's lecture, speaking of research jargon, is on that very topic. We'll be in room 3105 tomorrow at 5 pm, so do please come along if any of that sparked your interest, all are welcome.

Thank you very much."

9 July 2017 at 8:19 pm

From: Emer Emily Neenan

To: Joseph Roche

Dear Joseph,

Thank you again for suggesting I apply for the Erice School of Science Journalism and Communication. I've just returned, and it went really well! I headed the most popular "media lab" flash presentation and I was asked to give an interview (by another participant) and a presentation on the last day on science communication in Ireland (by the organisers). Also participants kept wanting to talk to me or sit at my table. I took advantage of that, and gathered as much information as possible about geoscience in their various countries.

Since I'm exploring the use of qualitative data and alternative written formats for expressing research, I've written the information I have on geoscience education in an international context (gleaned from published syllabuses and from information provided by my international group of science communicators/educators) into the form of a semi-fictional short story set during my stay in Erice. (attached below)

Looking forward to telling you all about Erice and my new ideas!

Best wishes,

Emily.

ATTACHMENT:

One Summer's Day In Erice

One Summer's Day In Erice

by Emer Emily Neenan

Emily sighs with relief when the steep cobbles level out, fanning herself with her notebook as she follows the chattering group out of the midday Sicilian sunshine and into the restaurant. Eyed by a slightly alarmed waiter, they descend on a long table, half a dozen conversations in English and Italian barely pausing as everyone finds a seat. Emily nabs one near the centre, beside Katrine.

“How are you finding the summer school?” Katrine asks, in her precise Danish accent.

Emily sets aside her menu, preferring to chat. “It’s great, I’m really enjoying it. I wasn’t sure how useful a summer school focused on science journalism would be, really, since my area is science education, but so much of what we’re talking about is applicable in both contexts. The balance between accuracy and comprehensibility, the challenge of communicating complex information in a relatively short amount of time, the socio-political aspects of scientific issues...”

They’re interrupted as the waiter takes the table’s orders. It’s a complicated operation, with a dozen hungry science communicators from at least eight different countries at the table, only a handful of whom speak Italian with any competency.

Ryota smiles at Emily as the waiter leaves. “Your area is geoscience, right?”

“Yes, I’m working on my PhD in geoscience education,” Emily says. “I’m researching students’ attitudes towards Earth Science, and their understanding. Earth Science and kind of climate change as well. There isn’t really much geology taught in Irish primary or secondary schools, although there’s an Earth and Space strand as part of the Science curriculum at lower secondary school level now. Maybe we don’t pay too much attention to it because for most Irish people, geology is just limestone and maybe a granitic hill or two. We don’t have the attention-grabbing parts of geoscience - volcanoes, earthquakes, that kind of stuff.”

Katrine nods. “It’s the same in Denmark. I suppose Denmark and Ireland are quite similar, really. Small, flat little countries. You’re an island and we’re a peninsula. The geology of Denmark is quite uninteresting, and volcanoes and earthquakes are not as relevant as how we will take care of the fish population!”

“In Japan, of course, even outside of a formal geology class, we must learn about some parts of geoscience,” Ryota says. “We have no way to teach our history and society without mentioning earthquakes.”

“Of course!” Emily agrees. “And what about natural resources? Japan doesn’t produce much oil or gas, does it? But it’s a major manufacturing economy.”

Ryota nods. “We are the world’s largest importer of natural gas, and second largest for oil. And coal, too, we still use a lot of coal, which is all imported. The oil and gas comes from the Middle East, but the coal usually comes from Australia, I believe.”

Across the table, Amy turns to them, her country’s name catching her ear. “Are you talking about coal mining?”

Emily shrugs with a laugh.

“Kind of. We’re talking about the geology of our countries. Ireland has some natural gas. We have some oil, but it’s not currently being drilled, so we import oil, mainly as petrol and diesel. We only produce about 15% of our energy ourselves, mainly peat or renewables. Opposite ends of the scale, almost! We do have mineral resources, though, including Europe’s largest zinc mine. That surprises people.”

“Yes, I’m surprised!” Katrine agrees.

“Australia exports loads of mineral resources,” says Amy.
“Geoscience is a big industry for us.”

“I think Ireland would be quite similar to Scotland, yeah?” adds Bryce. “We have some natural resources, oil and coal and iron, and so on. But we primarily see ourselves as an agricultural economy.”

“Yes, definitely. Even though we’re supposed to be a knowledge economy now.” Emily nods. “Oh, I think this is our food!”

The waiters distribute crisp pizzas and light fish pastas to the table, the Italian speakers among the group translating on the fly and ordering more water, as neighbours exclaim over one another's choices in a happy babble that dies away as everyone tucks in.

“So here's a chance to help me with my research,” Emily says, once the first few bites are dealt with. “Do students in primary or secondary school in your country learn any geology or geoscience? And if they do, is it part of a larger umbrella subject, like Science, or is it its own subject? In Ireland, students in secondary school learn some geology as part of the subjects Geography and Science, but geology is not a subject on its own. Is that true in your countries?”

There are nods around the table.

“Even in Japan, it's usually included as part of other subjects, most often Science. At upper secondary level, there is an option, earth science class. But as I said, aspects come up in subjects like Sociology,” Ryota says.

“In Denmark, it's part of Nature and Technology early on, then part of Geography,” Katrine agrees. “At secondary level, it would fall under Nature Geography, but not all schools would offer that. That's as opposed to the more 'soft' geography, approaching sociology. Demographics and things.”

“Like in Australia,” says Amy. “It's part of Geography, which is an elective subject.”

Anwasha leans over to join the discussion.

“In West Bengal, in India, it would come under Physical Geography, which is one part of the broader Geography subject,” she says.

“In Italy it’s the same,” Silvia joins in. “Students do learn a bit of geology, but it’s not a subject on its own. Or not usually. Basically, everything is messy! Practically every school works differently, so they may or may not teach geology depending on the school. Mostly, it would be included under Science, but you might even attend a very specific school where you have a subject called “Earth Science” or even “Mineralogy and Geology”.”

Beside her, Daniela nods. “Similar to Portugal. It’s usually part of some other subject, Environment Studies or Natural Sciences. But not all schools would offer the geology option within science.”

“So does anyone’s country actually offer it as its own subject, before third level, besides Japan?” Emily asks.

“Scotland does,” Bryce replies. “But in my own experience, geology was taught as a small part of geography and also featured in chemistry, and was never a standalone subject in my school. You *can* take it as a Higher in the last two years of secondary school, but it’s not a subject that’s commonly available.”

“So in principle, it’s an available subject, but in practice, it’s quite similar to Italy and Portugal, and it depends on the school,” Emily suggests, and Bryce nods. “It seems to really come down to individual school choices, in a lot of places.”

“Some countries more than others,” Katrine says. “We in Denmark have a national curriculum that schools must comply with, but I know that Finland’s national curriculum is very flexible, and individual schools might choose very different topics to cover as part of Nature or Geography or whatever subject.”

Anwasha nods. “And within larger countries, like in India, there are significant differences between regions. India has 22 officially represented languages, and over a billion people. Bengal is no more similar to Punjab than Ireland is to France, although Ireland and France are separate countries. I couldn’t even tell you whether other regions in India had different regulations on the school curriculum.”

“Of course, you’re right,” Emily says. “And then, even in countries or regions with a relatively strict national or regional curriculum, the actual amount of time spent on geology, or the depth to which geological concepts are explored, will vary with the teachers’ interests, abilities, backgrounds, and the schools’ resources. The students in a class with a teacher who took Geology at university level, living in a region with earthquake activity and a mining economy will inevitably have a different exposure to geoscientific concepts than the students in a class with a teacher who loves biology in a town by the sea.”

“It sounds like many schools in Ireland are more like these ones in towns by the sea, with not very much geology?” Ryota points out. “How are you going to study how students are learning geology, if they are not learning much geology?”

Emily laughs. “Isn’t that the question?”

“Sounds like you have your work cut out for you!” says Katrine.

“But at least I can compare Ireland to some other countries now,” Emily says. “Including geological concepts as part of broader subjects like Science or Geography is fairly typical of formal education globally. I’m going to see if students think there should be more emphasis on it, maybe if it should be its own subject. It would be interesting to then do a comparative study with some other countries and see if attitudes and engagement are different. Anyway, thank you, everyone! You know my thesis is an epistolary? I’ll have to include ye in it!”

“Ah, really?” Ryota asks. “It would be exciting to be in your story!”

“Ha, looking forward to seeing how you write me,” Amy says. “The crazy drone-flying Australian!”

“Oh, don’t worry,” Emily laughs, “It’ll just be about the geoscience stuff, none of our antics! But it would mean a lot to me to include ye all.”

“You’ll make our names immortal!” Anwasha says.

The waiters are clearing the plates away, and Katrine checks her watch.

“Time to get back to the venue!” she says, “I don’t want to miss the start of the next session, it looks like an interesting one!”

Coimisiún na Scrúdaithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION

GEOSCIENCE EDUCATION STUDIES - HIGHER LEVEL

Section A

Question 1

(a) What is the Junior Cycle?

(5 points)

(b) Among the Junior Cycle subjects, there is no Geology or Earth Science subject specifically. Describe what aspects of Earth Science are covered in the subjects (i) Science and (ii) Geography. In your answer, refer to the current subject specifications for both subjects.

(10 points)

(c) An important reason for students to study Earth Science is to become engaged and knowledgeable citizens with sufficient geoscientific literacy to meaningfully tackle big questions like climate change. Does this aim fit into the Junior Cycle programme? In your answer, refer to

- the 2015 Framework for Junior Cycle
- the Science curriculum
- the Geography curriculum

(25 points)

(40 points)

The Junior Cycle

Question 1:

Q (a) What is the Junior Cycle?

A (a) The Junior Cycle is the programme of learning that students in Irish secondary schools complete over the first three years of their post-primary education. It consists of twenty-one subjects and a number of short courses. All students must do Irish, English, and Mathematics, but schools and students may choose from the other subjects and from the short courses. It is assessed via a mixture of classroom-based assessment tasks during the second and third years and State examinations at the end of the third year. Most of the subjects can be taken at Higher Level or at Ordinary Level. The Higher Level course covers more topics in more complexity than the Ordinary Level course.

Q (b) Among the Junior Cycle subjects, there is no Geology or Earth Science subject specifically. Describe what aspects of Earth Science are covered in the subjects (i) Science and (ii) Geography. In your answer, refer to the current subject specifications for both subjects.

A (b)(i) In Science, the old syllabus (from 2003) divided Science into three sections; Biology, Chemistry, and Physics. But in the new Science subject specification, introduced as part of the new Framework for Junior Cycle, currently being phased in, there are instead five strands. These are the unifying strand 'Nature of Science' and the four contextual strands: 'Physical World', 'Chemical World', 'Biological World', and 'Earth And Space'.

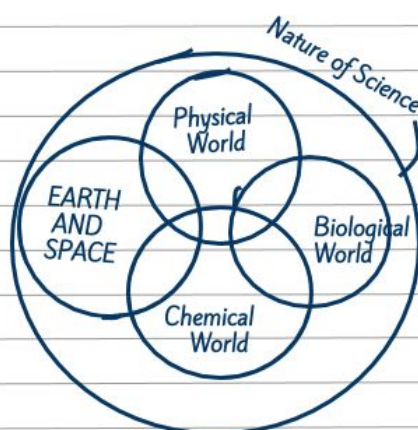


Figure 4: Breakdown of new Junior Cycle Science specification into strands

This last strand is the first time Earth Science has its own specific area of the curriculum at secondary school level in Ireland. The strands are not separate but inform one another, with the unifying strand connecting and informing all the other strands. The unifying strand could be described as directly addressing "scientific literacy", which is defined by the Programme for International Student Assessment (PISA), as quoted in the subject specification document for the new Junior Cycle Science curriculum, as

"the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen"

Each strand has "elements" which are ways to connect the strands together. For example, the element "energy" connects the Physical World (force and energy) with the Chemical World (chemical reactions) with Earth and Space (energy resources) with the Biological World (energy in the body). There are four elements.

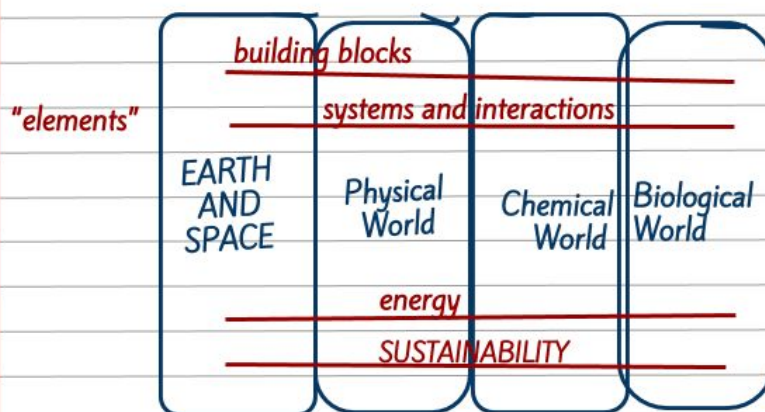


Figure 5: Breakdown of new Junior Cycle Science specification into elements

In terms of Earth Science knowledge and practice, the subject specification says that as part of the Earth And Space strand of Junior Cycle science, students learn about the water and carbon cycles, research energy resources, and evaluate climate change initiatives. However, the Earth And Space strand is arguably more space-focused than Earth-focused. Very little of what would be covered by the subject Geology is included, e.g. rocks, volcanoes, etc. They also learn about material resources, including extraction

(e.g. mining, drilling for oil), as part of the "sustainability" element of the Chemical World strand; consumption of electricity as part of the "sustainability" element of the Physical World strand; and human impact on ecosystems as part of the "sustainability" element of the Biological World strand.

A (b)(ii) In Geography, the new subject specification is still being phased in. So at the time of this project, most Junior Cycle students are still using the previous syllabus. However, most of the actual content knowledge with regard to Earth Science is the same in both the old syllabus and the new subject specification.

Under the old system, the curriculum was divided into A: The Human Habitat, B: Population, Settlement Patterns and Urbanisation, and C: Patterns in Economic Activity. Students learned about the Earth's crust and the tectonic plates under section A: The Human Habitat, generally as the first topic introduced, forming the bedrock of the course (pun intended). They also learned about landscape processes and atmospheric processes in this section. Under section C: Patterns in Economic Activity, they learned about natural resources, including water and petroleum oil. For each aspect covered, local, national, and/or international examples were discussed. For example, on the topic of the rocks comprising the Earth's crust, given examples are a common rock quarry (local example) and the distribution of rock types across Ireland (national example). On the topic of the rate of the exploitation of natural resources with technological change, the national example given is the cutting of peat in the midlands of Ireland.

The new Junior Cycle Geography subject specification covers a lot of the same material, although the landscape (pun intended) of the course is different in layout. The new subject specification document centres the concept of geoliteracy, even more explicitly than the Junior Cycle Science subject specification document centres scientific literacy.

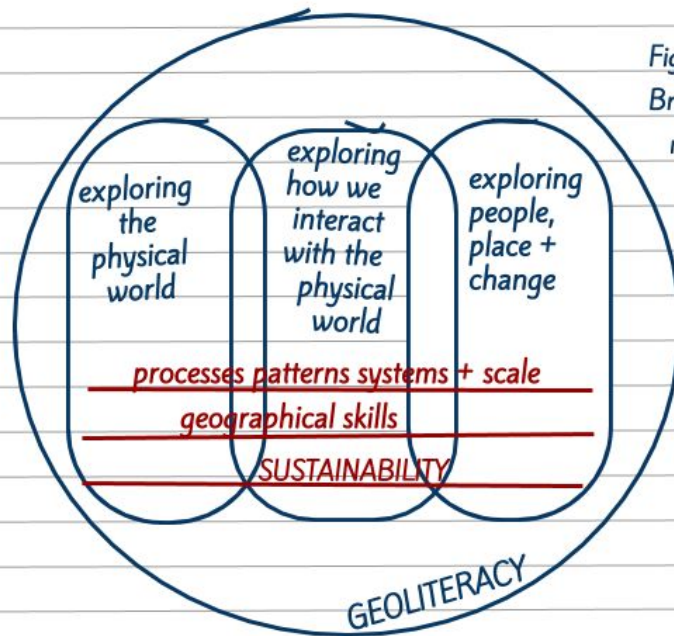


Figure 6:
Breakdown of
new Junior
Cycle
Geography
specification

Within an overarching framework of geoliteracy, it divides topics into three strands. These are 'Exploring The Physical World', 'Exploring How We Interact With The Physical World', and 'Exploring People, Place And Change'. Cross-cutting the three strands are three unifying elements: 'Processes, Patterns, Systems, And Scale'; 'Geographical Skills'; and 'Sustainability'.

Again, the first listed topics under the first strand (Exploring The Physical World) deal with the Earth's crust:

- 1.1 describe the formation and global distribution of volcanoes, earthquakes, and fold mountains in the context of plate tectonics and structure of the Earth
- 1.2 distinguish between different categories of rock type, referring to composition and formation

This strand also includes content information on energy resources, and on the global climate (although climate change is not specifically mentioned under this strand in the subject specification document; climate change is mentioned in the Rationale for the subject as a whole, which I will discuss further in part (c) below).

The socio-cultural overlap with Earth Science is tackled in the second strand (Exploring How We Interact With The Physical World), which is a vital part of a good Geography course (arguably the whole purpose of the subject!):

2.1 describe the economic and social impacts of how we interact with the occurrence of volcanoes, earthquakes, and fold mountains

2.2 evaluate the environmental, economic, and social consequences of rock exploitation and energy resources

2.4 assess the exploitation of water, fish stocks, forestry, and soil as natural resources

2.7 investigate examples of how people interact with and manage surface processes

2.8 investigate how people respond to a natural disaster

2.9 assess the interrelationships between the physical world, tourism and transport

Overall, across the two subjects discussed - Science and Geography - Junior Cycle students in Irish secondary schools are provided with a reasonably good introduction to Earth Science and geoscientific topics, including topics such as climate change and sustainable management of natural resources.

Each subject (aside from Irish, English, and Mathematics) at Junior Cycle level is timetabled for 200 hours, and a typical Junior Cycle student takes between 9 and 13 subjects (or 9 to 12 subjects and one or more short courses). Science and Geography are both popular subjects, and even mandatory in some schools (though not at national level). Currently approximately 65,000 students sit the Junior Certificate examination every year, of whom almost 60,000 sit the Science paper. About 51% of the students sitting the Science paper are male, which is close to the figure for the mandatory subject English. Slightly fewer sat the Geography paper, just over 58,000 students in total. So almost all students are exposed to Earth Science within these two subjects, however, the total time and attention given to Earth Science within the overall Junior Cycle for a given student, even one who does both Science and Geography at Higher Level, is necessarily fairly brief, as it makes up only parts of one or two strands in either subject.

Q (c) An important reason for students to study Earth Science is to become engaged and knowledgeable citizens with sufficient "geoscientific literacy" to meaningfully tackle big questions like climate change. Does this aim fit into the Junior Cycle programme? In your answer, refer to

- the 2015 Framework for Junior Cycle
- the Science curriculum
- the Geography curriculum

A (c) In my opinion, the aim of developing geoscientific literacy is supported by the new Framework for Junior Cycle and the subject specifications for Science and Geography. However, in practice, in a classroom with up to 30 students, taught by a teacher who may not themselves have any particular grounding (pun intended) in Earth Science past their own secondary school education, it remains to be seen whether a student studying under the new Junior Cycle Framework actually develops their geoscientific literacy and becomes an engaged and knowledgeable citizen.

Within the subject specifications, geoscientific issues are mentioned ("climate change" is mentioned in both the Science subject specification and the Geography subject specification, albeit only once each), and in both Science and in Geography, "sustainability" is taken as one of the overarching "elements" connecting knowledge across multiple strands. This is a notable improvement compared with the previous syllabus, which did address issues of resource management, environmental conservation, and pollution, but did not centre sustainability in the same way. The previous Junior Certificate syllabus did specifically say,

"Particular emphasis should be given to social and environmental education"

while the new Framework for Junior Cycle does not specifically mention "environmental education" or a similar equivalent. In the broad aims of the Framework for Junior Cycle, the key skill Working With Others includes "contributing to making the world a better place", but there is no specific mention anywhere in the key skills of 'sustainability' or the

environment, or indeed socio-political engagement as a citizen. These principles are mentioned within the individual subject specifications. Sustainability is, however, mentioned in the Framework for Junior Cycle's student learning activities.

"Student learning activity: 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."

It is also mentioned in the Statements of Learning (SOL), along with other principles or areas which I consider to be connected to the development of geoscientific literacy. The subject specifications explicitly connect some Statements of Learning to each subject. Of the twenty-four Statements of Learning, I consider five of them to be directly connected to geoscientific literacy.

SOL 7. values what it means to be an active citizen, with rights and responsibilities in local and wider contexts

This SOL is not explicitly connected to either the Science or the Geography subjects in the subject specifications, and only Geography is listed in the Framework of Junior Cycle as connected to this SOL. However, I consider this an oversight on the part of the curriculum, as engagement as active citizens is vital to many geoscientific topics (most notably climate change).

SOL 8. values local, national and international heritage, understands the importance of the relationship between past and current events and the forces that drive change
For this SOL, both Science and Geography are listed as relevant subjects, but no specific description is given for Science. The description for Geography is "Students consider factors that influence human settlement in relation to origin, location, and sustainable change".

It is understandable that, although in reality every single subject has a heritage and drives change within its own sphere, not every subject can directly tackle this SOL. There is, however, much to learn from the history and heritage of science, and

scientific and technological development are among the most powerful drivers of change. I would personally have explicitly centred the subject Science with this SOL, but of course, I am biased.

SOL 9. The student understands the origins and impacts of social, economic, and environmental aspects of the world around her/him

For the subject Science, the specification gives the description, "Students will collect and examine data to make appraisals about ideas, solutions or methods by which humans can successfully conserve ecological biodiversity". Meanwhile, for the subject Geography, it says "Students explore and engage with areas of learning such as population, settlement, development and globalisation". These are vital topics within geoscientific literacy.

SOL 10. The student has the awareness, knowledge, skills, values and motivation to live sustainably.

This SOL is obviously very fundamentally connected to the development of geoscientific literacy. It is typical of the Western engagement with sustainability that the SOL addressing it specifies "to live sustainably", read as an individual or household topic, while the SOL addressing becoming an "active citizen" is not connected to sustainability. The concept of "sustainable living" has been framed in our consciousness as an individual choice, whereas in actuality, in order to make true sustainable change, it is systems and societies that have to change. And the only way to change the systems in which we live is by engaged citizenship (voting, lobbying, protesting). In any case, the subject specification for Science says, "Students will engage critically in a balanced review of scientific texts relating to the sustainability issues that arise from our generation and consumption of electricity." which is certainly a vital step, although the equivalent in Geography merely says, "Students learn about the importance of living sustainably".

SOL 19. The student values the role and contribution of science and technology to society, and their personal, social and global importance

This SOL is only connected to Science, and the subject specification says, "Students will research and present information on the contributions that scientists make to scientific discovery and invention, and the impact of these on society". This is also a vital step in engaging with geoscientific topics such as climate change and resource management. Although students must eventually learn not only to value, but rather, to evaluate and critically examine the costs as well as the benefits of technological advancement.

Overall, I believe the current Framework for Junior Cycle explicitly and implicitly supports the development of geoscientific literacy, at least on paper, which is all the Framework documents and subject specifications can give me. It is particularly heartening that sustainability is centred in both the Science and the Geography subject specifications as one of the overarching "elements" binding the curriculum together, and similarly with "energy" for the Science curriculum. Both subject specifications discuss scientific- or geoliteracy, but the nature of the subject divisions means these literacies are being developed separately, as opposed to as a cohesive "geoscientific literacy". The Geography specification in particular emphasises citizenship and active engagement with the world, in the Geography subject rationale. It goes on to say,

"Students viewing events through a geographical lens are well placed to be part of a generation which can deal effectively with and mitigate global challenges, and can rise to related opportunities."

I consider this the crux of geoscientific literacy as an engaged citizen.

In my project, I hope to find that the current Junior Cycle can deliver on its objectives, and if it cannot, I hope to find out how any shortfalls can be successfully addressed.

- That would be an epistemological matter -

I'm thinking about the philosophical basis for my thesis and I thought I'd better jot down my notes.

Initially, I thought I would do quantitative research arising from a positivist/realist philosophy, the sort of default philosophy of a young, educated scientist in western academic tradition. In my first description of my methodology, I wrote

“My methodological philosophy arises from my background in geology and physics; therefore, the ontology and epistemology will be primarily positivist.”

My ontological positivism went unquestioned through my MSc, but when I began this project, and started thinking about how to measure such things as “understanding” and “engagement”, I had to interrogate my philosophical assumptions. Children's behaviour is not as easy to quantify as earthquakes' behaviour! Now I realise I do not truly believe that concepts like “understanding” are quantifiable, objective, external entities. A purely, or even dominantly, positivist ontology no longer makes sense for me, although I still believe that these concepts are measurable and that data on these concepts is verifiable and actionable. So, if not objective entities external to our conceptions of them, what are they?

Colette (along with a few others in the School of Education) introduced me to social constructivism, and the value of qualitative data; data that don't come in a numerical form, or that cannot be easily translated into numerical form. Not something I have much experience with! I find I agree with a lot of constructivist thinking; that concepts are socially constructed. It makes sense, in the context in which I'm working, to define "understanding" as a subjective entity that is not external to the socio-cultural context, and that may change over time. But, while a constructivist-interpretivist ontology and epistemology sit well with my moral and ethical principles, it allows for too much flexibility where I believe that there should be structure. There are things I believe are actually externally "real", in some sense of the word, to the socio-cultural constructs humans use. Furthermore, while a qualitative approach can give important information about a topic, a typical qualitative study doesn't lead to actionable recommendations. It may shed light on reasons and emotions and suggestions, but it doesn't say "if X policy is implemented, Y% of this demographic will improve on Z metric by a measurable amount".

I began to read about other philosophical paradigms. Realism is a close fit: perhaps my concepts are real, but socially interpreted? A lot speaks to me in Critical Theory; problems arise from unjust power structures in society that must be dismantled. Epistemologically speaking, empiricism makes sense to me, drawing knowledge from experiential data, but how to define that?

And then I got frustrated. At a certain point, it doesn't actually matter whether a concept is real or not real, whether it's constructed or co-constructed, objective or subjective. First of all, it only matters at all if it's relevant, if it's crucial to my research questions. So I don't have to worry about whether emotions are really real or not, because I'm not asking any questions about emotions. Secondly, if a concept is measurable and actionable, and allows me to answer my questions with a high degree of validity, does it really matter if it's externally, objectively real, or a socio-cultural construct? Not to me it doesn't.

Or as Charles Sanders Pierce (1878) said, “It will sometimes strike a scientific man [sic] that the philosophers have been less intent on finding out what the facts are, than on inquiring what belief is most in harmony with their system.”

Turns out, this ontological perspective is pragmatism, so I’ve been reading William James’s lectures on the subject.

I quite liked James’s take, partly because he respected that I might not like it.

“You may not follow me wholly in these lectures; and if you do, you may not wholly agree with me. But you will, I know, regard me at least as serious, and treat my effort with respectful consideration.”

- William James
Pragmatism, 1907

Perhaps, rather than my ontological and epistemological philosophy, what I actually brought from Geology was a mindset of practicality. You have to be practical about things when you’re out in the field: practical maps, practical boots, practical plans. It’s certainly worth interrogating our own conceptualisations of the entities we propose to measure, but at a certain point, methodological choices must be made and the research questions must be answered. And at that point, when it comes to ontology, “If no practical difference whatever can be traced, then the alternatives mean practically the same thing, and all dispute is idle.” as William James says.

So, if my ontology is rooted in pragmatism, where does that leave my epistemology?

“No theory is absolutely a transcript of reality, but that any one of them may from some point of view be useful.”

- William James
Pragmatism, 1907

Abraham Kaplan, following on from James's adoption of a mixture of methods in researching broad and complex questions, discussed the dangers of relying too heavily on one singular method, to the exclusion of others.

“What is objectionable is not that some techniques are pushed to the utmost, but that others, in consequence, are denied in the name of science.”

- Abraham Kaplan

The conduct of inquiry: methodology for behavioral science (1964)

Pragmatism bypasses the “paradigm wars”; quantitative and qualitative methods don't have to oppose one another in a pluralist paradigm with room for both or any kinds of approaches, as several writers suggested in the 80s and 90s (Howe, 1988; Tashakkori & Teddlie, 1998).

A pragmatist epistemology, logically, is one that allows the research questions to lead. The research questions are logically prior to the methodological paradigm; a question that seeks a contextual, emotional answer will require a different research approach than one that seeks a numerical, actionable answer. My epistemological attitude is to be open-minded and follow the research questions.

What makes a lot of sense to me is Richard Rorty's assertion (as described in Bernstein, 1983 and Tashakkori & Teddlie, 2003) that concepts in the social sciences are not isomorphs of concepts in the natural sciences. Therefore, it isn't logically inconsistent to apply different methodological approaches to them.

So now I have to decide what methodology my research questions require, and whether I'll use quantitative or qualitative data, or both, and what research tradition I'm working in. Lots to do!

> Women in Academia Support Network

> New posts



Amalea Carter

24 Nov 2017 at 23:41

I have a question for the wise women of WIASN... It's time to outline my epistemological and ontological approach but I'm finding it really difficult to write about because I seem to fall between two camps (or maybe even three!) They gave the impression in our Research Methods classes that you have to pick one. Is it against the principles of designing research to draw from two different approaches or is it okay? How does one justify it? It feels a bit hodge podge 😞



9



Kathryn Lambe

24 Nov 2017 at 23:45

Have you looked at pragmatism? Maybe [@Emily Ellis-Neenan](#) could weigh in?



3



Emily Ellis-Neenan

24 Nov 2017 at 23:59

Yes! Ontologies are not precisely defined discrete boxes, so much as they are useful constructs to use to communicate how we as individual researchers recognise our own conceptualisations of the world. They don't exist independent of our understanding of them, they aren't something out there that we go and put ourselves in, they're templates against which we measure our own internal idea of "how the world works", and we match up with those templates to be able to do our research in a consistent way, and communicate it to others. You have a personal, individual, internal (and evolving!) ontology and you just need to be able to communicate it, which we mostly do by using ones that have previously been developed. As long as you are self-consistent and able to express your ontology and defend it, I think it's perfectly valid. But of course I am a pragmatist! 😄



7

A brief discussion of the relative merits of quantitative, qualitative, and mixed methods in educational research, as they apply to this project.

Emer Emily Neenan

To answer questions properly, seek fact
The truth is found true aggregatively¹
The scientific method is exact
Investigate things quantitatively

Nothing in life is quite black and white
People particularly
To venerate numbers, boxes, and scales
Enervates creative generation of data and fails
To allow for the “wow” of addressing a question imaginatively²
Discover things qualitatively

A true positivist ontology
Asserts the world in which we live is real³
Define a measurable entity
Then quantitative data is ideal

1 Kurtz, A. K. & Mayo, S. T. (2012). *Statistical methods in education and psychology*. New York: Springer Science & Business Media.

2 Loehle, C. (1990). A guide to increased creativity in research: inspiration or perspiration?. *Bioscience*, 40(2), 123-129.

3 Hudson, L. A. & Ozanne, J. L. (1988). Alternative ways of seeking knowledge in consumer research. *Journal of consumer research*, 14(4), 508-521.

Well, count your blessings if you can
Measure emotions in metres or grams
Our concepts are constructs
Co-created in context⁴
Written and wished
Interpretivist
No being, no meaning, without us to see them⁵
Qualitative data is how we reveal them

Keep samples large and always randomised
Approach each piece with objectivity
Researcher bias thus is minimised⁶
In quantitative methodology

The impossibility of objectivity⁷
Aside
I won't apologise for being me
For holding how I see and how I feel
I look my bias in the eyes
It is one side
The other, wise
A wrinkled face, empathetic and experienced⁸

4 Hodson, D. & Hodson, J. (1998). From constructivism to social constructivism: A Vygotskian perspective on teaching and learning science. *School Science Review*, 79(289), 33-41.

5 Berkeley, G. (1881). *A treatise concerning the principles of human knowledge*. Philadelphia: JB Lippincott & Company.

6 Punch, K. F. (2013). *Introduction to research methods in education*. London: Sage. 288-289

7 Katz, C. (1992). All the world is staged: intellectuals and the projects of ethnography. *Environment and Planning D: Society and Space*, 10(5), 495-510.

8 Mies, M. (1993). Towards a methodology for feminist research. In M. Hammersley (Ed.). *Social research: Philosophy, politics and practice*. (1st ed., pp.64-82). London: Sage.

I hold my bias firmly by the tail
It's not a failure
To spend the coin of subjectivity
In qualitative methodologies

The truth is that the numbers cannot lie
Once all due care is taken with the task
How variables correlate and why⁹
Due quantitative queries can unmask

People tell stories
That's how we make sense¹⁰
We build fences, defences, explore the world's glories
In words
A vast and lasting amount of what we know
Is narrative
Give qualitative questions their due

Experimental methods give control
A certainty that other methods lack
Identified relationships the goal¹¹
Which quantitative instruments unpack

9 Punch, K. F. (2013). *Introduction to research methods in education*. London: Sage. 270-276

10 Hutto, D. D. (2007). Narrative and understanding persons. *Royal Institute of Philosophy Supplements*, 60, 1-15.

11 Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research*. Chicago: Rand McNally & Company.

A person's own words in a person's own home¹²

Whatever that home might be

Opening inviting questioning

And encouraging honesty, seeing what they can see

Picking one thread through the weaving

Plucking and pulling a string

Qualitative instruments sing

To build on strong foundations is robust

A chain of logic strengthened link by link

Existing frameworks built for us to trust

Our quantitative methods kept in sync¹³

Ask a question never asked before

Find and open a brand new door

Do more

Go further or deeper or broader

Qualitative methods let you explore¹⁴

But a policy needs solid evidence

Validity must be external, then

Proposals are put forth with confidence¹⁵

The quantitative process proves again

12 Punch, K. F. (2013). *Introduction to research methods in education*. London: Sage. 270-276

13 Gjersing, L., Caplehorn, J. R., & Clausen, T. (2010). Cross-cultural adaptation of research instruments: language, setting, time and statistical considerations. *BMC medical research methodology*, 10(1), 13.

14 Punch, K. F. (2013). *Introduction to research methods in education*. London: Sage. 115-116

15 Davies, P. (1999). What is evidence-based education?. *British journal of educational studies*, 47(2), 108-121.

Improvement is a wanted change
It's strange
To think a stranger could know better
To get the best result
Listen
Feminism fights the power differential¹⁶
It's essential to be deferential to lived experience
To hear them speak
Their truth
And yours too
That process is collaborative¹⁷
It is
Qualitative

But

Can't we combine paradigms and align
The finest and most fitting bits?
Each lending its strengths to the other
To cover the failings or gaps¹⁸
Let them overlap
Flaws can be fixed
When methods are mixed

16 Mies, M. (1993). Towards a methodology for feminist research. In M. Hammersley (Ed.). *Social research: Philosophy, politics and practice*. (1st ed., pp.64-82). London: Sage.

17 Lieberman, A. (1986). Collaborative research: Working with, not working on. *Educational leadership*, 43(5), 28-32.

18 Johnson, R. B. & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational researcher*, 33(7), 14-26.

Taking a pragmatist viewpoint
The thing that works best is what works
Joint methods in tandem
Not random but thoughtfully done¹⁹
Why stick to just one?
To best answer questions
Reflect on suggestions

Quantitative, qualitative
All the ways to break things up and
Separate things into slices
But these concepts are not binaries
Though one method might be primary
Think in continuums
Use what is optimum

The goal is to answer the questions
As best as restrictions allow
And how will *my* project be best done?
A mixed methods process is how.

19 Jayaratne, T. (1993). The value of quantitative methodology for feminist research. In M. Hammersley (Ed.). *Social research: Philosophy, politics and practice*. (1st ed., pp.64-82). London: Sage.

20 Onwuegbuzie, A. J. & Leech, N. L. (2005). On becoming a pragmatic researcher: The importance of combining quantitative and qualitative research methodologies. *International Journal of Social Research Methodology*, 8(5), 375-387.

21 Johnson, R. B. & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational researcher*, 33(7), 14-26.

12th September 2017 at 2:27 pm

From: Shaun O'Boyle

To: Emer Emily Neenan

Hi Emily,

It was great to chat with you at the Long Room Hub about our plans for European Researchers Night at the end of the month.

I love your suggestion of having a poetry event at European Researchers Night and I was hoping to run some thoughts and ideas by you. I'd appreciate any thoughts or feedback you might have, if you have time:

- Invite researchers who write poetry to read their own work
- Invite researchers who study poetry to read from texts they study
- Invite researchers who don't work with poetry to read poems related to their field

In total, I thought we could have 6 readings in a 30-min event. I was wondering if you would consider hosting the event, and also reading a piece at it?

Would love to hear your thoughts.

All the best,

Shaun

--

Dr Shaun O'Boyle

science communicator | producer

30th September 2017 at 11:05 am

From: Francesca O'Rafferty

To: Emer Emily Neenan

Hi Emily,

Sounds like the poetry event at Researcher's Night was a big hit! Would you and the other Hub residents who recited poems be interested in doing a reprise for the Hub coffee morning? Maybe the last one before Christmas?

Warm regards,

Francesca

20th December 2017 at 4:34 pm

From: Jane Ohlmeyer

To: Emer Emily Neenan

Loved your rap/poem at the Hub Christmas coffee morning, Emer Emily. Really gets to the heart of the arts and humanities.

We'd love to have you perform it again at the Hub's 10 year anniversary showcase - Caitriona will be in touch with the details closer to the time. Well done!

Prof Jane Ohlmeyer

Erasmus Smith's Professor of Modern History

Director, Trinity Long Room Hub

Trinity Long Room Hub

Arts & Humanities Research Institute

Trinity College Dublin, the University of Dublin

Dublin 2, Ireland

An tOllamh Jane Ohlmeyer

Ollamh Erasmus Smith le Nua-Stair

Stiúthóir, Mol an tSeomra Fhada

Mol an tSeomra Fhada Institiúid Taighde

na nEalaíon agus na nDaonnachtaí

Coláiste na Tríonóide, Baile Átha Cliath

Baile Átha Cliath 2, Éire.

9 May 2017 at 11:45 am

From: Áine O'Neill

To: Emer Emily Neenan

Dearest Daughter,

Our paper is published! Look, we got written up on the main page:

In their article titled "[Addressing the impact of the media on the gender gap in science: 2nd Commemoration of the International Day of Women and Girls in Science conference review](#)", Emer Emily Neenan, researcher in geoscience education in Ireland at the Department of Education, Trinity College Dublin, and Áine O'Neill, lecturer in Biosciences in IT Carlow, provide JCOM readers with a detailed description of the topic addressed, a gender breakdown of attendees and speakers, and information on discussions and suggestions which have emerged.

I'm going to have a celebratory cup of tea and I suggest you do too.

How is the work going?

Lots of love,

Mammy xx

Dearest Mammy ~ Feminist Research Tradition

9 May 2017 at 12:34 pm
From: Emer Emily Neenan
To: Áine O'Neill

Dearest Áine,

Yay! Look at us, being a boss mother-daughter feminist academic team!

The work is going okay, a bit overwhelming but I'm feeling optimistic. Actually I must thank you (again) for the unapologetic feminist upbringing you (and Frank, but mostly you :P) gave us; I'm utilising intersectional academic feminism in my research now! My approach to the research is really informed by my personal feminism, which I credit largely to you. <3

Like, one of the most important tenets of your particular flavour of second-wave feminism (with its foundations in student protest and solidarity with working class concerns of course) is "the personal is political". My earliest lessons in feminism with you involved the politics of education: who gets to go to what school, who decides what is taught and how it is taught, and who is listened to. Remember you warned me that children and women are often ignored, even when they're correct or telling the truth? And that the right thing to do is to question everything and always listen.

That's what I want to do in my research. I want to question, and I want to listen.

I don't know if you're very familiar with academic feminism. It doesn't come up much in science, where you and I are usually at home! Academic feminism tries to minimise the power differential between the researcher and the people being researched, which means the methods must be designed with this feminist approach in mind. After all, as Maria Mies says in *Towards a Methodology for Feminist Research* "new wine must not be poured into old bottles"; i.e. traditional positivist methodologies are inherently patriarchal and both rely on and propagate a hierarchical system where the researcher is looking down from above on the researched. If feminist scholars rely on these methodologies, they will perpetuate a system of domination and oppression, even with the best of intentions. (Although from a sustainability perspective, we should reuse them!)

And choices about research style (quant vs qual, paradigm, etc.) are choices that have political elements (Sapsford & Abbott, 1996). The personal is political. Education is political. Research is political.

But, I don't believe feminist research necessarily has to be qualitative. As Jacqueline Scott says, the reliance on qualitative methods does a disservice to the potential breadth of feminist research, and is based on "a somewhat misleading portrayal of quantitative research".

I've been reading *Social Research: Philosophy, Politics and Practice*, edited by Martyn Hammersley if you want to look it up, and I'm forming a feminist structure for the project based on the work by Maria Mies and Toby Epstein Jayaratne in that book. In fact, Jayaratne's views in particular fit very well with my pragmatist ontology and epistemology: that a mixture of methods should be used if that best serves our goals, and that we as feminists can adopt the useful parts of positivist quantitative statistical research and work to change those elements which are antithetical to feminist ideals (e.g. putting the researcher deliberately in a position of power over the researched, studying white men by default, using statistics to support sexist agendas, etc.).

My feminist approach so far is as follows:

First, objectivity is impossible and, in educational research, unnecessary.

Instead, a conscious partiality (Mies, 1993) is cultivated: bias and experience/investment are two sides of the same coin.

"Too many social researchers assume they are 'appropriately' detached if they do not have strong feelings about the issues they study. Often what they do not realize is that their views really indicate a strong commitment to the *status quo* - which is as potentially biased as any other orientation" (Jayaratne, 1993).

My experience and my personal opinions will be part of the project, always acknowledged, addressed, and where appropriate, interrogated, but never ignored.

Second, and following from the first point, research can and should be used to inform policy. What's the point in listening to someone if you don't act on their wishes? "Many social scientists feel that their obligation to research ends with a published document; whether results from their studies have any impact on policy seems to be of little concern" (Jayaratne, 1993). Research can impact policy both directly and indirectly (e.g. via public opinion). This is a stated and definite aim of this project.

Third, it's important to collaborate with the demographic being studied (in this case, to listen to children and young people). Although the language itself perpetuates a hierarchical system, the idea is to frame the view from "below", not the view from "above" (Mies, 1993). Some feminist researchers say that quantitative data "collection" is inherently exploitative. But, a feminist approach can be very effective in quant research. A trusting, respectful, dialogic relationship with research subjects can lead to better data (Jayaratne, 1993).

So, I intend to involve children/teenagers as collaborative co-researchers in the project.

External to this framework, or perhaps the window through which the project will be viewed, the epistolary idea also coheres nicely to this explicitly feminist approach. Epistolary is a feminist form of narrative, and historically the only narrative form women could easily and consistently write in, as Olga Kenyon says in *800 Years of Women's Letters*. (Thank you for lending it to me!) Although women have always been at the forefront of literary innovation (The Tale of Genji by Murasaki Shikibu, a Japanese noblewoman, is widely considered to be the first novel!), there is a history of women's writing being hidden or disapproved of. Our favourite, Jane Austen, who wrote epistolary novels and frequently used letters as devices within novels, seems to have hidden her novel-writing as letter-writing; the latter, unlike the former, was a perfectly acceptable diversion for upper and middle class women of the time.

Anyway! I should get back to it. You know I could talk to you all day about this stuff!

Love you lots like jelly tots,

E mee.

P.S. If you're interested in any of the papers or books I mentioned, you can use Google Scholar like Barry showed you, here's the citations:

Jayarathne, T. (1993). The value of quantitative methodology for feminist research. In M. Hammersley (Ed.). *Social research: Philosophy, politics and practice* (1st ed., pp.109-123). London: Sage.

Kenyon, O. (2011). *800 years of women's letters*. Stroud, Gloucestershire: The History Press.

Mies, M. (1993). Towards a methodology for feminist research. In M. Hammersley (Ed.). *Social research: Philosophy, politics and practice* (1st ed., pp.64-82). London: Sage.

Sapsford, R., & Abbott, P. (1996). Ethics, politics and research. In R. Sapsford & V. Jupp (Eds.), *Data collection and data analysis*. (2nd ed., pp. 317-340). London: Sage.

Scott, J. (2010). Quantitative methods and gender inequalities. *International Journal of Social Research Methodology*, 13(3), 223-236.

07 September 2017 at 12:17

From: Colette Murphy

To: Emer Emily Neenan

Hi Emily,

I like your feminist approach! Let's talk about research methods. You mentioned before you were interested in the Children's Research Advisory Groups (CRAGs) method and you wanted to learn more.

Honestly, Lauren Boath is the real expert now, not me. She's one of my other students, now based in the University of Dundee. She's done loads of work with CRAGs.

Let me put you two in touch. She would be a great mentor for you!

Thanks

Colette

"Why is it, in spite of the fact that teaching by pouring in, learning by passive absorption, are universally condemned, that they are still so entrenched in practice?"

John Dewey, Democracy in Education 1916, Page 46

27 September 2017 at 13:13

From: Lauren Boath

To: Colette Murphy, Emer Emily Neenan

Hi Colette

Do you have any recommendations for a good place for me and Emily to have a working brunch in Belfast on Sunday morning? Making use of every minute and saving Emily a flight to Scotland!

L.

Cupán TAE

by Emer Emily Neenan

A pleasant buzz of greetings and conversations builds in the room. Emily wanders back and forth between the brightly-lit lecture room with the vivid purple carpet and the adjoining conference/coffee room, unable to sit still with adrenaline. Tanya directs people from the pots of tea and coffee to take their seats, as Mags tries to chivvy people to sit in the front row. Joseph hurries in at the last minute and takes a seat beside Autumn.

“Are you ready?” Tanya asks Emily.

“Yep, whenever suits,” Emily answers. “I don’t really think we’re waiting on many more.”

They stand at the front of the room and Tanya raises her voice to speak over the chatter. Emily tries not to fidget.

“Hello everyone! It’s time to get started,” Tanya says. “Welcome to our Talk About Education seminar. If you don’t know me, my name is Tanya Zubrzycki. Usually this isn’t my job, to introduce the speaker, but usually it is Emily’s job and she is the speaker this evening. So I will introduce her. If you haven’t been to a Talk About Education before, we have a topic and one or more speakers, and usually it will be on some part of the process of research, not just results. Emer Emily Neenan is going to talk about her research method including students in research, so go ahead, Emily.”

“Good evening, everyone, thanks for coming!” Emily begins, making an effort to keep her voice steady and her breath slow. “Before I get started, I just want to let you know, I have no slides and, as we try to keep the format flexible and discussion-focused, I not only don’t mind being interrupted for questions, I would love to be!

“So! Can everyone hear me?”

There are nods around the room.

“Loud and clear!” answers Mags in the front row.

“Great,” Emily says. “I want to tell you about the research method I’m going to use in my PhD research, called Children’s Research Advisory Groups, or CRAGs, like C-R-A-G. The idea is to include children as expert co-researchers, rather than just as participants, in research that affects them and their lives. Children who represent the demographic being studied are experts on a child’s lived experience.

“This method is based on the United Nations Convention on the Rights of the Child, which states in Article 12 that ‘the child’s views must be considered and taken into account in all matters affecting him or her’. It’s a requirement. As my supervisor, Colette Murphy, and I have discussed, this follows naturally from my feminist approach to the project.

“However, simply giving children the opportunity to speak doesn’t guarantee them their right to a voice if they lack the tools and vocabulary to express themselves. In order to implement this principle in practice, it is necessary to provide children with four things: Space, Voice, Audience and Influence. These are the four necessary factors for their input to be meaningful, according to Laura Lundy’s 2007 work on conceptualising and implementing Article 12.

“Children can contribute to all stages of a research project: designing research questions as in Kellett, 2004... as part of data collection as in O’Brien & Moules, from 2007... the data analysis as in Coad & Evans in 2008... and during dissemination as in Tisdall, 2008.

“Lundy and McEvoy first used the CRAG, which was then called a CAG, a Children’s Advisory Group, in a study published in 2009. The tasks of the CAG-CRAG were, and let me read this from my notes to get it exact:

‘(1) to advise on the research process which principally involved assisting with the interpretation of survey results and the findings of the literature review; (2) to provide insight on the main issues relating to educational underachievement and social disadvantage; and (3) to identify potential services which might address the problems.’

“That’s from Lundy & McEvoy, 2009.

“So, following on from this, Lundy worked with Colette on a project funded by the Wellcome Trust, which is the first time this method was applied to science education specifically. They convened CRAGs to assist on a project investigating children’s perceptions of primary school science assessments in England and Wales. They found that the CRAGs raised points that the adult researchers had failed to consider, which is written up in Colette Murphy’s et al 2013 paper.

“Colette’s student Lauren, whom some of you might know, is now using CRAGs for her project investigating children’s experiences learning about science in contexts outside of formal education, such as science museums. She convened CRAGs to give input on the design of the research instrument, which is a questionnaire, and again to assist in the analysis of the data.

“This two-phase CRAG system seems ideal for my project too. So that’s a brief overview, any questions?”

There’s the usual digesting pause, and Emily glances to Tanya.

“It sounds like a very interesting method, Emily,” Tanya says. “Someone have a question? Mags?”

“So, maybe this is a silly question, but how does ethics work?” Mags asks, looking up over her glasses, laptop perched for notes. “Do you get the same kind of ethical approval as us plebs with a common or garden focus group?”

“Yes, of course, everything has to be cleared by the School Ethics Committee,” Emily answers, “but that’s a good question, not silly, because it’s not quite the same thing. So, generally, the CRAG will fall under the same restrictions and protections as any focus group with minor participants, as you say. However, the students who take part in the CRAG are not “participants” in the traditional sense...

“Actually, sidebar for a sec! I can’t seem to find a tight definition of participants in education or social science research - this is strange?? It seems epistemologically vital?? I’m relying on my own definition for the moment, something like, ‘people with whom the researcher generates the actual data, whose actions, attitudes, or answers are the focus of the study’?

“Anyway, the students in the CRAGs are not “participants”, they’re representative co-researchers. They’re more like colleagues or consultants, who contribute, in this case, to designing the research instruments and analysing the data. But I don’t think we have any choice but to clear everything as though they are participants, since the system isn’t set up for getting ethical approval to work with minor co-researchers or consultants. Some parts will actually be easier, I think. For example, I won’t be audio or video recording the CRAGs, because they aren’t generating data, so I won’t have to worry about that part of the ethics application at all. But other parts raise conflicts for me. Most pressingly, I would usually consider it extremely bad practice not to acknowledge the contributions of co-researchers or colleagues or experts who contributed their perspective to my research. But if I get normal ethical approval, I won’t be able to do that for the representative co-researchers because I’ll have to keep the students’ identities completely anonymous. So yes, mostly the same process, but the ethics is something that needs to be considered in detail. Thanks Mags!”

“Anyone else--” Tanya begins. “Oh, Autumn?”

“Thanks so much for this talk, Emily, it’s wonderful to hear about your methods in detail and it’s really raising questions in my own head for how I might go about my data collection when the time comes,” Autumn says. “I was just wondering if you could tell us a bit more about the way y’all are going to run the CRAGs? I know from organising this and that myself, it’s not always the simplest thing in the world to get teens to open up!”

“Yeah, absolutely!” Emily agrees. “So, a big part of it is that efforts are to be taken to conduct the CRAGs in a manner that is ‘not like school’, to ensure the children feel empowered, which goes back to Lundy and McEvoy writing in 2009 again. Associations can have a strong impact on children’s willingness to participate or open up, as the opening anecdote of Woodhead and Faulkner’s chapter in *Research with Children: Perspectives and Practices*, from 2000, demonstrates. Only one child was willing to participate in a study being run in a nursery school, and the researcher almost gave up, blaming themselves for this terrible ‘failure’, when the principal pointed out the study was taking place in what the children thought of as the ‘naughty room’. Switching to more neutral ground was all that was needed! In school, children are used to a considerable power differential between themselves and the adults, like the teachers and principal. Suggestions to minimise this association, from Lundy’s work and from Colette and Lauren, include... Not holding the CRAG in their usual classroom and ideally in an ‘unconventional’ room like maybe the art room, maybe that’s more neutral ground... Giving children the choice of their own pseudonym, and using informal language and first names... Deciding with the children how the CRAG will proceed, as opposed to telling them it will proceed in a certain way... and giving them control over what records would be kept. That kind of thing

“It’s also very important that the children are acting as experts on ‘children like themselves’, and don’t feel like they have to answer on their own feelings. Lundy et al in 2011 said if they appear to be discussing the topic solely from their own perspective, they should be asked questions like ‘do you think your classmates would agree?’ or ‘what about other children, what do they think?’. You want them to feel able to be honest with you!”

“Unfortunately we’re running out of time,” Tanya says. “Maybe we can move the discussion to be more informal and get our cups of tea. Everyone is welcome to stay around, of course. Thank you so much, Emily.”

“Thanks, Tanya! Definitely, I’ll be around for the evening, if anyone fancies more chats over tea, or strolling across to Doyle’s once the tea runs out! And if ye’re interested in this topic, I’m going to be presenting the main points of this method as a poster for the TCD Multidisciplinary Research Showcase, and competing in the Thesis-In-Three as well, so come along to either of those!”

- ★ Coad, J., & Evans, R. (2008). Reflections on practical approaches to involving children and young people in the data analysis process. *Children & Society*, 22(1), 41-52.
- ★ Kellett, M. (2004). ‘Just teach us the skills please, we’ll do the rest’: empowering ten-year-olds as active researchers. *Children & Society*, 18(5), 329-343.
- ★ Lundy, L. (2007). ‘Voice’is not enough: conceptualising Article 12 of the United Nations Convention on the Rights of the Child. *British educational research journal*, 33(6), 927-942.
- ★ Lundy, L., & McEvoy, L. (2009). Developing outcomes for educational services: a children’s rights-based approach. *Effective Education*, 1(1), 43-60.
- ★ Lundy, L., McEvoy, L., & Byrne, B. (2011). Working with young children as co-researchers: An approach informed by the United Nations Convention on the Rights of the Child. *Early education & development*, 22(5), 714-736.
- ★ Murphy, C., Lundy, L., Emerson, L., & Kerr, K. (2013). Children's perceptions of primary science assessment in England and Wales. *British Educational Research Journal*, 39(3), 585-606.
- ★ O’Brien, N., & Moules, T. (2007). So round the spiral again: A reflective participatory research project with children and young people. *Educational Action Research*, 15(3), 385-402.
- ★ Tisdall, K. E. (2008). Is the honeymoon over? Children and young people's participation in public decision-making. *The International Journal of Children's Rights*, 16(3), 419-429.
- ★ Welty, E., & Lundy, L. (2013). A children’s rights-based approach to involving children in decision making. *JCOM*, 12(03), C02.
- ★ Woodhead, M., & Faulkner, D. (2000). Subjects, objects or participants. *Research with children: Perspectives and practices*, 9-35.

Versions of this image as a poster were presented at the Trinity Multidisciplinary Showcase, the Irish Geological Research Meeting, and the Trinity Research in Childhood Centre Showcase



First Class Experts! Teenage Co-researchers in Geoscience Education Research

Emer Emily Neenan
School of Education
neenane@tcd.ie

The Idea

Including children & teenagers as expert **representative co-researchers**, rather than just as participants, in research that affects them and their lives (Lundy et al, 2011).

Children who represent the demographic being studied are experts on a child's lived experience.

based on...

The United Nations Convention on the Rights of the Child

The UNCRC stipulates that children should be given a voice in decisions that affect their lives. The **Children's Research Advisory Groups (CRAGs)** method gives children/teens Space, Voice, Audience, and Influence, the necessary factors for their input to be meaningful.

give children/teens a voice in...

Development and Use of the Research Instruments

CRAGs can give input on the research instruments, contributing to their design (Murphy et al, 2013). Children/teens use language differently to adults: their use of language is more fluid. CRAGs help develop the language of questions to be used in surveys or interviews, using language in ways that suit the child/teen participants. They also assist in the development of the style and format of the instruments. CRAGs co-design the survey in this project, determining both scope (e.g. including climate change explicitly) & details (e.g. fonts, etc).

The Potential Impact

This project aims to assist schools nationwide to fully engage students with the Earth and Space Science section of the new Junior Cycle curriculum, and thereby effect a significant improvement in Earth Science engagement and understanding of the next generation of Irish voters, equipping them to critically engage with modern geoscientific socio-political issues such as...

- climate change**
- clean water
- natural disasters
- energy
- mining

Why now?

CRAGs method in an exciting phase of development

Earth Science newly in Junior Cycle Science

No research to date on Earth Science at Irish second level

Murphy et al (2013) found that the CRAGs raised points that the adult researchers had failed to consider.

Junior Cert Geoscience Survey 2019

Survey will be rolled out to schools next year

In a Round Table format

It's important the CRAG be conducted in a manner that allows the representative co-researchers to express their true opinions without censoring themselves. Representative co-researchers choose their own pseudonym and are consulted on how the discussion should proceed and how and what records are kept (Lundy & McEvoy, 2009).

Figure 7: "First Class Experts! Teenage Co-researchers in Geoscience Education Research" poster overview of Children's Research Advisory Groups method

Another version was used as the handout for the student taking part in the CRAGs to give them some background on the methodology and the project itself - it went down very well with them!

27 February 2018 at 15:35

From: Emer Emily Neenan

To: Joseph Roche

Hi Joseph,

Find attached the thorny sections of the ethics submission. Everything else is straightforward; there really are minimal risks and mostly the Research Advisory Groups follow the template for a focus group, despite being, to my mind, ethically and epistemologically distinct. But because I'm working with under-18s, it's automatically a "moderate to high risk" application, so I have to be exact.

With the way the system is set up for ethical approval, there is no way to include minors in the research without offering our best attempt at anonymity, or, rather, confidentiality. I honestly don't see how anonymity could ever be guaranteed in such a small country! If I were to give any details about the school - which may be relevant to the research and necessary to include - anyone who knows the school, and knows that a nice young lady came to visit from Trinity last year, will be able to guess. The students in the class/year will certainly all know who amongst them got to miss a class to do the research project.

Anyway, Ireland's small, tight-knit, and gossip-prone population aside, my one ethical gripe with the ethics process is that as my CRAG groups have to be treated as though they are participants, even though they're not, I can't credit them by name for their work. If I was working with a different group of expert co-researchers on this project - say if I scheduled a series of meetings with the Public Perception of Geosciences group at iCRAG to discuss this project - I would be remiss **not** to credit them as having provided expert opinions and useful insights. The students comprising the CRAGs are all in their mid-teens, and I personally feel it would be a lot more beneficial to them to credit them by name so they have a reference to add to their CV, if they want to do that.

But obviously, it is most important to make sure that minors are protected when involved in any capacity in research. So I see the necessity in erring on the side of caution.

Please take a look over these sections and let me know if there are any changes to be made. I want to send in the ethics submission this week and get going!

Best wishes,
Emily.

ATTACHMENT: Neenan_ethics

Trinity College Dublin

School of Education

[Application for Ethical Approval of Research Proposals](#)

Researcher's Name

Emer Emily Neenan

Trinity Email Address

neenane@tcd.ie

1. Please give a structured abstract of the proposed research, including the methods you intend to use (approx. 300 words).

To date, no research has been published on the engagement of post-primary students in mainstream Irish schools with Earth Science, and little has been published on primary students (Neenan & Roche 2016). This research aims to investigate student engagement with Earth Science via a mixed-method summative evaluation. Participant-led qualitative focus groups will facilitate students to contribute to the direction of the research, while quantitative questionnaires will assess students' interest (Murphy et al., 2013) and their understanding of core geoscientific concepts (Libarkin & Anderson, 2006). Barriers to engagement of the students will be identified and recommendations will be proposed to the Department of Education and to the schools. Particular efforts will be made to examine and improve the engagement of female students (Archer et al., 2012).

I will bring together groups of children aged 12-18 from secondary schools, to form Children's Research Advisory Groups (CRAGs) using a method developed by Murphy et al, after the work of Welty & Lundy, 2013. These groups will assist in devising the specifics of the research instrument to measure interest and understanding among 12-18 year old students.

Following on from this, I will visit or communicate with up to 60 schools in order to administer this research instrument. The research instrument will take the form of a questionnaire for students (such as that used by Murphy et al., 2013). The questionnaire will be administered at school, during school hours, and at a time that suits the participants and that does not disrupt their formal studies. I will have the CRAGs meet again to discuss the data and provide feedback to inform the conclusions.

Archer, L., DeWitt, J., Osborne, J., Dillon, J., Willis, B., & Wong, B. (2012). "Balancing acts": Elementary school girls' negotiations of femininity, achievement, and science. Science Education, 96(6), 967-989.

Libarkin, J. C., & Anderson, S. W. (2006, October). Development of the geoscience concept inventory. Proceedings of the National STEM Assessment Conference, Washington DC (pp. 148-158)

Murphy, C. Lundy, L., Emerson, L., Kerr, K. (2013) Children's perceptions of primary science assessment in England and Wales. British Educational Research Journal 39 (3), 585-606

Neenan, E. & Roche, J., Geoscience Education in an Irish Context: A Need for Research, Journal of Geoscience and Environment Protection, 4, 2016, 1 - 8

Welty, E., and Lundy, L. (2013), A children's rights-based approach to involving children in decision making. JCOM 12(03): C02.

4.(a) Please indicate how informed consent of all participants will be gained.

All parties involved in the project will be informed of the structure and purpose of the research and completed consent forms will be required before the study is conducted. For the research taking place in schools, an information sheet and consent form will be presented to the principals of the schools. The research, and the nature/duration of the students' participation, will be described to the principals and teachers and written consent will be sought to proceed with the research in the schools. The study will be described to students in person. The attached information sheet will be provided and they will be asked to indicate their consent to take part using the attached consent form. An information sheet and consent form, will also be sent home with students for their parent(s)/guardian to complete if willing to take part in the study. No data will be collected until all forms are returned and signed by all relevant parties.

4. (b) Please detail any ethical aspects that must be considered, including the proposed use of any incentives.

The research will adhere to Trinity's Policy on Good Research Practice (see link below). It will be based on a) respect for the participants, b) beneficence and the absence of maleficence, and c) justice. No incentives will be offered and there are no further ethical aspects that must be considered in the recruitment of the proposed participants. All participants will participate on an informed and voluntary basis and they will be free to withdraw at any time without having to give a reason and without prejudice. Participation will be arranged at a time that suits the students and so as to cause minimum disruption to their formal studies.

6. (a) Please indicate how the participants' rights to privacy (inc. confidentiality and anonymity) and the privacy of their data will be protected. Highlight potential limitations of confidentiality in the ethics form and information sheets for participants (e.g. for small samples or insider research and how this will be addressed).

Confidentiality and anonymity will be assured as far as possible for all participants. Neither the participants nor the school will be named in the study itself. Participants' identities will be anonymised by randomly assigning ID numbers. Pseudonyms will be used where necessary. With the informed permission of the participants in the CRAGs, their teachers, and the school principal, their work will be acknowledged in the thesis acknowledgements as "CRAGs from [school's name]," to give them due credit for their assistance on the project without compromising the privacy of any individual member. If the schools do not waive their right to anonymity, the acknowledgement will read "CRAGs from participating schools" or similar.

Any quotation from a member of the CRAG will be included in the notes only with that member's verbal consent. If the quotation is included in the thesis, it will be under a gender-neutral pseudonym, and any information about the student will be included only if strictly necessary or unavoidable (for example, if the student says "As a girl in the science class, I feel" on the topic of gender, then her own gender will be unavoidably included). A student's name or class or any identifying information will not be included.

The researcher will not observe the participants as they complete the questionnaires, and the questionnaire will not record participants' names or directly identifying information. It will record broad demographic data (e.g. gender identity, year of study). Responses will not be attributed to individuals. Generally, results from the questionnaires will be aggregated and individual responses will only be highlighted in unusual circumstances, and without any identifying information included.

6. (b) Please also indicate how the data will be stored (and ultimately destroyed as appropriate).

Data will be stored and destroyed in line with the relevant Irish Data-Protection legislation (Data Protection Act 1988, 2003:

<http://www.irishstatutebook.ie/eli/2003/act/6/enacted/en/print.html>). The

data will be stored on a USB and computer folder, both encrypted. All questionnaires and surveys will be securely stored in a locked cabinet in the researcher's school at all times. Access to raw data will be limited to the research team and, potentially, examiners. Data will be retained for 10 years. Following this period, all electronic copies of the data will be deleted from all storage sites and all paper copies will be shredded.



Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin



IRISH RESEARCH COUNCIL
An Chomhairle um Thaighde in Eirinn

Student Information Sheet **on Research Advisory Group**

My name is Emer Emily Neenan and I am a researcher at the School of Education, Trinity College Dublin. I'm researching how Junior Cert students learn about or engage with Earth Science.

My research questions are:

- How do students engage with and understand Earth Science by the end of the Junior Certificate?
- How can schools support Earth Science engagement among students, particularly female students?

I'd like your input on how best to measure these things, so I'm inviting you to be part of a Research Advisory Group.

If you agree to take part in the Research Advisory Group, you will be asked to discuss the Junior Cycle Science program with other students and with me. We'll have a round-table discussion. You might be asked to write down some of your thoughts. I'll use the information you give me to make a questionnaire for Junior Cert students about Junior Cycle Earth Science and about Earth Science generally. I'll take notes or photos of anything you write down or draw so I can look back over it later. I'll delete all of that when I'm finished my project.

The Research Advisory Group will take place in your own school during school hours.

When I get the results from the questionnaires, I might invite you back to discuss the results and give your input on what the results mean. Again, participation is completely voluntary, you don't have to do it if you don't want to. The results will form part of my PhD thesis, and my supervisors and the examiners for the thesis might look at them. I'll write about the results and talk about them at conferences.

There are no particular risks of taking part in the study, it'll just be like a normal conversation except I'll take notes. The information I collect will be private. If I quote

you, I'll only use your first name or a fake name. Information will be stored safely with access only available to the research team and examiners and it will all be destroyed after 10 years.

Information about the results will be sent to your school if you want to find out about the project when it's finished, or you can always contact me directly.

You don't have to take part in this study if you don't want to. You can withdraw from the study at any time, and I won't ask why. And if you have any questions or if you don't understand something, you can always ask me.

My contact details:

Emer Emily Neenan neenane@tcd.ie
School of Education
Trinity College Dublin

The project supervisors:

Dr Colette Murphy colette.murphy@tcd.ie
Dr Joseph Roche joseph.roche@tcd.ie



Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin



IRISH RESEARCH COUNCIL
An Chomhairle um Thaighde in Éirinn

Student Consent Form for Research Advisory Group

You are under **no** obligation to participate in this study. If you agree to participate, but at a later stage want to stop, you are free to do so.

Please answer all of the following (tick the appropriate box):

	Yes	No
I have read and understood the information sheet.	<input type="checkbox"/>	<input type="checkbox"/>
I understand what the project is about, and what the results will be used for.	<input type="checkbox"/>	<input type="checkbox"/>
I am fully aware of all of the procedures involving and of any risks and benefits associated with the study.	<input type="checkbox"/>	<input type="checkbox"/>
I know that my participation is voluntary and that I can withdraw from the project at any stage without giving any reason.	<input type="checkbox"/>	<input type="checkbox"/>
I am aware that my input will be kept anonymous.	<input type="checkbox"/>	<input type="checkbox"/>

I agree to participate in the above study.....

Signature of Student

Date

Signature of Researcher

Date

22 March 2018 at 4:15 pm

From: Emer Emily Neenan

To: Joseph Roche

Hi Joseph,

The draft of the questionnaire is coming together.

The questionnaire will be primarily quantitative. I'm going to leave the option open to the CRAGs whether we'll include any open-ended questions. But the majority of the questions will generate quantitative data. I'm likely to measure "engagement" as a multifaceted construct (Fredricks & Blumenfeld, 2004), using validated self-report scales such as those described by Appleton et al (2006).

I'm going to present the draft version of the questionnaire to the CRAGs, and see what changes they suggest and what points they raise.

The finalised questionnaire will then be sent to all the schools in the sample who agree to take part. I'll visit to administer it myself, where possible, but I won't be able to get to every school. For the remainder, I'd like to send a video explaining it, which the teacher administering the questionnaire can play for the participating students. This is a technique that Lauren Boath recommends, based on her experience (Boath & Murphy, 2017). But I'm not sure if that will be feasible for teachers - I'll discuss it with them.

As well as questions about their engagement, I'm going to include some items on the questionnaire that measure understanding of geoscience concepts. I'm thinking of using a concept inventory, probably the Geoscience Concept Inventory as developed by Julie Libarkin et al (Libarkin & Anderson, 2006), to do this. What do you think?

Best wishes,
Emily.

Appleton, J. J., Christenson, S. L., Kim, D., & Reschly, A. L. (2006). Measuring cognitive and psychological engagement: Validation of the Student Engagement Instrument. *Journal of School Psychology, 44*(5), 427-445.

Boath, L., & Murphy, C. (2017). *Children's perceptions of learning science beyond school*. Paper presented at 3rd European Conference on Curriculum Studies 2017, Stirling, United Kingdom.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of educational research, 74*(1), 59-109.

Libarkin, J. C. & Anderson, S. W. (2006). Development of the geoscience concept inventory. *Proceedings of the National STEM Assessment Conference, Washington DC, 19-21 October 2006*, 148-158.

22 March 2018 at 5:04 pm

From: Joseph Roche

To: Emer Emily Neenan

Hi Emily,

Definitely sounds like a good idea to measure as much as possible! I'm afraid I haven't heard of the Geoscience Concept Inventory. In fact, I'm not even sure what a concept inventory is! So I can't really advise you on that. Can you send me some information so I can read up on it?

I would also suggest you contact Julie Libarkin. From a quick google, it looks like she's still very active in the field of geoscience education, and she may be able to help you.

Sincerely,

Joseph.

P.S. When you're writing up your epistolary, you could have me ask about concept inventories to introduce your explanation of them!

24 March 2018 at 7:20 pm

From: Emer Emily Neenan

To: Joseph Roche

Hi Joseph,

Thank you! And good idea about the framing questions ;)

So, as the name suggests, a concept inventory is an instrument by which students' understanding of concepts can be assessed. They can be used to identify areas of conceptual difficulty, and to measure changes in conceptual understanding after an intervention (Libarkin, 2008).

The first science concept inventory was the Force Concept Inventory, which was introduced by Hestenes and Wells in 1992. It was developed to measure learning in introductory physics classes at undergraduate level in the USA. From my reading on the topic, it seems that assessing learning at undergraduate level is still the most common use for concept inventories, including the Geoscience Concept Inventory (GCI), see, for example, Libarkin 2008, Elkins and Elkins 2007, and Undersander et al. 2017.

Unlike other concept inventories, the GCI is not a single list of items. Rather it is a bank of interrelated items on overlapping concepts, from which a targeted sub-list can be formed, typically of about 15 items (Libarkin & Andersen, 2006). It uses a single scale across all items, meaning users can pick and choose which items to use, depending on their own needs, without compromising validity of comparison. Each item comprises a question, multiple “wrong” answers, and one “correct” answer. Some items include a diagram as part of the question, or diagrams for the answers. Qualitative data from students was used to produce authentic “wrong” answers (Libarkin et al. 2006). Examples 1 and 2 are from the GCI.

Example 1

- Where are volcanic rocks found?
- A. Mostly on islands or in the ocean
 - B. Mostly near the equator
 - C. Mostly on the edges of continents
 - D. Almost anywhere**

bold = correct answer

Question Identifier: GCI_2011_096

Designed for: *Non-Science Majors*

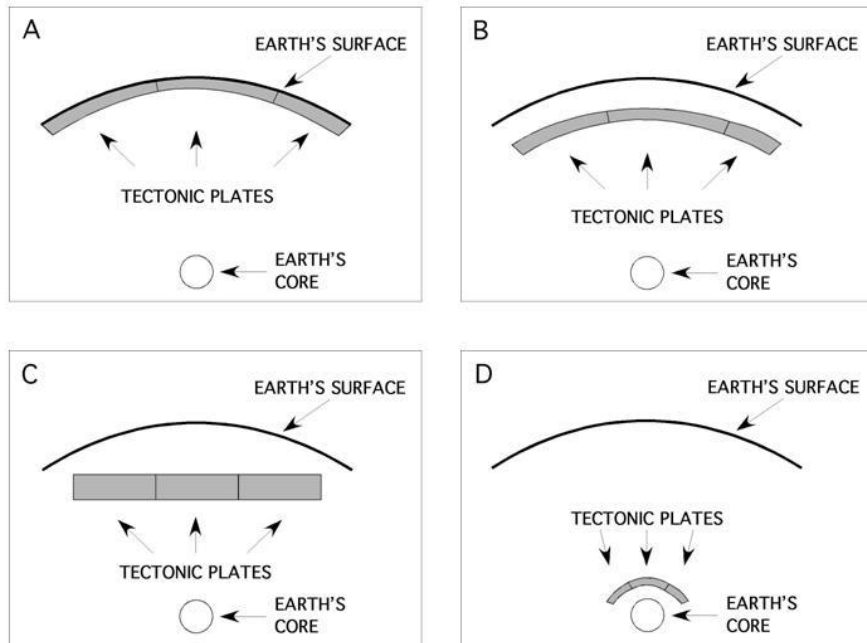
Primary Author(s): *J. Libarkin, S. Anderson*

Contributing Author(s):

Misconceptions' Reference: *Original GCI*

https://www.msu.edu/~libarkin/GCI_PUBLICATIONS.html

Scientists often talk about the Earth's tectonic plates and their role in mountain formation, volcanism, and earthquake occurrence. Which of the following figures most closely represents the location of the Earth's tectonic plates?



- A.**
- B.
- C.
- D.

bold = correct answer

Question Identifier: GCI_2011_059

Designed for: *Non-Science*

Primary Author(s): *J. Libarkin, S. Anderson*

Contributing Author(s): *S. Clark*

Misconceptions' Reference: *Original GCI*

https://www.msu.edu/~libarkin/GCI_PUBLICATIONS.html

There are several published studies using the GCI to assess geoscience education at undergraduate level. For example, Elkins and Elkins' 2007 study, which showed an introductory geology course that takes the form of an extended field trip leads to better understanding of geological concepts (as measured by GCI) than a traditional intro geology course. But I can't seem to find any published studies using it at primary or secondary level.

The GCI website says, "The GCI was designed to test the geosciences understanding of entry-level college students. Today, it is being used to study learning in college classrooms and measure expertise, and revisions are allowing its use in elementary and secondary classrooms" (from <https://geoscienceconceptinventory.wikispaces.com> on the 24th March 2018).

Per your suggestion, I contacted Julie Libarkin and she wrote back! She was really lovely. She said that the GCI *has* been used with younger students, but she doesn't know if anyone has validated that use. She also suggested the American Association for the Advancement of Science (AAAS) assessments, some of which are revised GCI items (example 3, below).

I have made a shortlist of items from both the GCI and the AAAS, which I'm going to bring to show to the CRAGs. I'm planning to include at least 10 items, depending on the feedback from the CRAGs. We should be able to use them as written, for the most part, but I'll run the wording past the CRAGs.

I'm also going to investigate if there are other Concept Inventories that would be useful...

Looking forward to getting to the CRAGs and designing the questionnaire!

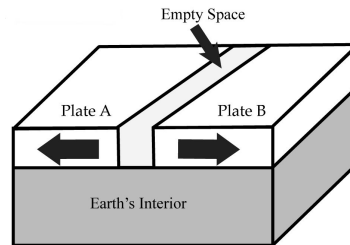
Best wishes,

Emily.

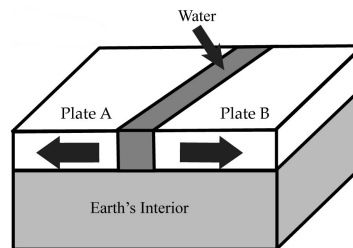
Example 3

Each of the diagrams below show a plate boundary where two of the earth's plates are continuously pulling apart. Which of the following happens over time?

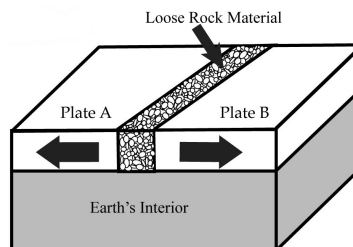
A. As the plates pull apart, an empty space forms between them that gets wider over time.



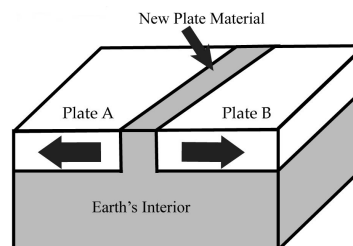
B. As the plates pull apart, water immediately fills the empty space between them.



C. As the plates pull apart, loose rock material immediately fills the empty space between them.



D. As the plates pull apart, new plate material immediately forms between them, so there is no empty space.



Correct Answer

D

Misconceptions:

Answer Choice: A: PTM047: When two plates move away from one another, an empty gap forms between them (Ford and Taylor, 2006; AAAS Project 2061, n.d.).

Answer Choice: B: PTM134: When two plates move away from each other, water fills the empty gap that forms between the plates (AAAS Project 2061, n.d.).

Answer Choice: C: PTM135: When two plates move away from each other, loose rock material fills the empty gap that forms between them (Libarkin et al., 2005; AAAS Project 2061, n.d.).

26 March 2018 at 01:10 am

From: Emer Emily Neenan

To: Joseph Roche

Hi again,

Turns out there's a Climate Change Concept Inventory, developed by Dr Lorna Jarrett. I emailed her and she very kindly sent the latest version, though she hasn't published it yet, so I've identified some questions from that too, to include!

Emily.

Reference added June 2020:
Jarrett, L., & Takacs, G. (2020). Secondary students' ideas about scientific concepts underlying climate change. *Environmental Education Research*, 26(3), 400-420.

Eight Chairs Around A Table

by Emer Emily Neenan

“My train’s at 10:15!”

“Well,” he says. “I’ll see what I can do for you.”

As the taxi weaves through the traffic, Emer is left with no current control over whether or not she makes the train. She checks her phone, fusses through her bag to make sure she has everything she needs (not much), checks her phone, adjusts her coat and bag strap, checks her phone...

Five minutes till the train leaves.

She pulls up the Iarnrod Éireann email with her ticket booking on her phone. An 11-digit booking reference. Great.

The taxi sweeps into the bustle of the drop-off lane of Heuston Station.

Three minutes to go.

“Do I -- Does the app pay you?” she calls, dragging her little suitcase out of the car, slamming the door shut.

“It does, don’t worry, thanks!”

She runs, back away from the platforms, to the ticket machines in the central concourse.

*The train now standing at platform 2 is the ten... fifteen service to... Waterford...
Calling at... Newbridge... Kildare... Athy... Carlow...*

Taps in the 11-digit booking reference. Like a quick-time event in a video game. The ticket drops. She grabs it.

Two minutes.

Through the barrier, to the platform, into the open door of the train.

Dia dhaoibh a dhaoine usaile, agus fáilte rombat...

She falls into a seat, glad to get a table to herself, at least for the moment. The train is already moving by the time she's sat down.

To: Mammy
Phew, made it!!

With an hour on the train before the next step on her journey, she settles in. She unpacks her laptop, and takes out one of the miniature posters she'll give to the students. She almost reads through it, but resists the temptation. If she finds a typo at this juncture, she'll scream!

This is a milestone moment, her first time convening a Children's Research Advisory Group. First time doing any kind of research in a school!

She takes a photo of her laptop and the poster and her pens, on the train table.



But it's too exciting and nerve-wracking to actually get any work done, so instead, she just goes over her preparations.

The consent forms were sent by email ahead, and she hopes the students have them ready. It would be so disappointing not to be able to proceed because of something like that. But the principal - Fionn Preevidja - assured her they would be ready, so she'll trust him!

Also ahead of time, she had asked Fionn to have this group meeting take place in a room other than a classroom. The students need to feel comfortable, and if they do it in a classroom, it's hard for them not to be in a "student" role and see her as playing a "teacher" role. Ideally she'd like to meet them after school and let them change out of their school uniforms too, but that's not practical. She'll just have to try to assure them she's not there in a "teacher" capacity!

She has her laptop, but for this first visit, it may not be that useful. For the follow-up visits, the survey will be on the laptop to show them, but for this visit, there's obviously no survey yet! So she has a straightforward black Eason notebook too. She'll see whether it suits better to take notes on the laptop or just jot things down by hand in the notebook.

When the train pulls in to Carlow station, she's waiting in the doorway, gripping her suitcase firmly. It's a mild day for November, but the air is still bracing compared to the warmth of the train carriage. The dark grey Saab is waiting by the curb outside the station, and she tosses her suitcase in the back before she slides into the passenger seat and slams the door.

"Hi honey, are you all set?"

"I hope so!" Emer answers, leaning over to kiss her mother's cheek. "Never done this before, but I think I'm reasonably well prepared? And Fionn, the principal, he seems nice."

“You’ll be brilliant!” Áine assures her, as she pulls out from the station car park, heading out of town. “You’re a star researcher. Covered in stars!”

Emer looks down at herself and laughs. She’s wearing a black, knee-length, long-sleeve dress with a pattern of colourful stars.

“Oh, why thank you,” she teases. “I got this from my mammy, you know.”

“Are you just wearing it to humour me?”

“No, not at all!” Emer traces one of the stars on the skirt. “I need to feel professional. The first person I’ll meet is the principal and I have to convince him I’m a competent researcher. And you were right, it does well as a work dress. It’s pretty professional.”

“Despite the stars,” Áine laughs.

“Well, that’s the thing!” She traces a second star. “I think the stars make it a little friendlier, kinda whimsical, right? I don’t want to appear too much like a...” She hesitates. “You know, like a *grown-up* grown up to the students. It’s important that they feel comfortable enough to be honest with me. I’m asking them to contribute to the project as co-researchers, I want to put them at ease. I feel like if I’m dressed in a suit or high business formal, I might as well be dressed in a scary lab coat and peer at them!”

“Mmh, very wise, my dear.”

“And...” Emer taps a third star and grins. “It has pockets!”

They chat about other things for the rest of the journey, flying down the motorway and skimming the outskirts of towns, Emer navigating via Google Maps on her phone once they get close. They know they’re right when they start passing girls in bottle-green kilts and boys in neat trousers under their winter coats, in twos and threes, strolling out to enjoy their lunch in the November sunshine.

Áine pulls into the driveway of the school and stops before the steps leading up to the front entrance.

“Do you know when you expect to be finished, honey?”

“No... not really?” Emer answers. “I think the school day is over at 4 pm, so then at the latest. But I’m not sure how long the group will take...”

“Don’t worry, take your time. If I’m not here when you come out, call me, I won’t be far.”

“Thanks, Áins, you’re the best!”

“I know,” Áine teases. “Go on, and good luck!”

Hoisting her bag on her shoulder and settling her dress again, Emer waves to the car as it pulls away, and then climbs the steps. It takes her a moment to find the buzzer, and a few moments longer before the buzz is answered.

“Hi, this is Emer Emily Neenan, I’m here for the research project?”

The door blares a fuzzy note, and she pulls it open. Inside, she finds every Irish secondary school ever; concrete block walls painted a faded icecream colour, a dark wooden goldfish tank of a reception desk, a statue of Our Lady, framed photos of sports teams and debs cohorts of years gone by...

She approaches reception. It feels strange how strange it feels to be here. Her life as a plaid-kilted veteran of such hallways as these is longer and longer ago.

“Hello?”

“Welcome to St Brigid’s,” the woman on the desk says, still deftly sorting paperwork.

“What did you say you were here for?”

“The research project,” Emer answers. “I spoke to Fionn?”

“Who?” the woman asks, inspiring a brief frozen moment of sheer terror in Emer.

“Oh, you mean Finn. It’s spelled Fionn but he pronounces it Finn. I’ll call him, just a moment. You can wait there, take a seat.”

Emer isn’t waiting long, perched on the uncomfortable armchair, eyed by curious students on their way to and from class or wherever else.

“Emer?” A tall, narrow man with dark hair approaches. “Finn. How are you?”

They shake hands as Emer stands.

“So we’ve got a conference room for you to use, and I have the consent forms for you. Do you want to have a cup of tea or anything, or would you rather get set up first?”

“Thanks very much, I’ll get set up, if you don’t mind.”

The conference room is at the end of a long corridor emblazoned with student artworks and themed display boards. It’s locked, and Fionn opens it with a key, gesturing her inside.

“I hope it’s suitable...”

Emer finds a neat, if rather dark, conference room; a table with ten plush chairs surrounding a table perhaps slightly too large for the space.

“It’s perfect, Finn, thanks so much,” she says, walking around the table to the far end.

Fionn leaves the key with her and pops away to fetch the consent forms, as she sets up. She automatically goes for the chair at the far end from the door, at the head of the table, then remembers. She’s trying to meet these students as co-researchers.

They’re like colleagues, but unlike her actual colleagues, they probably don’t feel very

secure in their role as co-creators of the research instrument. They haven't done this before. So instead, she sets up at one of the four chairs along one side of the table. That way, it should feel a little bit more like a round-table discussion, not her sitting as the chairperson at the head of the table.

By the time Fionn comes back, there's a miniature poster at each of the other chairs, blocks of post-it notes out along the centre of the table, a selection of coloured markers arrayed around, and Emer is sitting with her laptop and notebook out.

"There's the consent forms for you there now," he says, brandishing a thick brown envelope. "Will I send them in to you? You don't need anything else?"

"No, I'm all set, thanks so much," she says, "Whenever they're ready to come in."

He vanishes back out the door again, and Emer waits, opening and closing her notebook, rearranging her single pen, double checking her laptop charger. Then she hears the intercom system crackle.

Will the following students please go now to the conference room... Niamb Gallagher... Jane O'Ceallaigh... Úna Daly... Connor Whelan... and Colm O'Brien...

And about two minutes later, a head sticks in the door... followed by the rest of a teenage girl in one of those plaid skirts, immediately looking behind her to make sure the others are following.

"Hi! Come in, sit wherever you like," Emer says, trying to seem friendly, but professional, but casual, but competent, but not a teacher.

The last person in is Fionn again.

"So, everyone, this is Emer, who's doing the research project," he says. "Do you want a cup of tea, Emer?"

“Oh, yes please,” she answers, then glances around deliberately. “Anyone else?”

Glances are exchanged, as Fionn looks a little surprised, but three students ask for tea, and he nods.

“Hey, so,” Emer begins, when he leaves, and the students exchange another round of glances. “I need to check the consent forms are all accounted for ... and stuff,” she says, meandering her way towards a level of linguistic formality that works for this. “I thought maybe we could all write our names on a post-it and put it in front of us, cause I’m, like, definitely going to forget your names!”

A general slow shuffling, as the students sit up a little, one by one, and two begin to reach for blocks of post-its, another reaching for a marker, before the latter stalls.

“Can we use these...?” she asks nervously.

“Oh yeah, definitely!” Emer says. They’re stiffer and more nervous than she expected. “So look, this isn’t school, okay? I’m not a teacher and I can’t get you into trouble or anything. You’re helping me out with a project I’m doing as part of my university work, basically. I’m a student too! So like, anything you’d do in here if it was just yiz, like, just students, is fine. You can chat and swear and whatever, I’m not gonna tell Fionn or anything. Okay?”

A selection of nods, ranging from disinterested to dubious to reassured.

“Ye seem pretty nervous,” she continues, trying to sound light. “It’s okay, like, this isn’t anything scary, I promise!” With a laugh.

“I’m just freaked out by the room,” one of the girls suddenly volunteers.

“What?” Emer asks. “What’s wrong with it?”

“Only time I been in here was for my Irish oral,” the girl answers. “Mortified, like.”

“Yeah, me too!”

“I don’t even know what else they use this place for?”

Emer groans internally. This is exactly the opposite of what she wanted by asking for a room that wasn’t a classroom. Being in the role of a “teacher” in a classroom setting is bad enough, being in the role of the godforsaken *Gaeilge Scrúdaitheoir* in an oral exam setting is a hundred times worse! Literally the anecdote from Woodhead and Faulkner about the children scared of the ‘naughty room’.

At this moment, Fionn arrives back with a tray of four teas, and leaves again with a “Good luck now, and behave yourselves!”, closing the door behind himself.

“Okay well, this is definitely not an exam, and look, I don’t think Fionn will be back again so--”

“Who’s Finn?” one of the students mutters to his neighbour.

“I think it’s Mister Preevidja,” she whispers back. “Isn’t his first name Finn?”

“Yeah, you’re right,” another chimes in.

“Oh god, sorry,” Emer says. “Well, either way, I don’t think *Mister Preevidja* will be back!” she amends, leaning playfully formally on his surname.

The students crack up, the tension broken, mimicking her overblown formality back at her in tittering echoes.

“Here, you wanted us to do our names, right?”

“Yeah, well, I just thought it’d be easiest!” Emer agrees, grabbing a post-it to do her own and sticking it in front of her. “Whatever, like.”

“I want the purple one!”

“Fine, I’ll have this one, there’s two greens.”

“Can I do like, a doodle?”

“Seriously, whatever you like!” Emer insists. “Let me match yiz to consent sheets, here, and then I’d really like to hear what ye think of my ideas for a survey, okay?”



How do you do your research: Emer Emily

Neenan

Research, for me, often has the activity pattern of a big cat; long stretches of waiting, interspersed with flurries of furious activity. Never was this more true for me than earlier this year when, after waiting months to get started on school visits for my PhD research (wait for supervisors to sign off, wait for ethical approval, wait for schools to reply to enquiries, wait for the day the school can fit a researcher visit in...), I rushed down a platform and dived onto the train less than a minute before the doors closed. Months of slow, step-by-step progress, followed by a frantic sprint. It's taken me a while to realise that this kind of activity pattern is normal. Or one of many normal patterns. Or maybe that there's no such thing as normal at all in research. I used to blame myself for not getting more done in advance, for working to deadlines, for my "stroll and sprint" method of crossing the finish line. The important thing, of course, is simply to get there, mental and physical health intact, whatever route you take. This is why it's so important not only to share the results of our research, but to share our experiences and our processes with other researchers, especially research students and early career researchers. I love hearing about how other researchers faced challenges or obstacles, how they figured out some solution, how that solution is often the equivalent of duct tape; imperfect and a little sloppy, but working. (And, of course, how sometimes the solution is literally duct tape.) We should tell each other about the boring parts and the panicky parts and the hilarious parts. When we finish a project, we look back and we naturally construct a smooth narrative about the path we took, focusing on the final decisions, the results, and the outcomes. We package this narrative as a thesis, or a paper, or a seminar, and it becomes the official version of the research. But this streamlined, official version doesn't have to be the only story we tell.

“ I love hearing about how other researchers faced challenges or obstacles, how they figured out some solution, how that solution is often the equivalent of duct tape; imperfect and a little sloppy, but working.

Sharing the other kind of information - the meandering route, the false starts, the nitty-gritty details, the messages left on school answering machines, the scrapped pilot, the hilariously inaccurate Gantt chart - is relegated to the fringes, usually in-person conversations (not infrequently taking place in the pub). It makes sense that no one's going to write their paper or thesis focusing on the moments where they got lost in the weeds of the research, or went for a stroll through a few enticing alternative theories, or rearranged their schedule four times to accommodate meeting participants for interviews. Or sprinted down a train platform. But we can still talk about those moments.

The school visit, after that panicked start, was very successful. My research - on Irish secondary school students' engagement with Earth Science - uses a children's rights based methodology. As a key part of this, I convene Children's Research Advisory Groups (CRAGs) to act as expert co-researchers on key aspects of the research project. These are groups of usually between 6 and 8 representative students, who meet with me several times over the course of the project and give input and feedback on the research questions, the research instruments, the results, etc. They are experts on the lived experience of current Irish secondary school students, and they act as experts; they ask questions, they sign off on the notes taken at our meetings, and their input is incorporated. For their participation as co-researchers to be meaningful, they need to be given Space, Voice, Audience, and Influence (according to Laura Lundy's work on conceptualising and implementing the United Nations Declaration on the Rights of the Child). They have to be given the opportunity and time to give their input. That's no good if they aren't given the tools and vocabulary to address the complexities of the research they're advising on. Someone has to actually listen to what they say. And then that person or group of people has to actually incorporate their opinions and feedback into the project.

I tried to come up with a description of the two CRAGs I've worked with to design the research instrument, but the truth is, they're like any other group of people, except a little better at referencing internet memes than the academics I usually work with.

The reason I'm using this methodology is because it fit with my own personal ontological and epistemological approach to education research, and with my principles as a feminist researcher. It also has the great side-effect of making the research better. An additional perspective - or several highly opinionated meme-literate perspectives - is a huge advantage. The CRAGs take me off the beaten track, intentionally and unintentionally. We don't always stay off the beaten track, sometimes we decide to go back to the "standard" way of doing things, but now we know exactly why that way is the best way. They were also able to tell me exactly how to present the survey (quickly renamed a "questionnaire" by the CRAGs, who pointed out that secondary school students are all sick of TY project "surveys" that "no one takes seriously") to their peers.

“ I tried to come up with a description of the two CRAGs I've worked with to design the research instrument, but the truth is, they're like any other group of people, except a little better at referencing internet memes than the academics I usually work with

Eight Chairs Around A Table~ Implementation of CRAGs In return for their expertise, they're getting an opportunity to learn something new in a very different way than what they're used to in school. (They are also - and this is vitally important - getting to skip the occasional unpopular class to participate in the CRAGs. I won't perpetuate the stereotypes by telling you which classes are the ones they want to skip. If you went to school in Ireland, you can guess, and if you didn't, you can ask anyone who did!) The kids in the CRAGs are getting to learn about research methodology the way PhD and research Masters students learn about research methodology; with one sometimes-confused senior researcher (me in the CRAGs, a supervisor for research students) telling them specific information as it becomes relevant, and otherwise, trial and error. Research students also, of course, might attend a research methodology class, and are probably reading a variety of books and papers on the subject. Although, in fairness, the former can sometimes feel a bit like one confused senior researcher doing their best, and the latter can often feel like trial and error.

As PhD or research Masters students, we are both researchers and students. We're learning, and we're paying our fees in order to learn. And no one learns in isolation. Trial and error is a pretty effective way to learn, but it's impossible for a PhD student to make all the errors necessary to learn everything. We don't have time, and honestly, our collective mental health is precarious enough without having to deal with making literally every possible mistake. Sometimes it might feel like I'm making literally every possible mistake, totally lost in the weeds off the beaten track, until I fall into conversation with another PhD student or early career researcher, and hear about their meandering journey, their stops and starts, their thrill at stumbling across some treasure in an unexpected archive or on their day off, their stack of rejected theories, their new blue-sky idea. All the little twists and turns that won't make the official story, but do make the research.

Working with the CRAGs, who don't have the same preconceived notions of academia or the traditional paths research is supposed to travel along, helps me see getting lost in the weeds as something different; getting to explore in a meadow. A stroll-and-sprint gives you time to take things in, and time to make lots of progress. A meandering route is a scenic route. The right path is the one that gets you there. And all the better if you stop along the way and share your stories - not just the official one - with your fellow explorers.

Emer Emily Neenan



Emer Emily Neenan is a PhD candidate at the School of Education, Trinity College Dublin, studying Earth Science education in Irish schools, funded by an Irish Research Council Government of Ireland Postgraduate Scholarship.

She holds a Bachelor's degree in Geology from Trinity College Dublin, and a MSc in Geology (Seismology) undertaken at the Dublin Institute for Advanced Studies Geophysics Section. She enjoys exploring alternative ways of expressing science and research, including poetry, creative non-fiction, graphic design, and painting.

These lilac boxes are my annotations on the actual survey, replicated here as accurately as possible (notwithstanding the inherent differences between these and online survey tools). “Quotes” from CRAGs are paraphrased from anonymous notes taken during the discussions.

CRAgs say call it a questionnaire, not a survey.

In Irish secondary schools, as part of the Transition Year (16-year-olds) program, students have to do “surveys” as part of their project work. The other classes are “fed up” of surveys and might take it less seriously if they associate it with TY projects.

Earth Science Questionnaire

* Required

This is a research questionnaire for a Trinity College Dublin project on how people learn about the Earth and Earth Science.

My name is Emer Emily Neenan and I'm a researcher working at Trinity College Dublin. I'm a geologist (a scientist who studies the Earth's crust) and I also teach classes about Earth Science. At the moment, I'm researching what makes people interested in learning about Earth Science and how much they learn. This questionnaire will ask you about your experience learning about the Earth in school.



Lauren Boath (see document 12) recommended that I include a photo of me, to “introduce” myself, particularly since I wouldn't be visiting every school in person.

THIS IS ME

CRAgs and I designed the language and layout together, trying to keep it professional but “friendly” e.g. this little note.

Q.1	
Yes	<input checked="" type="checkbox"/>
No	<input type="checkbox"/>
Maybe	<input type="checkbox"/>

The purpose of this research is to help design the best ways to teach people about Earth Science. The results will be written up in a formal report to the Department of Education, and sent to schools, teachers, and scientists who want to learn how to teach Earth Science in the most interesting and successful ways. You can help by reading the questions carefully and giving your best answer.

CRAgs were very insistent that I include the purpose of the research and to whom it would be disseminated. They said it would “make people care more about it” if it would have an impact.

This is an optional questionnaire. If you don't want to do it, you don't have to and you don't need to say why. You can just click "No" on the first question, or skip every question. You can skip any question you don't want to answer. Your name won't be on your answers and your teacher is not allowed to look at them.

It was important to me to include a brief explanation of CRAGs for the survey respondents.



CASEY

Some secondary school students helped me write this questionnaire. They are co-researchers. For some of the questions, they suggested the kind of answers you might give or how you might start off an answer. This is just to give you an idea if you're stuck. You should always use your own words. We want to know what you think!



DAIRE



BARRY



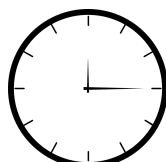
ANA

The questionnaire also had to conform to the ethical standards, so the CRAGs and I had to ensure that informed consent was properly covered.

I chose four names to use for the sample answers; two gendered (Ana, Barry), and two ambiguous (Casey, Daire); two international (Ana, Casey) and two Irish (Barry, Daire); beginning with A, B, C, D.

Including sample answers (derived from the CRAGs' suggestions and the pilot responses) is a technique suggested by Lauren Boath (see document 12).

If you have any questions about the research, you can ask your teacher to contact me, or you can email me yourself at neenane@tcd.ie and I'll email you back. When the research is finished, I'll send the report to your school so you can find out what the results were!



The questionnaire should take you about 15 - 20 minutes to do, but some people might go faster or slower. Take your time and give your best answers.

Thank you very much for participating in this research!

1. Do you agree to take part in this study by answering this questionnaire? (If you answer “No”, the questionnaire will automatically end.) *

Mark only one circle.

- Yes
- No

This second round of consent allowed students to accept the directions of their teacher and begin, without having to actually do the questions and submit them, if they didn't want to. (Of course, as detailed on the consent form, they could also quit out at any time.

[SURVEY ONLY PROCEEDS IF “YES” SELECTED, OTHERWISE SURVEY ENDS]

As far as possible, on the advice of the CRAgS, the reasons for questions were given, e.g. here, demographics.

These are some short questions about you as a student. This is so that we can arrange the answers by groups of the same kind of student (for example, students studying Geography at Junior Certificate, or female students).



This was the single question that required the most debate and discussion among the students in the CRAgS. I personally wasn't sure how important they would consider it, while many of my (adult) colleagues assumed teenagers would be more opinionated about and comfortable with non-traditional conceptualisations of gender. But several of the student co-researchers expressed the same confusion over non-traditional genders as the adults had.

“Female” was considered more professional and less patronising than “girl”, and the idea of having a text field for gender was emphatically rejected as being too open to “trolling” (giving a false answer for amusement). “Non-binary or other” was eventually determined to be the most inclusive option without requiring a long list or an open text field.

2. What is your gender?

Mark only one circle.

- Female
- Male
- Non-binary or other
- Prefer not to say

3. Did you study Science or Geography for the Junior Certificate?

Mark only one circle.

- I studied Science for Junior Certificate (but not Geography)
- I studied Geography for Junior Certificate (but not Science)
- I studied both Science and Geography for Junior Certificate
- I did not study either of those subjects for Junior Certificate

4. If you studied Science, did you learn about Earth and Space Science in Science class?

Mark only one circle.

- Yes
- No
- I'm not sure
- I did not study Science

The CRAGs explicitly reviewed all of the language used in the survey, deciding on phrasing, e.g. "I'm not sure" as opposed to "I don't know" or "I don't remember".

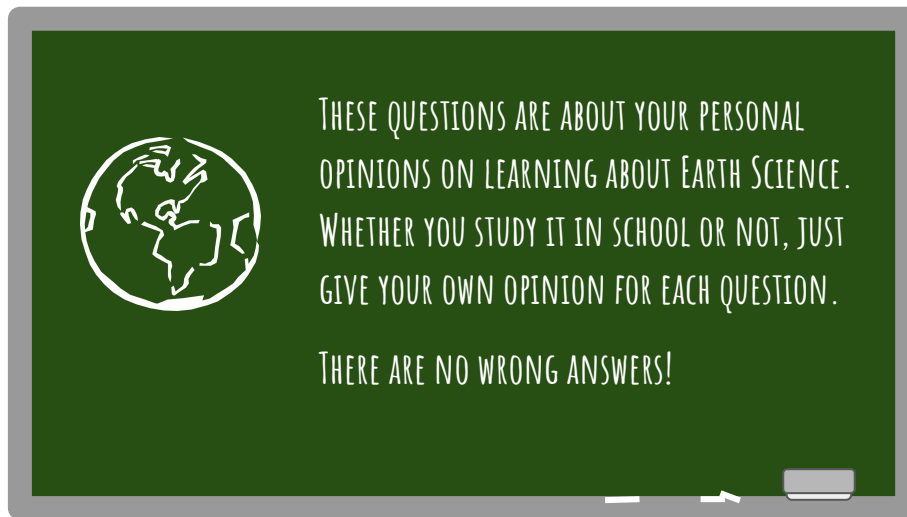
5. If you studied Geography, did you do the composition of the Earth?

Mark only one circle.

- Yes
- No
- I'm not sure
- I did not study Geography

We considered various options for asking what subjects and topics the respondents had taken at Junior Cycle level. Splitting it over three full questions was the clearest option. Most students in Ireland do both Science and Geography at Junior Cycle level, and the aspects of Earth Science covered in these subjects are not optional. An artifact of the development process is that there is no question asking about Civic Social and Political Education, the third subject which covers climate change as a topic, as initially the study focused more tightly on Earth Science, and climate change was emphasised after the discussions with the CRAGs.

Questions about learning about Earth Science



We wanted the survey to be engaging, but not childish or patronising. In general, the CRAAGs were very clear that the font used should be a standard professional font, in black (they specifically requested Times New Roman, but the online form didn't support that font, so we compromised on Roboto, a straightforward online-friendly sans serif font). They approved of "fun" fonts as part of images.

6. If you were going to describe what "Earth Science" is, what would you say? Just use your own words.

Barry's answer started "I would say it is..." and Casey's started "Earth Science is the study of..."

For some questions, on the advice of Lauren Boath (see document 12), we included "prompts" to give a direction on how to begin. Giving these prompts from (fictional) other students would hopefully feel more like a reassuring guide and less like explicit direction.

7. Are you interested in learning about the Earth? That includes the crust (rocks, volcanoes), the oceans, the atmosphere, fossils, what the Earth is made of and how old it is, the inside of the Earth, etc.

Check all that apply.

- Yes
- No
- I'm not sure
- Some parts but not other parts

After some discussion, the CRAAGs decided it was useful to give a list of Earth Science topics here, in case of misapprehensions as to what exactly the term covered. (This later turned out to be very sensible, as there was not universal accuracy in the descriptions of Earth Science given for Q6.

8. Do you feel it is important or useful to learn about the Earth?

Check all that apply.

- Yes
- No
- I'm not sure
- Some parts are important but some parts are not important
- Some people need to learn about the Earth but it doesn't matter if most people don't know about it
- Other

The student co-researchers *felt* that using “feel” rather than “think” would encourage people to give their actual opinions, rather than looking for the “right” answer. This is the kind of vital linguistic ambiguity that representative co-researchers catch.

9. Why is it important or useful to learn about the Earth? Or why is it not important or not useful?

Ana wrote “It is important to learn about the Earth in order to take care of it”. Daire started off by saying “I think it is pretty important because...” and Casey started off by saying “I’m not sure if it’s useful because...”

It was difficult to balance offering suitable prompts to encourage students to engage with the longer and more complex open questions while minimising bias. The prompts were developed from real answers given during the pilot, but, for example, perhaps including the phrase “take care” here caused students to write similar answers, either because they want to give “right” answers or just simply by reminding them or “putting it in their head”. On the other hand, students are unlikely, even if prompted, to write answers they explicitly do not believe in an anonymous survey about a fairly low-stakes topic. So even if it “reminds” them, it probably only reminds them of an opinion they do genuinely hold.

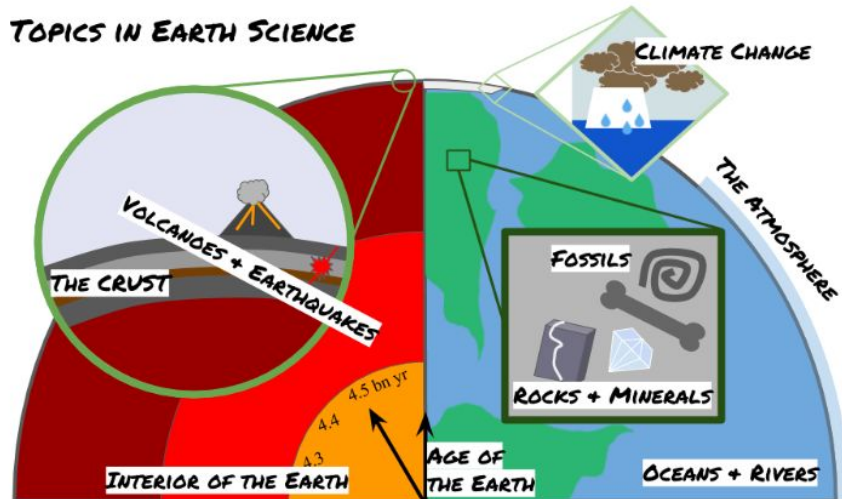
10. Do you pay attention to classes about the Earth?

Mark only one circle.

- Yes
- No
- I'm not sure

This question was chosen (with phrasing decided by the CRAGs) to give a rough barometric reading of interest in Earth Science classes specifically, as distinct from Earth Science topics.

There are many different parts of Earth Science. Here are a few.



The CRAGs were absolutely emphatic about the use of images: the more, the better. They felt the images would be engaging and fun, and encourage people to pay attention to the survey and have a “good impression” of it. I had created an image-heavy handout (see page 84) for the CRAGs, and they suggested making more images for the survey along those lines. These images were all created in Google Slides from basic shapes and lines, as the most efficient option in terms of time, saved data, and expense.

11. Which parts of Earth Science do you think are especially INTERESTING to learn about? (You can pick all of them or some of them or one of them or none of them. It's up to you! Pick any you think are very interesting or fun to learn about.)

Check all that apply.

- The interior of the Earth, the Earth's core and mantle
- The Earth's crust and tectonic plates
- Volcanoes and earthquakes
- Fossils (e.g. dinosaur fossils, shell fossils, leaf fossils, etc.)
- Rocks and minerals (e.g. marble, diamonds, copper, etc.)
- The oceans and rivers
- The atmosphere
- The age of the Earth
- Climate change
- Other: _____

For “fossils” and “rocks and minerals”, the student co-researchers felt it was useful to include examples to give a more specific and accurate idea of what these topics are.

12. Which parts of Earth Science do you think are especially IMPORTANT to learn about? (You can pick all of them or some of them or one of them or none of them. It's up to you! Pick any you think are important for students to learn about.)

Check all that apply.

- The interior of the Earth, the Earth's core and mantle
- The Earth's crust and tectonic plates
- Volcanoes and earthquakes
- Fossils (e.g. dinosaur fossils, shell fossils, leaf fossils, etc.)
- Rocks and minerals (e.g. marble, diamonds, copper, etc.)
- The oceans and rivers
- The atmosphere
- The age of the Earth
- Climate change
- Other: _____

Similar questions (11 & 12) were included asking respectively about students' interest and their opinions on topics' importance. The CRAgS were confident students would tackle these concepts separately and not just answer the same for both.

13. Do you feel it's important or useful to learn about climate change in school?

Mark only one circle.

- Yes
- No
- I'm not sure

This topic was not included in my initial notes that I brought to the CRAgS, but during our discussions we decided to be more explicit about climate change in the survey. The School Strikes for Climate were in the news and the student co-researchers thought it was an important topic to cover explicitly.

14. Why is it important or useful to learn about climate change? Or why is it not important or not useful?

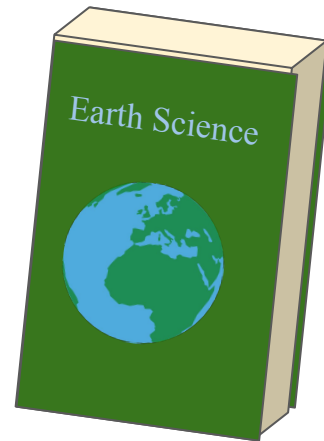
Daire wrote "It's important to learn about this so we can save the planet" and Barry wrote "It is important to learn about climate change because it is happening right now so we need to know more about it." Ana wrote "It's important but it's not useful like instead of teaching us how to prevent it they just teach us about it which basically defeats the point of learning about it if we cant stop it".

These sample answers are again taken directly from the pilot, with the assistance of the student co-researchers.

The student co-researchers were concerned that their peers would see the GCI and CCCI questions as a “test” and be nervous to answer them, so we included a direct reassurance here, before the section.

Earth Science quiz questions!

These are some questions about things you might have learned about Earth Science. There are right and wrong answers for each question, but there's no marks or points. It's not a test, and you can't fail. It's just to measure how many students have learned about these things.



The rest of the survey is comprised of 15 questions from the GCI and CCCI, with the aim of measuring student understanding of a range of geoscientific topics. See document 21 for a breakdown of the questions and the results.

Again, the CRAGs were highly encouraging of the inclusion of images, and we decided on a mixture of diagrams and photos. I brought all the questions that were suitable from both the GCI and the CCCI, and the CRAGs chose the 15 that were used in the survey. They prioritised questions that included images (and encouraged me to create additional images), and questions that were “not too easy” and ones that were “not confusing”. We arranged the questions to intersperse the few without images throughout the list, to make sure the text and questions were always frequently broken by an image.

The CRAGs “did” the whole survey themselves to test it, at the end of our last design session, giving the approximate time for completion and ironing out any confusing phrasing. They were satisfied that the online survey tool was easy to use and suitable for the purpose.



Stuart Gorman

last seen today at 4:19 pm

Friday 18 January 2019

The pain is too bad 9:09 am

I'm calling my mammy 9:09 am

she says go to Holles St 9:12 am

9:13 am oh no :(

9:13 am I'm in meetings, do you need me to leave work?

no don't worry, I'll manage 9:12 am

neighbour gave me a lift, waiting to be seen 11:21 am

going to see a nurse, she'll do a pregnancy test first 11:21 am

11:22 am but you already did one, right?

I did three!!! 11:22 am

nurse just called me, will call if it's news 1:21 pm

outgoing call to Stuart Gorman 1:23 pm

duration 4:24

outgoing call to Áine O'Neill 1:29 pm

duration 20:32

outgoing call to Frank Neenan 1:56 pm

duration 2:07

outgoing call to Kathryn Lambe 2:25 pm

duration 1:05:45

outgoing call to Joseph Roche 3:55 pm

duration: 14:48

05 March 2019 at 9:05 am

From: Emer Emily Neenan

To: Ms C McMuinteroir

Hi Ciara,

Thank you so much for all your help with this project, I really appreciate it! You and St Brigid's have been so helpful in facilitating CRAGs, and I hope you might be able to help me with another aspect of the project.

It would be amazing if you could get some or all of the third years at the school to take the questionnaire. This is the pilot, to iron out any last issues with the questionnaire.

It's online, so they'll need a computer/tablet connected to the internet. If that doesn't suit, let me know and I'll send a paper version.

This is the link: <https://goo.gl/forms/lkQ7F4CgBv4xao9k1>

Like the focus groups, I need to collect a consent form for each student from the student themselves and also from their parent or guardian. I have attached pdf versions of the two consent forms, along with an information sheet for the school. Let me know if a different format, including digital, would be better. I can pick up the consent forms from the school, either immediately or when I visit again in April/May to finalise the main questionnaire design with the St Brigid's CRAG.

Best wishes,

Emily.

Emer Emily Neenan
Irish Research Council Postgraduate Scholar
School of Education
Trinity College Dublin, Ireland

SNAFU ~ Implementation of Survey

05 March 2019 at 4:48 pm

From: Ms C McMuinteoir

To: Emer Emily Neenan

Hi Emily,

I teach this group on Fridays, I'll hand out the consent form then. Then hopefully we will be able to do the survey on the following Monday or Friday.

Ciara

10 March 2019 at 11:23 am

From: Emer Emily Neenan

To: Joseph Roche

Hi Joseph,

There's going to be a School Strike for the Climate in a few days, led by teenagers, I'm going to go to it right before I head to Japan! This is incredible timing to be researching Earth Science and climate change amongst second-level students!!

Emily.



Emer Emily Neenan 

@e3neenan

Arrived in Japan for two weeks of science museums & education conferences! (& some sightseeing of course!) So far trying to figure out if I can feel this skyscraper swaying or if it's just the jet lag...?



6:31 AM · Mar 17, 2019 · Twitter for Android



Emer Emily Neenan 🌸

@e3neenan

Feel guilty tweeting about [#ClimateAction](#) 🌍 today on [#FridaysForFuture](#) as I'm in Japan & got here on a plane obviously. I'd personally rather phase out cars & short hop flights & try to keep long hauls so we can still see the other side of the world. But...

9:11 AM · Mar 22, 2019 · Twitter for Android



Emer Emily Neenan 🌸

@e3neenan

·Mar 22, 2019

Replying to [@e3neenan](#)

... I'm sure other people would say ditch long hauls which only quite privileged people can access anyway, to keep something else. The point is, in 2019, running out of time, this is the kind of debate we should be having!



Emer Emily Neenan 🌸

@e3neenan

·Mar 22, 2019

"what can we keep & what needs to go?" is the [#ClimateChange](#) debate to have, not "is it affordable/profitable to save our environment?" let alone "is climate change even real?" Politicians & journalists should stop giving any time to the latter & jump right in to the former. Now.



Emer Emily Neenan 🌸

@e3neenan

A few days ago (when I didn't have WiFi) I got to visit the Kyoto 大学 阿武山地震観測所 seismological observatory & have a tour by Professor Iio Yoshihisa. These interactive models were a highlight but the whole tour was great!





Emer Emily Neenan 🌸

@e3neenan

Japan and Ireland are pretty much opposite end members of the spectrum of seismological activity, so it's really interesting to me to see how the other half lives (living = learning about [#earthquakes](#) & [#geoscience](#) obviously)! Would love to do a comparative study!



12:21 AM · Mar 25, 2019 · Twitter for Android

 **Emer Emily Neenan** 
@e3neenan

Ready to go at the @iafor 5th Asian Conference on Education & International Development #iafor #aceid

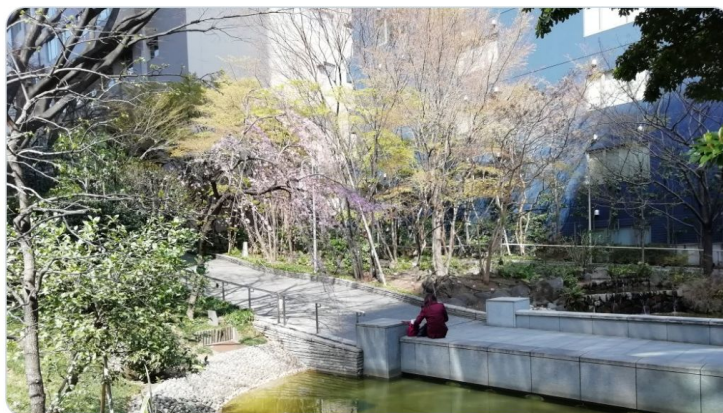


1:50 AM · Mar 25, 2019 · Twitter for Android

 **Emer Emily Neenan** 
@e3neenan

Meant to live tweet the conference but my phone's being fickle with WiFi & anyway I spent all my free moments at the conference chatting with people instead of looking at my phone screen which is probably a good thing, so instead here's a short roundup!

Arriving at the hotel to a pond overlooked by sakura blossoms on a sunny morning was a good omen!





Emer Emily Neenan 🌸

@e3neenan

The keynote by Professor Haruko Satoh was especially memorable to me (about the issues facing Japanese universities integrating intl students). I enjoyed her frank & personable style of presentation & felt lucky to chat with her (about Brexit & being "ex-Catholic") afterwards.



Emer Emily Neenan 🌸

@e3neenan

Trivial side note: the boxes the Japanese bento lunches came in were only gorgeous & I'm cross I forgot to take a photo! Must try to remember at ACAH later this week if they're the same...



Emer Emily Neenan 🌸

@e3neenan

Got to see some very interesting talks on a wide range of education topics. Particular shout out to Marissa Fearnley for a great talk on Perceptions on Disaster Risk Reduction Issues by Junior High School Students in Manila, Philippines.



Emer Emily Neenan 🌸

@e3neenan

Delighted with how my talk went! People very kindly took actually good photos of me but this one's my favourite cause distractedly moving around while smiling is really on brand for me.

"The Earth Is 🌍ut There: Attitudes of Irish Junior Secondary Students Towards Earth Science"



Emer Emily Neenan 🌸

@e3neenan

Oh, & great poster session, there was a real buzz. Conferences please take note: give posters a good slot & space & enough time! Between the keynotes & the welcome reception was a great slot!



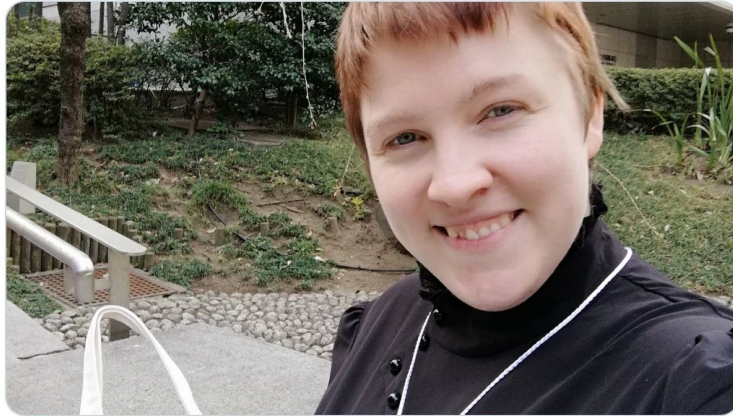
SNAFU ~ Implementation of Survey



Emer Emily Neenan 🌸

@e3neenan

Overall a great & useful experience getting some very different & global perspectives on #EducationResearch. Glad I could present on my Irish perspective too! #LoveIrishResearch



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Emer Emily Neenan

@e3neenan

On my day off between conferences I obviously went to the National Museum of Nature and Science in Tokyo!



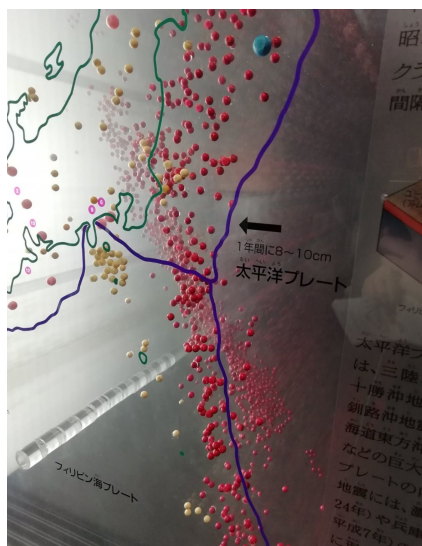
2:13 AM · Mar 29, 2019 · Twitter for Android



Emer Emily Neenan

@e3neenan

I absolutely LOVE this 3D representation of earthquakes in the subsurface (I'm pretty sure; my Japanese is bad & there wasn't much English!) It's a tricky concept to show & this is a wonderful solution!



2:51 AM · Mar 29, 2019 · Twitter for Android

28 March 2019 at 03:04 am

From: Emer Emily Neenan

To: Joseph Roche

Hi Joseph,

こんにちは from Japan!

Last night I saw a call for a summer school on the intersection between geosciences and social sciences run by iCRAG in Dublin this coming summer, and I'd missed the deadline!! I emailed Geertje at iCRAG, who's the contact person. I thought maybe since I don't need accommodation, they might let me sit in on it anyway. She says to apply immediately, and if they have anyone drop out, they'll give me the place. So fingers crossed!

My first talk went really well, next conference tomorrow.

There's so much to learn here about the different ways to teach geoscience. I was hoping I might get to know a Japanese teacher or science education researcher, but the conference is almost *too* international. It's great to meet people from all over the world, though!

Looking forward to telling you all about it when I get home!

Emily.



Emer Emily Neenan 🌸

@e3neenan

It's #FridaysForFuture & I'm feeling demoralised by the sheer amount of single use plastic I generated on this trip. #Japan is gorgeous (sakura season! 🌸) but oh my god the level of plastic packaging is something else entirely.

2:10 PM · Mar 29, 2019 · Twitter for Android



Emer Emily Neenan 🌸

@e3neenan

I've been in 3 cities & in all of them got plastic wrapped napkins, double bagged purchases, plastic sleeve on each postcard, individually plastic wrapped bananas (🍌 comes in its own natural wrapping!!). I've been trying to avoid as much as poss but I need to eat & can't cook in hotel!



Emer Emily Neenan 🌸

@e3neenan

Meanwhile Ireland 17 years past free plastic bags & now talking about straight up banning single use plastic (although some are nec, especially for disabled and sick people). I'd say Japan might generate twice as much plastic waste in a day as tiny Ireland does in a month, makes Ireland's policies feel a bit futile!!



Emer Emily Neenan 🌸

@e3neenan

But that's the thing about #ClimateAction & tackling #ClimateChange; it feels futile, each individual action feels too small. We do them anyway. Each individual voice is too quiet; we raise it anyway. Each step is tiny & difficult; we take it anyway. We must.

(And that is also why I tweet into the void.)



Emer Emily Neenan 🌸

@e3neenan

Despite everyone's considerate efforts to contain their colds behind masks, I have successfully caught one anyway. Am attempting to contain it behind a mask...



Note added August 2020:
this selfie was taken one year and three days before my first masked selfie of the COVID-19 pandemic. This photo now feels a bit dislocated in time!

4:12 AM · Mar 30, 2019 · Twitter for Android



Emer Emily Neenan 🌸

@e3neenan

Exciting to happen to be in #Japan for the announcement of the name of the new era: #令和 pronounced Reiwa, meaning order & harmony (I'm told). The era will change from the current 平成 (Heisei) when the current Emperor abdicates & his son assumes the throne.

4:05 AM · Apr 1, 2019 · Twitter for Android



Emer Emily Neenan 🌸

@e3neenan

Brief roundup of @iafor's #ACAH Arts & Humanities conf at the weekend. It's briefer than my ACEID roundup because I've got a horrible cold & sadly missed several sessions & had to keep ducking out. Still, it was a good experience!

1:50 PM · Apr 1, 2019 · Twitter for Android



Emer Emily Neenan 🌸

@e3neenan

A minor but lovely thing: a beautiful conference programme, very appropriate to the gorgeous #sakura blossoming in Tokyo at the moment!



2

3

7



Emer Emily Neenan 🌸

@e3neenan

Delighted with the discussion about aiming outreach at children, at & after Dr Yutaka Mino's interesting talk, Museums Cultivate Aesthetic Sensibility.



Emer Emily Neenan 🌸

@e3neenan

Really interesting conference chat, with people from such a broad array of backgrounds across the Arts & Humanities. Of course I'm used to that kind of thing from @TLRHub but it's still lovely! Specific confs/groups are useful but broad ones broaden perspectives.



Emer Emily Neenan 🌸

@e3neenan

Very happy with my talk, It's Our Future, Ask Us: Centring Children's Voice in Geoscience Education Research. Battled through my horrible cold & got lots of laughs which is always fun!



02 May 2019 at 12:48 pm
From: Emer Emily Neenan
To: Joseph Roche

Hi Joseph,

So the survey is completely ready, but it's now into May...

I think at this point, it would make more sense to roll out the main survey in September. I can target the incoming Transition Year students, who will just be completing the full Junior Certificate cycle now; they'll be doing the Junior Certificate examinations in June, and most of them will be going into Transition Year. TY students have a lot more flexibility than JC students, and teachers are often looking for activities for the TY classes. Some of the teachers have been expressing to me that it would be difficult for them to do a survey with a JC class, especially in the final term, so I think we'll get a lot more responses if we wait until September.

My main concern with that plan is that I will need to take some time off at the end of September (or sooner??) because apparently human infants don't take care of themselves. I want to take as little time off as possible, but there's no way to have a baby during the PhD and not have it have some impact on the speed and efficiency of my work on this project.

The other worry I have is getting schools to do the survey when it's quite a lot of work for them. I can minimise most of it as best I can, except the whole consent procedure. Obviously it's important, but it's also a considerable burden on schools. I can't do much of the work on it. I can email them pdfs of the consent forms for them to print themselves, or I can post them the number of consent forms they think they need. Either way, the teacher has to hand out the consent forms in the class, two for each student - one for the student themselves, one for the student's parents or guardians - and explain the procedure. The explanation is something I could do if I visited the school, but then I would have to visit again the next class (which may not even be the next day!) if I was to help with the administration of the survey itself. And I can't visit all the schools anyway, since it would be a huge expense and use of my time. The students can fill in and sign

their own consent form, but they have to bring the parent/guardian one home, get it signed, and bring it back in. Then the teacher has to collect them. I have offered to come and pick them up myself, and give a talk while I'm at the school, or else pay to have them posted back. This is all before the teacher has to set up and supervise the actual survey itself!

I suppose we'll see how it goes.

In the meantime, I have really good news - I've been awarded a place at the LERU doctoral summer school! I applied last year and the Dean, Neville Cox, said my application was very good and that I should apply again, which I really appreciated. I almost didn't bother this year, but since he'd been so supportive, I did, and he just emailed this morning to say I got a place this year! Yay!

Talk to you later in the week,
Emily.

03 May 2019 at 01:55 am

From: Joseph Roche

To: Emer Emily Neenan

Hi Emily,

First of all - well done on getting a place at the LERU summer school! I've always heard that's an incredibly competitive process. Amazing work!

As for the survey, please don't worry too much about it. We can start getting schools and teachers on board in August, and if the survey is still ongoing when you have to take some time for the pregnancy and everything (or any other reason!) myself and the rest of the research group here will be able to keep things ticking along. We can make a plan closer to the time. But whatever you need for the pregnancy and looking after the baby, we'll make it work.

For the moment, well done on getting the survey finished, that's a huge milestone! And well done again on getting a place at LERU - on top of the place at the ReSToRE summer school too! Even if your survey has to be paused until September, you'll have a busy summer!

Keep up the great work!

Joseph.

**Baby Goth
Fashion:
Autumn
Trends**



**American Gorman
Contingent Planning
Dublin October Visit**

**Séan O'Neill and
Nancy Erwin Become
Great-Grandparents**

THE IRISH TIMES

irishtimes.com

Saturday
28 September 2019

Adorable baby Kai Alexandrite Brídín Ellis born

First of a New Generation
Born in Dublin Hospital

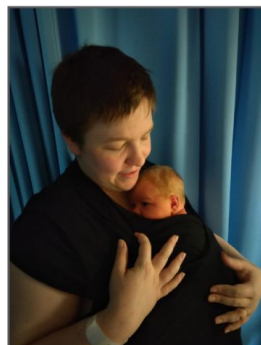


great-grandchild on both sides of the family, and sources close to the new Ellis family trio report that they eagerly anticipate plenty of visitors over the coming days and weeks to welcome the new arrival.

Joyful scenes in the National Maternity Hospital Holles St. as Kai Alexandrite Brídín Ellis, 0, was born at 11:41pm today the 28th of September 2019. Baby Ellis who weighed in at 4.635kg, (10lb 6oz) and is 53cm, (21in long), was born in the central Dublin Hospital to delighted parents Emer Emily Ellis-Neenan, 29, and Stuart Ellis-Gorman, 30. New grandmother Áine O'Neill, 58, was also present for the momentous event. Ellis is the first grandchild and



Alexandrite



Breaking News: Astonishing exclusive images of new baby



Kai Alexandrite Brídín Ellis

Welcoming Service

The Welcoming service for Kai Ellis will take place in the Unitarian Church, on St. Stephen's Green in Dublin, early next year. A date of the 16th February was chosen by the Ellis family in consultation with the church. The Welcoming, a short ceremony to formally welcome the new arrival to the community, will form a special part of the usual 11am Sunday service. All are welcome to attend. The Unitarian church choir, of which Kai's mother Emer Emily is a member, will perform at the ceremony.

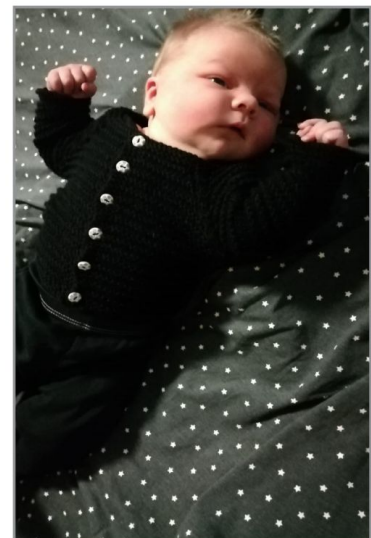


Figure 8: Birth announcement of the author's daughter

(Design: Emer Emily Ellis-Neenan & Maeve O'Neill, Formatting: Maeve O'Neill)



Kathryn Lambe

last seen today at 5:02 pm

Monday 9 March 2020

On my way to campus to teach! 2:03 pm

First time since baby was born...!! I'm so eager to get back to it. 2:03 pm

2:05 pm Is baby gonna TA for you?

I hope she sleeps through it..... 2:08 pm

2:55 pm Best of luck, hon!

so had a hiccup with the room - apparently it wasn't booked 4:41 pm

but I gave the lecture and even started on time despite! 4:42 pm

4:42 pm Omg??

4:42 pm Sounds like you handled it!

finished on time too 4:43 pm

really looking forward to Wednesday's!! 4:43 pm

and baby was so good! just listened quietly for 45 minutes 4:44 pm

4:44 pm Yessss well done baby!

:D 4:45 pm

Tuesday 10 March 2020

1:39 pm See TCD are moving lectures are moving lectures online

1:39 pm That is, I have seen it, not have you seen it

1:39 pm I'm sure you got all the emails!!

yeah I have no capacity to give tomorrow's lecture online so idk 2:02 pm

2:14 pm :/

2:14 pm You and plenty of others...

Sorry I vanished - unexpected parents! 4:33 pm

conveniently my mammy did a course literally YESTERDAY on how to give

lectures through Blackboard Collaborate Ultra 4:33 pm

so they drove up to ours and she walked me through it all 4:34 pm

think I can actually give a good attempt at an online lecture! 4:34 pm

4:34 pm Omg g'wan Áine!

4:35 pm I went for a walk anyway

4:35 pm Great big lakes in the fields

4:35 pm Fences just disappearing, must've been four feet of water

4:35 pm unreal

the world's ending 4:36 pm

4:36 pm genuinely feels like it

4:36 pm have to go shopping - my list is so loooong

4:36 pm #JustCoronaThings

omg when the students got the email that lectures are going online they all went to the Pav to celebrate... ideal virus-spreading behaviour there 10:05 pm

10:07 pm oh my god GUYS

the world's ending ~ Reorientation Due To Pandemic

I was literally back one (1) day 10:07 pm

I can't believe I have to teach this online 10:07 pm

what am I going to do with the baby? 10:07 pm

my tiny apartment was already not a good place to work, it's definitely not set up to teach comfortably or anything 10:08 pm

10:08 pm oh honey :(

10:08 pm just do your best


10:08 pm it's their first day of online lectures too!

I can't believe Joseph is away right now 10:10 pm

I need to be as fair as possible on the undergrads, but this isn't "my" module to make unilateral decisions on, this is so difficult 10:10 pm

10:11 pm Joseph trusts you

10:11 pm I bet he's glad his module is in a steady pair of hands

 10:12 pm

Wednesday 11 March 2020

5:01 pm How's your day going?

actually not bad! 5:02 pm

just finished my class and it went surprisingly well 5:02 pm

5:02 pm Brilliant!

5:02 pm Áine's stuff was helpful?

turns out the trick to success is being a third-generation academic 5:04 pm

hmm maybe I should've told the students that 5:04 pm

5:05 pm [makes note and sticks post-it on monitor]

5:05 pm Well well done anyway!

thanks! :D 5:05 pm

it's a pandemic now! 5:15 pm

5:15 pm Omg really?

so sayeth the WHO 5:16 pm

tutorial tomorrow at noon and then was supposed to

give a talk at 4 pm 5:17 pm

you know the Talk About Education seminar series I founded last year?

Autumn and Angeliki are running it this year

and they asked me to talk 5:17 pm

but I suspect it'll be cancelled 5:17 pm

5:18 pm gah that's frustrating

5:18 pm NUIG is closing but mixed messages about whether that means folk like us should work from home or what

yeah Trinity's physically closing

but we're all supposed to work from home 5:20 pm

we think lol 5:20 pm

in fairness they're doing a pretty good job so far

on taking decisions and communicating them,

I'm pretty impressed 5:20 pm

this is so disruptive though 5:22 pm

I've been focused on trying to get the online lectures sorted 5:22 pm

but what does this mean for my research??? 5:22 pm

and I'm supposed to present at EGU at the start of May! 5:23 pm

is that going to be cancelled?? 5:23 pm

Welcome to the EGU General Assembly 2020

EGU2020: Sharing Geoscience Online (#shareEGU20) is a week-long series of online activities to help minimize the impact of COVID-19 on scientific research and collaboration in the geosciences.

Please select a Programme Group.

Union-wide

- Union Symposia (US)
- Great Debates (GDB)
- Short courses (SC)
- Education and Outreach Sessions (EOS)
- Networking (NET)
- EGU Community Events (ECE)
- Feedback and administrative meetings (FAM)
- Townhall meetings (TSM)

Programme Group: EOS

Your sessions have been highlighted.

Sessions in which you are a presenter are marked with ★

EOS2 – Higher education teaching

> expand

★ EOS3 – Educational research in higher education and at school level

v

★ EOS3.1

Geoscience educational research

Convener: Chris King | Co-convener: Steven Rogers

Displays | Wed, 06 May, 14:00–15:45 (CEST)

EOS4 – Communication and outreach

> expand

EOS5 – Geoethics

> expand

EOS6 – Diversity and equality

> expand

EOS8 – Geoconservation and geoheritage

> expand

★ EOS9 – Interdisciplinarity

v

★ EOS9.1

Social science meets geoscience: research at the interface of two disciplines

Convener: Fergus McAuliffe

Co-conveners: Hazel Gibson, Anthea Lacchia, Jen Roberts, Geertje Schuitema

[Displays](#) | Mon, 04 May, 16:30–18:00 (CEST)

EOS9.2

The use of historical images and high resolution topography in geosciences

Co-organized by EOS9/CL2/CR2/GM2/HS13/NH6

Convener: Livia Piermattei

Co-conveners: Penelope How, Wilfried Karel, Anette Eltner, Andreas Kaiser, Mike James, Mark Smith, Jack Williams

[Displays](#) | Fri, 08 May, 08:30–10:15 (CEST)

Active Session:

Social science meets geoscience: research at the interface of two disciplines

Convener: Fergus McAuliffe | Co-conveners: Hazel Gibson, Anthea Lacchia, Jen Roberts, Geertje Schuitema

[Displays](#) | Mon, 04 May, 16:30–18:00 (CEST)

Your time now: Mon, 04 May, 15:27 (IST)

Vienna time now: Mon, 04 May, 16:27 (CEST)

[Begin Chat Log...](#)

Fergus McAuliffe, iCRAG (convenor) (15:27) Welcome to the session, everyone. We'll get started in three minutes.

Jade Steinmann, University of Vienna (attendee) (15:27) Hello. Thank you

Emer Emily Neenan, Trinity College Dublin (author) (15:27) Hello everyone!

Stanford Mason, University of Minnesota (15:29) oh good, I'm at the right time this time :) I totally missed a session earlier because I counted my timezones wrong :(

Emer Emily Neenan, Trinity College Dublin (author) (15:29) Oh no! And you're in Minnesota? I almost did the same thing and I'm only one hour difference!

Fergus McAuliffe, iCRAG (convenor) (15:30) Glad you made it, Stanford, and everyone else.

Let's get started.

Welcome to this interdisciplinary session on the interface between the geosciences and the social sciences. We have a series of really interesting presentations lined up. Myself and my team of co-convenors in the chat will lead us through each presentation in the order they appear on the programme. We have 10 minutes for each presentation, so the presenter has 4 or 5 minutes to give us a brief tour of the display materials, and then we'll have 5 or 6 minutes for questions and comments. Try to note questions by saying "question" at the start, so it's easier for the presenter or convenors to pick them up.

So let's jump right in with Shinju Ishiyama, with a fascinating project on public acceptance of mining. The floor is yours, Shinju.

Arkaitz Peña, University of the Basque Country (attendee) (15:31) hi everyone :)

Fergus McAuliffe, iCRAG (convenor) (15:33) Is Shinju Ishiyama here?

Rochelle Clacher, University of Edinburgh (author) (15:33) It's something like 11 pm in Japan, maybe they can't be here.

Fergus McAuliffe, iCRAG (convenor) (15:34) If they arrive late, we can fit them in at the end as long as everyone keeps to time.

Let's move on to someone I know is here.

Emer Emily Neenan is presenting on her research on Earth Science in secondary schools. You have the floor, Emily.

Emer Emily Neenan, Trinity College Dublin (author) (15:34) Thank you, Fergus. I am here! I hope everyone can see the three slides I uploaded?

Figure 9: "The Earth Is Out There but I'm stuck in quarantine!: Challenges of researching Attitudes Of Irish Secondary Students Towards Earth Science during a global pandemic!" EGU presentation slides (Overleaf)

Emer Emily Neenan
neenane@tcd.ie
@e3neenan

The Earth Is Out There:
but I'm stuck in quarantine!

Perhaps we could use this opportunity to share how we're adapting methodologies in this new and very difficult situation.

Challenges of researching Attitudes Of Irish Secondary Students Towards Earth Science during a global pandemic!

Like many others, my research has been significantly impacted by the ongoing COVID-19 situation. Managing delays, quarantines, and remote research is part of the process now. My children's voice methodology requires student input on the data before dissemination, but schools are closed and my original ethical approval did not permit online contact with students..

The originally intended version of this paper will be submitted soon (perhaps AGU?), barring further global disasters...



Ethics



Depending on the project and phase, seeking new ethical approval could take anywhere from hours to months. The **impact on participants and data recording & storage** are particularly vital issues to address.

Remote/online methods

Recruitment: Those of us who recruit via schools and other in-person connections have to radically overhaul how to find and contact participants.

Connection: Flexibility and "flow" can be lost when **face-to-face becomes screen-to-screen**, but..

New opportunities: Online research affords the chance to **make new connections, gain new skills, and develop new methods.**

Inclusion: Some will have newly expanded scope to get involved in research, while **others will be left behind** as things move online.

Is 'exactly the same, but online'...
... the ideal to strive for?
... a wasted opportunity to expand methodological horizons?
... practically and philosophically impossible anyway?

Life

The difficulties in managing research from home are **exacerbated for those already at a disadvantage:** living in small rented homes, in unstable circumstances, juggling caring responsibilities, etc.



Emer Emily Neenan
neenane@tcd.ie
@e3neenan

Soon...

and...
stay safe,
everyone!

Writing

... will continue on my PhD thesis, which is written in a creative non-fiction epistolary format. This now includes reflective work on working & writing during a global disaster.

Student Perspective on Data Analysis

... will now be sought via online research advisory sessions, for which new ethical approval is required

Future Work

... will continue to develop & expand the children's voice methodology in Earth Science research. (For those who are interested in this, see EOS3.1)

Dissemination

... will hopefully take place more or less as originally planned over the next year, but probably with more virtual/remote presentations. This is something our research group has been considering anyway, to minimise our carbon emissions, so perhaps the expansion of virtual conferences will be a positive offset to all the difficult and challenging aspects!



the world's ending ~ Reorientation Due To Pandemic

Emer Emily Neenan, Trinity College Dublin (author) (15:35)

I'm Emer Emily Neenan, a doctoral researcher at the School of Education in Trinity College Dublin, Ireland. My PhD project is on geoscience engagement and education in Irish secondary schools, using a children's rights based methodology. I have a BA in Geology and an MSc in Seismology. I also write creative non-fiction and poetry, including my thesis, which is written in an epistolary format.

So, I had hoped to share today my preliminary data analysis on this project. The project is an assessment of interest in and understanding of Earth Science among junior secondary school students (so ages ~12 - 15) in Ireland.

However, my methodology involves including representative school students as co-researchers, and due to the COVID-19 issue, I haven't been able to contact any of my student co-researchers since schools were closed in Ireland. I don't think it would be fair of me to share my interpretation of the results before my co-researchers can give their input.

In order to get their input, I have applied for ethical approval to contact them online and run a session with them. Today is a bank holiday in Ireland but I should hear tomorrow! And hopefully be able to go ahead with remote discussions.

This is an example of one of the many challenges of researching-from-home, in an unprecedented disaster situation. This online chatbox, in place of me standing in front of ye to present my research, is another. These challenges are difficult and impact some people harder than others, but there are opportunities here too.

I thought we could take my situation as an example to share some of our challenges and opportunities as we navigate geo- and social-science research in a global pandemic.

I particularly want to draw attention to the "cloud" on the middle slide.

Is "exactly the same, but online"...

... the ideal to strive for?

... a wasted opportunity to expand methodological horizons?

... practically and philosophically impossible anyway?

Does anyone have any questions for me?

Fergus McAuliffe, iCRAG (convenor) (15:36) Thanks for the tour Emily! Now it is Q+A time.

Arkaitz Peña, University of the Basque Country (attendee) (15:36) I would vote for "a wasted opportunity to expand methodological horizons" !

Anna Arnaud, University of Antananarivo (author) (15:36) Question: How agile was the ethical approval process in light of the current situation? Did it raise any issues that would not need to be considered with your original process?

Stanford Mason, University of Minnesota (author) (15:36) Question. With your "children's voice methodology" is there now an opportunity to develop this into an on-line approach and target this to enhance stem inclusivity opportunity? The use of poetry and creative language ideas sounds great.

Emer Emily Neenan TCD (author) (15:37)

Thanks Anna. My university and School have been good at adapting to this new situation, so I'm hopeful we will be able to move on quickly with the discussion groups (CRAGs) online now.

But until this closure of campus, my university had absolutely no ethical approval in place for any remote video conference data collection/generation/discussion. This has been a big shake up! It's a learning experience for all of us.

One thing I would never have thought of - they have to ask if you have any little robots like Google Home or Siri listening in on you that might record a data collection interview unsecured!

Emer Emily Neenan TCD (author) (15:38) Yes, Stanford, absolutely. This has been a really challenging and oftentimes frustrating situation, but it is also an opportunity. I hope this new approach might allow me to be more inclusive and have students who might not have been able to meet in person.

Emer Emily Neenan TCD (author) (15:39) but there's also a huge barrier to many students with this approach - something like 10% of Irish households don't have internet (same issues globally), many more don't have reliable high-speed broadband. And many school students are competing for one or two laptops/computers in a household all trying to work/study from home!

Arkaitz Peña, University of the Basque Country (attendee) (15:38) Hi Emer, I think it is great that you are waiting till you can analyse your findings with your participants! In terms of the online approach to research, I think it cannot replicate the face to face stuff, but certainly can offer new insights that perhaps wouldn't have been found otherwise.

Arkaitz Peña, University of the Basque Country (attendee) (15:39) I hope you manage to find a way around the situation that you feel comfortable with, both in generating reliable data and ethically!

Emer Emily Neenan TCD (author) (15:39) Thank you Arkaitz! I hope so too!

Jen Roberts, Strathclyde Uni (co-convener) (15:40) I feel a lot of this is very relevant in shaping research and related activities that could otherwise have a very large carbon footprint, and therefore which will not be viable in netzero future. Do you have any thoughts on this?

Jen Roberts, Strathclyde Uni (co-convener) (15:40) Disadvantaged people are already harder to reach for a lot of social research methods. This may be exacerbated in C-19 (with, as you say, access to internet and so forth). What might be ways around this? How might barriers be reduced? I'm curious to hear your thoughts.

Emer Emily Neenan TCD (author) (15:41) Thank you Jen, yes, I think this is a difficult but vital opportunity for us to "pilot" more low-carbon ways of doing things. On the other hand, I'm now running screen after screen, instead of walking / taking the bus to local schools, haha!

Jen Roberts, Strathclyde Uni (co-convener) (15:41) (Lots of questions for you Emily!)

Emer Emily Neenan TCD (author) (15:41)

Another great question, Jen. This is all very new. There are opportunities here to reach some people who may find in-person things more challenging and online things less challenging (for example, people with mobility/fatigue disabilities, people who work from home to supervise children). But obviously there are also many people who will struggle to move online (people who don't have reliable WiFi/hardware, people who are grappling with additional caring responsibilities, people who have difficulties with accessibility online like getting access to transcripts, etc).

I think the main thing we can do to begin with is be aware and receptive. Ask what people's challenges are, give them space and opportunity to tell us, be as flexible as possible. Give people more time to respond, extend deadlines and be generous. Be open, if possible ourselves, to doing things different / more slowly / at different times / through different mediums. Be aware of the expenses to participants that are less visible but still possibly barriers or difficulties to them, and try to offset or cover those expenses where possible.

All of this will slow research down, but maybe that's a good thing - taking time to be more reflective and kind can be a bonus to both our science and ourselves.

I'm really glad we have this space to discuss these things, they're important! And I hope we can take some of these lessons back with us to our "new normal" when things improve.

Fergus McAuliffe, iCRAG (convenor) (15:41)

QUESTION: You said your PhD thesis will be written in a non-fiction epistolary format. This sounds different and exciting. So it will be done via letters? And if so, to whom?

(and will there be a letter from Samuel Beckett to Emer Emily Neenan?)

*Samuel

Emer Emily Neenan TCD (author) (15:42) Perhaps there will be, Fergus ;) The epistolary is a collection of documents (like the novel Dracula - not just letters but other formats too). In my case, emails, journal excerpts, papers, poems, as well as letters. It tells the "story" of the research. The strength of the epistolary is taking the reader in close to the action, feeling as though it's unfolding before them

Emer Emily Neenan TCD (author) (15:42) I look forward to sharing it when it's finished, this summer!!

Emer Emily Neenan TCD (author) (15:43) Thank you very much for all the great questions, please get in touch with any more questions or comments - neenane@tcd.ie or @e3neenan

Fergus McAuliffe, iCRAG (convenor) (15:45) Thanks, Emily, looking forward to hearing more about it.

Our next presenter is Rochelle Clacher, with a project highlighting Indigenous responses to climate change. The floor is yours.

15th April 2020 at 5:45 pm
From: Emer Emily Neenan
To: Ann Devitt

Dear Ann,

I hope you're getting on well in these strange times!

I was in the process of organising a follow-up round of school visits in March, in order to get student perspective on the data generated by the survey, which obviously didn't happen. This is the last thing, aside from writing, that I need to finish my thesis. Joseph and I have discussed it and our preferred option is to arrange to do virtual advisory groups via Teams.

For a Research Advisory Group in a school, the students are recruited through the school, I send the consent forms (student and parent) ahead, I visit the school, collect the consent forms, and convene a group of 4 to 8 students to discuss the project. I spend between 1 and 2 hours with the group, we decide collectively what gets recorded (written/typed) and how to structure the time. I expect that most of that process can be done remotely by email and by a Teams meeting. I do not audio or video record, I do not quote any student directly.

I would really like to proceed with this last step. My funding will run out at the end of September and best case scenario, the schools will only just be back then!

I see there is a procedure on Blackboard for updating existing ethical approval to move online? Should I proceed with that?

Best wishes,
Emily.

2nd June 2020 at 4:48 pm
From: Emer Emily Neenan
To: Fionn Preevidja, Ciara McMuinteoir

Dear Fionn and Ciara,

Last year I visited St Brigid's a few times as part of my PhD research on Earth Science in secondary schools. I actually have a book voucher to give the school as a token of my appreciation for all your help that I was hoping to deliver in person this term, but obviously wasn't able to! But I hope, despite the current pandemic situation, your students might be interested in being involved in the final stage of the project.

I would really appreciate if you could offer the below opportunity to your 2nd, 3rd, and/or 4th year students. I would be delighted to give an online talk (live or pre-recorded) to any group(s) of students in return, either now or in September. I can talk about Earth Science, natural disasters, diversity in science, or careers in science.

After a resubmission to the ethics committee at the Trinity College School of Education, I now have approval to do Research Advisory Groups online, via Microsoft Teams. As with the original group sessions I did in St Brigid's last year, these discussions are not recorded in any form, except that the students and myself might take some written notes or drawings. The students' names are not recorded anywhere except on the consent forms, which are stored securely until the end of the project.

I would particularly love to follow up with some of the students who so generously and enthusiastically contributed to the design of the questionnaire, so they can see the results they helped to discover. I would ideally do two sessions - one with any students who helped before, and a second session with any students who did not help before but want to be involved now. A group is generally between 3 and 10 students (plus myself) and takes place during school hours. However, I want to make this as easy as possible for you, given the stress we're all under at the moment. If there's a particular thing I can change to help (for example, scheduling it at a weekend instead, taking a whole class group at once) I'll do whatever I can to facilitate it.

If you're interested in being involved, just circulate the attached forms to the students/parents, and they can return them directly to me by email. I can provide an online form if it would be preferable. Or let me know if you have any questions. I'll also be happy to post the book voucher or send a digital version.

I hope you're safe and well and got a bit of a break over the sunny long weekend!

Best wishes,

Emily



Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin



IRISH RESEARCH COUNCIL
An Chomhairle um Thaighde in Éirinn

Student Information Sheet **About Online Research Advisory Group**

My name is Emer Emily Neenan and I am a researcher at the School of Education, Trinity College Dublin. I'm researching how Junior Cert students learn about or engage with Earth Science.

My research questions are:

- What is the impact of the new Earth and Space Science strand on students' engagement with Earth Science?
- How can schools be facilitated to support Earth Science engagement among students, particularly female students?

I'd like your input on how best to measure these things, so I'm inviting you to be part of a Research Advisory Group. This is a follow-up Research Advisory Group to work that I did last year with some students. At that time, we put together a questionnaire to ask TY students about their experiences learning about Earth Science during their Junior Cert. Now I have results from that questionnaire and I want to see what you think of the results.

If you agree to take part in the Research Advisory Group, you will be asked to discuss the questionnaire and results with other students and with me. We'll do it by Microsoft Teams online. I'll show you the questionnaire and the results, and we'll discuss them. I'll take notes or screencaps of anything you write down or draw so I can look back over it later. I'll delete the screencaps when I'm finished my project.

The results will form part of my PhD thesis, and my supervisors and the examiners for the thesis might look at them. I'll write about the results and talk about them at conferences.

There are no particular risks of taking part in the study, it'll just be like a normal (video chat) conversation except I'll take notes. The information I collect will be private. If I quote you, I'll only use your first name or a fake name. Information will be stored safely

with access only available to the research team and examiners and it will all be destroyed after 10 years.

Information about the results will be sent to your school if you want to find out about the project when it's finished, or you can always contact me directly.

You don't have to take part in this study if you don't want to. If you get involved and change your mind, you can withdraw from the study at any time, and I won't ask why. Even if you start the video chat, you can just turn off Microsoft Teams if you don't want to do it anymore, for any reason. And if you have any questions or if you don't understand something, you can always ask me.

If you want to take part, please download and fill out the "student consent form" below (either by adding to it digitally or by printing it off and filling it in with a pen) and ask your parents to fill out the "parent consent form" too. Send both forms back to me by email (earth@tcd.space)

If you printed them out to fill them in, you can scan them or you can just take a photo on your phone and send the photo. Just make sure it's easy to read so I can get in touch with you!

Thank you!

My contact details:

Emer Emily Neenan neenane@tcd.ie 087 660 1006
School of Education
Trinity College Dublin

The project supervisors:

Dr Joseph Roche joseph.roche@tcd.ie
Dr Colette Murphy colette.murphy@tcd.ie

Hubbub

by Emer Emily Neenan

“Hey! Can I join ye?”

Emily pulls up another neat green chair to the round table, wincing a little at the scrape of metal legs over the floor. Everything echoes in this open plan wooden area with the tall, unadorned windows and bare furniture. The Trinity Long Room Hub’s Ideas Space, scene of hundreds of book launches and wine receptions, and thousands of coffee-break chats.

“Sure,” says Jessica, shifting over a little, unnecessarily.

“But anyway if you want it to be sweet, you can just add sugar,” Carlos continues, across the table.

“Nooo,” Jessica answers. “It’s not the same! You *make* it sweet.”

“They are telling each other they are wrong about ice tea,” Louise explains to Emily, “Apparently in New York they do not make it sweet, but in the southern USA it is supposed to be sweet. I don’t know, in France we have it. Lemon, mango, or peach.”

“Yes, the same for Greece, usually lemon,” Angeliki says.

“Ugh, I hate ice tea. Lemonade is the far superior southern USA drink,” Emily says.

“I’m surprised to see you,” Louise says, “Aren’t you writing up?”

“I am!” Emily buries her face in her hands. “But I needed a break from staring at the screen. We’re staying at my parents’ house because of the pandemic, and I really miss these chats at the Hub. I decided to write one, even though they’re impossible right now, with campus closed. Jess in Kerry, Louise in France...”

“Ooh, so we’re going to be in your thesis?” Jessica asks, excited.

“Yeah, if ye don’t mind!”

“You should get us to sign an official consent form,” Carlos says. “But we live recklessly.”

“Yeahhh, tearing up the rulebook, going wild!” Louise says.

“I kinda miss this place too.” Carlos glances around at the books displayed on the shelves, the posters on the walls. “Doing a PhD is isolating enough already, I was relying on these chats.”

“Although I admit I get more shit done when I don’t have these long breaks,” Louise adds. “I’ve written a lot, just stuck inside my room.”

“Yeah, I’m getting a lot done at the moment, but it fluctuates, baby dependent, mental health dependent. And I really feel the loss of talking things out, you know?” Emily says. “It’s so valuable to talk about aspects of research with other researchers, even if they’re in different fields.”

Maybe especially if they're in different fields? If we're all stuck at home for the foreseeable, we have to find ways to recreate those casual spaces, corridors and coffee breaks, but digital. It's comparatively easy to move a seminar or whatever online, but then everyone just logs off at the end."

"Yes, it's good at least to have the video chat things, but it's not the same," Angeliki says.

"At least we can stay in touch," Jessica says.

"I still need to ask questions about things," Louise says. "And I will forget to speak English if I don't talk to you people."

"Hi folks," Professor Jane Ohlmeyer says as she sweeps past. "I hope everyone's getting on alright?"

"Well as can be expected," Carlos answers.

"That's another thing really missing now," Emily comments. "Building relationships with senior academics and academic mentors. We can set up casual chit-chat amongst ourselves but not with people like you, Jane!"

"Well we're really looking forward to welcoming you back, when it's safe, and in the meantime, we'll try to make do with Zoom and whatever else," says Jane. "Carlos, while I see you, great work on the Identities in Transformation series."

“Oh, yeah, they’re great!” Jessica agrees.

“I still have to write you a poem for that!” Emily says. “I will, it’s going at the end of my thesis too so I have to get it done very soon. Actually I just wrote another short story, or I guess technically a dialogue piece? It’s about doing my discussion groups online instead of face-to-face. It’s so different. This is all so different.”

Hi! Can you hear me?

Emer Emily Neenan

Barry Neenan: Hey, is your WiFi disconnecting?

Emer Emily Neenan: It IS! It's so annoying! And my research thing is on this afternoon.

BN: What thing?

EEN: You know! My CRAGs? The discussion groups with students I've been trying to set up for months but there's a pandemic and schools are closed and now I finally have one on today and the WiFi is acting up?

~

EEN: Is anyone using the landline right now? I need to phone this teacher to confirm and my phone isn't working for some reason!

Áine Ó Neill: Oh yes, they said on the radio, the whole Eir network is down.

EEN: *Why?*

~

EEN: No, I'm pretty sure it *has* to be Microsoft Teams, Zoom isn't GDPR compliant.

Stuart Gorman: Okay well then I think you need to call Joseph again. You don't have the right permissions for me to set you up for the CRAG thing on Teams.

EEN: Ugh, thanks for trying anyway. I'll call him.

SG: Good luck...

~

EEN: Áine! Help! Can I use your computer? Mine won't log in now, on top of everything else. ... I think I'm gonna cry. Or scream maybe.

ÁÓN: Of course you can, pet, it'll be fine!

~

EEN: Hi! Can you hear me? I can see people logging in but everyone has their video off, ha. Turn it on if you want to!

EEN: Hi! Is this working? Everything good?

EEN: Is that a nod?

EEN: I can only see two... no, three of ye. I think there's, um, 8 of us logged on?

EEN: Okay I'm getting nods. Um. Your teacher said ye were using Microsoft Teams for some classes and stuff since the pandemic started, right?

EEN: And usually everyone keeps their video and mic off? Well for this, it's literally whatever you'd like, so like if you're happier keeping it off and just turning it on to talk? Or even maybe you want to pop questions in the chat?

That's totally fine! And also if you want to turn it on, it's nice for us to see each other so. Either way! Is that okay?

Niamh Gallagher: ... Yeah.

Úna Daly: Yep.

EEN: Great! Thanks! Okay, so, um. First of all, thanks so much for agreeing to help with this. I know school's actually over now so it's really good of you to do this, it's really helpful.

Hi! Can You Hear Me? ~ Follow-up CRAGs

EEN: So like I said in the email, my name is Emer Emily Neenan and I'm working on my PhD, and it's about Earth Science education. I went to college to do Earth Science, Geology, and then this is, like, postgraduate? So another degree, like, extra on top of a normal college degree. And for this, I have to do research in an area, and then write it up, like, 70,000 words, so like a whole load of essays together. And I'm almost finished!

EEN: Um. So. Today I'd really like to show you... We did a survey, a questionnaire, about Earth Science in schools, like, Junior Cert. Like trying to find out if people doing their Junior were interested in Earth Science, and like, which parts? And also trying to measure if they understand the concepts. So like you know the way sometimes in school you're just kind of learning stuff off and you can write it out like it was in the textbook but it doesn't make much sense or connect to like, the real world? I want to know if people are just learning Earth Science that way or if they like, actually get it.

EEN: Um. Any questions so far?

...

EEN: Yeah so, I'd like to show you the survey that I used. I actually made it with another group of students, from a different school, and we designed it together to use for this. So I'll kinda talk you through that. And then I'll show you some of the results we got? Especially for... So there are some questions that are just multiple choice and then there are others where there's a box to type stuff in, and I especially want to know what you think of those questions where people typed stuff in. The idea here is that, you know, it's been a while since I did my Junior and I probably forget stuff about what it's like, and also, like a bunch of stuff has changed, like I didn't do Earth And Space Strand in Junior Cert cause it's only new. And people who are actually doing their Junior Cert at the moment or just did it like last year, like ye, ye'll

know how it works in practice. And also like, sometimes the way people write stuff, it makes total sense to someone else who's like, the same age and in the same sort of, like, class or whatever, but it doesn't make as much sense to someone else. For example someone might use slang and I don't know the slang cause I use different slang.

EEN: And this is literally just, like, your opinions, so if you think something is interesting or unexpected, or maybe you notice something weird. Or like, maybe everything is totally normal and boring and you just tell me like, yup that's what I'd expect. And that's good too because, I guess, then the survey worked pretty well if it gets lots of really typical answers that represent normal students and give us a good idea of what students usually, uh, think or experience.

EEN: And like, there isn't right or wrong answers or anything. I just want to give you a chance to see if there's anything you can add, and if not, I can say in my thesis that I asked some students and they all said it was boring and normal and they didn't notice anything. And that's still fine!

EEN: So. Does that sound okay?

...

Hi! Can You Hear Me?
~ Follow-up CRAQs

Conor Whelan: Cool.

ÚD: Yep.

NG: Yeah that sounds okay.

EEN: Great, so just, like, um, pop your mic on or whatever, or type in the chat thing, if you want to ask me anything or if I'm going too fast or too slow or whatever. Stop me at literally any point to ask anything.

EEN: I'm just going to go through the survey first and then we'll decide together how to go through the results? And like, if you want to take notes that's great, and you can share them, or not. Like you could email them to me after if you don't want to say it out loud. And you don't actually even have to say anything at all if you don't want to! Or if you have to go, no worries.

EEN: Um. Okay! So let me just screen share, and we'll get started. One sec...

It's Our Future, Ask Us!!

Use Of Children's Research Advisory Groups
To Centre Children's Voice In
Earth Science Education

AND TEENAGERS! it would work for anyone, actually! 😊 even adults?!

Children have the right, under the United Nations Declaration on the Rights of the Child, to give meaningful input on research that concerns them¹. *That means you have to actually listen to what we say.*

this stuff is fun cause it's different than schoolwork AND it's something important! Children can contribute to all stages of a research project: designing research questions², data collection³, analysis⁴, and dissemination⁵

It's going to be in a published report so we take it very seriously. CRAGs are used in an ongoing research project undertaken by Emer Emily Neenan in the School of Education, Trinity College Dublin. This project investigates Earth Science education in Irish secondary schools.

LOL IT'S A SURVEY In this project, the "research instrument" was co-designed by CRAGs, composed of representative students from two participating schools. The CRAGs will be convened again to give input on the results of the survey. **YAY!**


actually we called it a "Questionnaire" cause we didn't want it to sound like a TV project haha 😊

It is especially important to give children a voice on issues relating to climate change. Their opinions must be taken into account in education and policy. **#SchoolStrikeForClimate**

This!!!


WE WON'T BE SILENT!

CRAGs!!




(THIS MEANS TELLING PEOPLE ABOUT THE RESEARCH)

Yeah, we're helping write a paper and it's going on my CV.



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Emer Emily Neenan
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Figure 10: "It's Our Future, Ask Us!!: Use Of Children's Research Advisory Groups To Centre Children's Voice In Earth Science Education" poster both discussing the method and demonstrating the energy of it

1. Welty, E., & Lundy, L. (2013). A children's rights-based approach to involving children in decision making. JCOM, 12(03), C02.
2. Kellett, M. (2004). 'Just teach us the skills please, we'll do the rest': empowering ten-year-olds as active researchers. Children & Society, 18(5), 329-343.
3. O'Brien, N., & Moules, T. (2007). So round the spiral again: A reflective participatory research project with children and young people. Educational Action Research, 15(3), 385-402.
4. Coad, J., & Evans, R. (2008). Reflections on practical approaches to involving children and young people in the data analysis process. Children & Society, 22(1), 41-52.
5. Tisdall, K. E. (2008). Is the honeymoon over? Children and young people's participation in public decision-making. The International Journal of Children's Rights, 16(3), 419-429.

Time To Listen: Children's Voice In Geoscience Education Research

Neenan, Emer Emily *

Roche, Joseph

Bell, Laura

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Abstract

Arguably the greatest threat facing society today is that posed by irreversible climate change. In tandem with mitigating the effects of climate change, we must now make decisions about issues such as renewable energy, sustainable and safe water supplies, management of renewable and non-renewable natural resources, and management of natural disasters. The current school-age generation will see the worst effects of climate change, including greater frequency and intensity of extreme weather events, shortages of water and other necessary resources, and dangers due to pollution and toxicity in human environments and the human food chain. The next generation is coming of age as difficult socio-political choices are being made at local and national levels to manage resources and mitigate environmental damage. It is therefore important to centre the voices of children and young people in research aiming to address the social, political, and educational dimensions of geoscience topics including climate change and related topics. This paper proposes the use of Children's Research Advisory Groups (CRAGs) to meaningfully include children and young people as co-researchers in geoscience-related research.

Why Listen To Children About Geoscience?

Climate change is a vast, accelerating, and highly complex threat to human civilisation on our planet, requiring both scientific and socio-political expertise to tackle [1]. Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate, leading to natural disasters, low harvests, biodiversity loss, etc., according to the UN Intergovernmental Panel on Climate Change (IPCC). These effects, already in motion, are expected to worsen over the coming years, with a well-publicised estimation in 2018 by the IPCC that there are fewer than 12 years remaining to make the considerable changes required to tackle this threat (now 10 years) [2].

Therefore, significant decisions being taken today and over the next few years - on regulations, investments, and management strategies - will determine the state of the world the current cohort of school students inherit as young adults. It is the next generation that will bear the worst of the effects of unmanaged climate change, yet the decisions that determine how well those effects will be avoided or managed are being taken before the current generation of school students can vote or directly influence policy. These students have indeed been making their voices heard via protests, social media activism, and school strikes. It is vitally important to listen to them, and centre the voices of children and young people in research aiming to address the social, political, and educational dimensions of climate change and related topics.

Youth Activism

It would be of benefit to both the young people and the researchers themselves for researchers on climate change to listen to the younger generation. Young people have been a force in environmental activism for a long time, although attention has generally focused more on young adults (particularly college students) than on minors. The first “Earth Day” in 1970 was marked by activism on college campuses [3][4]. Individual youth activist activity during the 1990s and early 2000s led to the formation of the Youth Climate Movement in 2005 [5][6].

Compared with older generations, young people are consistently “associated with activism and with liberal politics”[7](p. 296). It makes sense that younger people are more likely to challenge a conservative status quo than their parents and grandparents, who are perhaps more likely to be comfortably established within it [8][9].

It also makes sense that young people are more likely to be concerned with projections of climate devastation over the coming decades than older people who, to put it bluntly, may not live long enough to see the worst effects. Wray-Lake, Flanagan, & Osgood [10] write that “today’s young people will inevitably become national and global leaders with responsibility for environmental stewardship and sustainability” (p. 62).

In August 2018, teenage climate activist Greta Thunberg staged a protest outside the Swedish Riksdag (parliament), with a sign that read "Skolstrejk för klimatet" ("School strike for the climate"). She has since staged the same protest every Friday [www.fridaysforfuture.org], and has been joined by both individual strikers and mass protests in countries from Ireland to Japan to Argentina [11].

Reis, Ng-A-Fook, & Glithero [12] provide a table of examples of “youth who are leading the way in recent environmental action” (p. 44).

Children and young people are increasingly aware that on the current trajectory, the risks and dangers of climate change will be significantly worse by the time they come of age.

The Case for Children's Voice in Geoscience Research

Thus the intertwined issues of climate change, sustainability, pollution, etc., are of considerable importance to the next generation [13]. But when research is undertaken, it is conceived, designed, and enacted by adults. The lives of children and teenagers have changed drastically since current adult researchers were teenagers [14]. How can adults know if they're even asking the right questions, if they have little familiarity with the world teenagers are living in now?

Furthermore, teenagers and young people use language differently to older people; not just unfamiliar new slang, but pioneering new grammatical constructions [15].

If adults manage to ask the right questions, how can they be sure they're interpreting the answers accurately?

The United Nations Convention on the Rights of the Child (UNCRC) says that children should have meaningful input on issues that affect them. This must include research undertaken on these issues, particularly where the goal of the research is to inform policy.

Research undertaken that will directly or indirectly affect the lives of young people should be informed by the experiential expertise of young people themselves. The following section will explain one method of centring children's voice by including representative students as co-researchers during the research process.

How To Listen To Children About Geoscience

James [16] catalogues the ways in which children's voices can be used in research, along with the common problems and pitfalls: "Giving voice to children is not simply or only about letting children speak; it is about exploring the unique contribution to our understanding of and theorizing about the social world that children's perspectives can provide" (p.262).

In order to incorporate children's and young people's voice in matters that affect them, it is useful to follow the principles laid out in the UNCRC. Giving children the opportunity to speak is not enough; there are four elements that must be present for their voice to be meaningfully incorporated. These are: Space, that is, the opportunity and time to express their views; Voice, including ensuring they have the requisite vocabulary; Audience, meaning that someone will listen to their views; and Influence, or the potential to actually enact change or progress [17]. The last of the four elements is crucial - there is no point listening to, e.g. student climate activists, if their opinions and preferences will not have an effect on the decisions being taken on policy [18].

The Research Advisory Group

The Children's Research Advisory Groups (CRAGs) method centres children's or students' voice in research [19][20]. Representative groups of children act as expert co-researchers, giving their opinions derived from their experiential expertise on "children similar to themselves" (for example, their peers, classmates, siblings, etc.). This method was first described by Lundy & McEvoy [21], then called a Children's Advisory Group.

As Lundy & McEvoy (ibid) describe, school is likely to be the most convenient location to hold a CRAG; however, it's important that the students don't feel like the CRAG is "schoolwork" or that they have to participate, or have to provide a "right answer". In order to minimise this, CRAGs are conducted in a manner that isn't like ordinary school, and the young co-researchers are consulted or given control over many aspects of the CRAG. For example, Lundy & McEvoy (ibid) suggest the CRAG not take place in the students' usual classroom (preferably in an unconventional room, such as the art room) and proceedings kept informal. Young co-researchers choose their own system for pseudonyms, if pseudonyms will be used. Perhaps most importantly, young co-researchers jointly determine how the CRAGs proceed, how the discussion is framed, and how records are kept. (Fig 1)

The Research Advisory Group method is particularly useful for topics where there is a high degree of student engagement, as is the case with climate change and environmental issues.

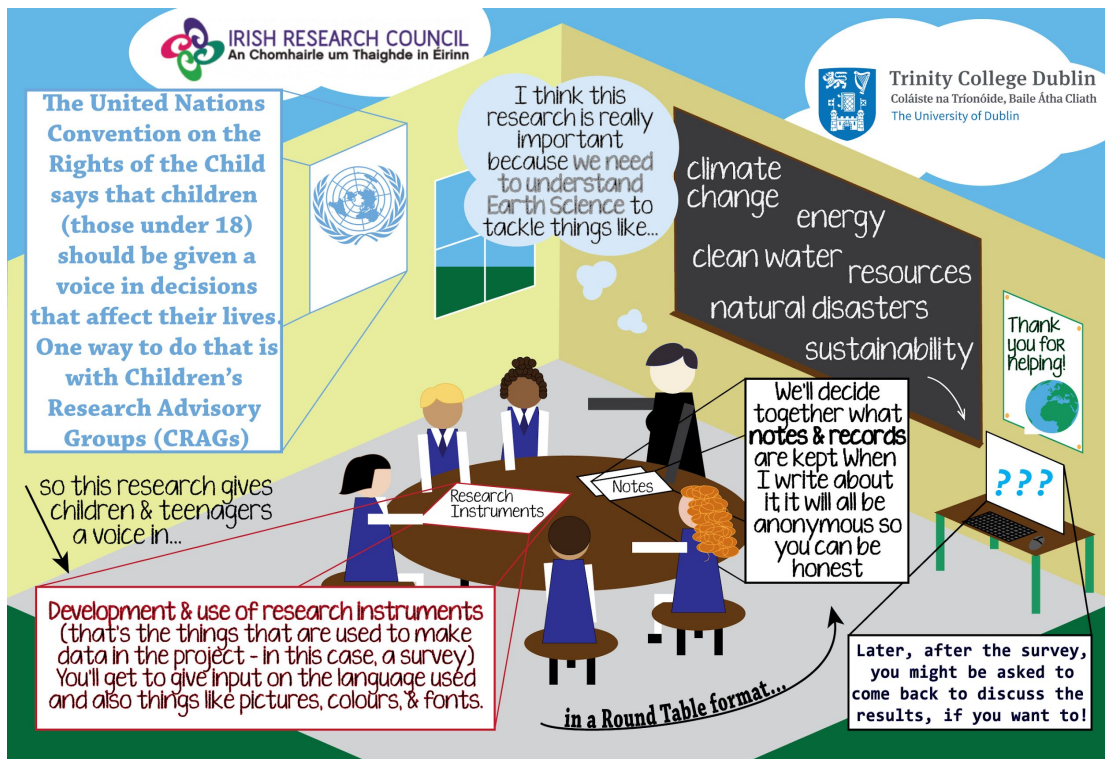


Fig 11*: Children's Research Advisory Groups: An excerpt (edited for clarity) from the information sheet given to student co-researchers as part of an ongoing geoscience education research project undertaken by the authors. (Artist is E.E.N.)

** Figure numbers have been amended to align with the thesis; these were originally Fig 1 and Fig 2 in the paper itself.*

For example...

... Let Students Improve Geoscience Education...

There is a need to address the place of geoscience in formal education [22][23].

Children's lives are framed around school from as young as four years old until typically their late teens. It is unsurprising that the teenage-driven climate change protest has focused on school strikes. Students ask why they should go to school if they are not being prepared for climate change, and instead are being taught skills and knowledge that may not be useful in a rapidly changing world.



Fig 12*: In Their Own Words: Signs by students expressing frustration at the first major School Strike For Climate march in Ireland, on Friday the 15th of March 2019. (Photographer is E.E.N.)

Placards with slogans such as “Why bother with school when you won’t listen to the educated?” and “This generation got no destination” are brandished by frustrated school students (Fig 2).

Student activist groups in several countries have explicitly called for climate change to be addressed in schools. For example, the Irish student-led activist group Schools’ Climate Action Network Ireland has called for “reform of the education system to address the need for ecological literacy” [24]. In many countries, climate change, natural resources, natural disasters, and sustainability are touched on as part of subjects such as Science, Geography, and Social Science, but there are increasing calls globally for climate change to be covered in more depth and detail in the formal education system. A 2019 YouGov poll commissioned by Oxfam in the UK found that 69% of teachers agreed there should be more emphasis on

climate change in schools, but that three-quarters of teachers did not feel they had received adequate training to be able to deliver climate change content in lessons [25]. This research didn't address students' opinions, nor is students' knowledge of the system usually drawn upon in curriculum reform.

One theory of the purpose of formal education is to prepare children for the future. It is increasingly clear that the impacts of climate change will significantly affect current students' futures, and the formal education system must take this into account. Using CRAGs in education research is relatively time-consuming and requires a lot of work from the school(s) as well as from the researcher(s). However, it is potentially an invaluable tool for education reform at all levels.

... Or Let Underrepresented Groups Improve Inclusion And Access.

The geosciences in Western countries have long been dominated by white men, at the loss of the expertise and perspectives of women, people of other races and ethnicities, disabled people, queer people, etc. [26][27][28]. Matters are improving, particularly with regard to gender, but slowly, and success with diversity and inclusion programs has been mixed [29][30]. Research on barriers and obstacles to inclusion, and programs and initiatives to diversify a field, are most effective when underrepresented groups have input from the very beginning [31][32]. In order to attract and retain more female, Black or minority ethnic, disabled, queer, working class, and other underrepresented geoscientists tomorrow, involve children and teenagers in the research on diversity and inclusion today.

When We Listen To Children About Geoscience...

... We Give Children and Young People Power...

Woolley et al. [33] demonstrate how, given the recent trends towards greater participant-driven research, crowdsourcing, and citizen science, it is important to make visible and clear the full context of how power is being returned to the participants in a system. Even aside from ethical or moral considerations of returning power to participants in research, children and young people have expertise on their own experience, which can be leveraged to improve data collection and analysis.

In order to balance the power in a researcher-participant interaction, care must be taken at every stage of the process. Eitzel et al. [34] show that even the terminology itself should be chosen carefully, and its usage explained for all participants. Aspects such as the language used or the space in which the discussion takes place must be considered and, if necessary, reworked. This is a process that costs time and effort, but that results in better data, and data that is arguably generated more ethically.

“Honouring young children’s rights to express their views creates more effective policy and it fosters stronger, more cohesive and inclusive communities. In these ways it contributes to a healthy democracy which recognises that children’s rights are the human rights of any citizen” (MacNaughton et al, 2007) [35](p. 9).

... And We Do The Right Thing.

Greta Thunberg rightly says “Those who will be affected the hardest are already suffering the consequences. But their voices are not heard” [36]

This doesn't just apply to young people: it applies to coastal and island villages, subsistence farmers, Indigenous populations, and many others. But the further someone is from their life expectancy, the greater the threat of climate change.

Young people must be given a seat at the table when the future of the planet 10, 20, 30 years from now is being discussed [37].

Students are experts on their own experiences and the realities of the worlds they live in; classrooms, family homes, family farms, student activist circles, clubs and sports, their local area. That expertise can and should be tapped into, especially when the stakes for the planet have never been higher.

Acknowledgements

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Author Contributions

E.E.N. carried out the CRAGs and led the writing of the paper. J.R. and L.B. contributed to the conceptual design, writing, and editing.

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01 July 2020 at 11:07 pm

From: Emer Emily Neenan

To: Joseph Roche

Hi Joseph,

Here's the final draft of the results section - I started with the survey itself and began adding charts and annotations to it, using the answer options as the keys for the charts... and it no longer resembles the survey particularly closely! But it follows the structure and includes all the questions, so I think it's easy to read.

The bulk of the analysis is from the discussions I had with the students who took part in the follow-up CRAGs. I did four of these CRAGs, with four different groups of students; two all-girls, one all-boys, and one mixed-gender, ranging from four to eight students. Most of the data analysis process was talking the questions out with these students. I tried to minimise what I did ahead of the CRAGs, in order to avoid imparting my own biases on the discussion, but due to the restrictions of time (I had to keep the CRAGs under two hours and honestly they could go all day!) I did have to narrow things down ahead of time for a few questions.

Specifically, I grouped the answers to the open-box questions roughly by theme ahead of the CRAGs. In order to keep this as objective as possible, three of us (grown-ups in the research group) did this coding work. The intercoder reliability was very high, with only a handful of answers differing across the three coders (where there was disagreement, I made the final call).

Anyway, the point is, I've kept this analysis quite straightforward, like we discussed. If I had had a larger sample, I would have enjoyed and been interested in doing a full statistical analysis, but with a sample of 111 responses across 5 schools (with individual schools ranging from 8 to 49 responses each), after a lot of consideration, I decided that I wouldn't really be able to stand over the significance of an in-depth statistical analysis. I'll discuss this again in the limitations or further work (documents 26 & 27) but while everyone always wants more data, this data stands very well as it is, supported by the CRAGs. I'm glad I put my effort where I did, even if, in an ideal world, I would have gotten more schools and more respondents.

Particularly, the gender balance is very skewed in these data. I'm sad that my efforts to recruit more schools were shelved but the circumstances were really beyond reasonable control (baby! pandemic!), so here we are. I'm going to discuss the gender aspect more in its own section (document 25), I'll send you a draft next week.

Just a note: once I start talking about the conceptual questions, there's quite a lot of white space on the page. That's only because I definitely did not want to divide a conceptual question over two pages, it's too confusing. The opinion questions do get divided over multiple pages sometimes because they wouldn't each fit one-per-page.

Let me know what you think!

Best,
E.

ATTACHMENT:

Cause we live ere - Results & Analysis

"Cause we live ere"

Analysis of the results of the survey

2. What is your gender? Mark only one circle.

- Female
- Male
- Non-binary or other
- Prefer not to say

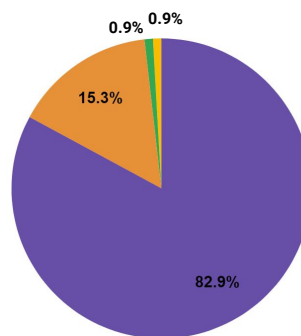


Figure 13:
gender
proportions
of sample

A comparatively high proportion of secondary schools in Ireland are still single-gender, compared to other EU countries. Of the five schools which participated in the survey, three were mixed-gender and two were all-girls, resulting in a considerably female-dominated sample.

3. Did you study Science or Geography for the Junior Certificate?

Mark only one circle.

- I studied both Science and Geography for Junior Certificate
- I studied Science for Junior Certificate (but not Geography)
- I studied Geography for Junior Certificate (but not Science)
- I did not study either of those subjects for Junior Certificate

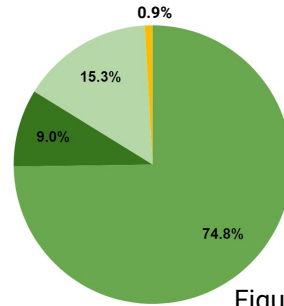


Figure 14

As expected, the majority of students studied both Science and Geography at Junior Certificate level. Many schools require either or both of these subjects, though they are not mandatory to the Junior Certificate. Only one student didn't do either subject.

4. If you studied Science, did you learn about Earth and Space Science in Science class?

Mark only one circle.

- Yes
- No
- I'm not sure
- I did not study Science

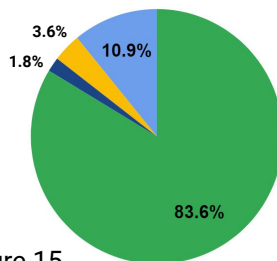


Figure 15

Of the three students who answered "I'm not sure", in fact, two had not studied Science at Junior Certificate. So only one student had studied Science but weren't sure if they had covered the topic.

5. If you studied Geography, did you do the composition of the Earth?

Mark only one circle.

- Yes
- No
- I'm not sure
- I did not study Geography

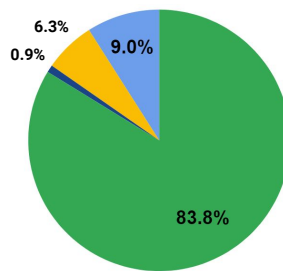


Figure 16

However, the students that answered "I'm not sure" to this question had indeed all done Geography. The CRAGs pointed out that the composition of the Earth was covered at the beginning of first year, in their Geography classes, while Earth and Space in Science was covered in the second term of third year. The survey targeted students at the beginning of 4th year. So it's likely that the somewhat higher proportion of students indicating uncertainty is due to them having forgotten exactly what was covered three years previously, reasonably enough.

**6. If you were going to describe what “Earth Science” is, what would you say?
Just use your own words.**

Barry’s answer started “I would say it is...” and Casey’s started “Earth Science is the study of...”

“Earth science is the study of the Earth.”

“Earth science is the study of what Earth is made of, how old the Earth is and whats inside of Earth. It is also about the oceans, atmosphere and fossil fuels.”

“I would say it is the study of how the earth is formed over time.”

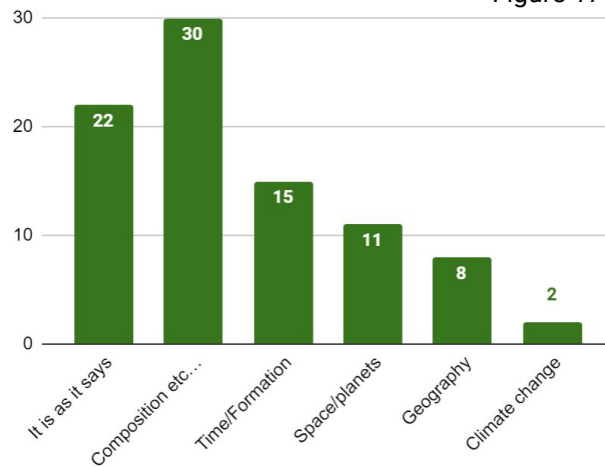
“Earth science is the observation of the general mechanics and composition (tectonic movements, layers, ect..) of the earth and other celestial bodies, like other planets.”

“its about learning about earth in a scientific way”

“studying about earth... its called EARTH science everyone has an idea that its about earth my 4 year old cousin probably knows that! stupid question.”

“I think earth science is,science based on the earth like what chemicals and gases are on the earth and what effects they have,maybe some stuff on global warming and what gases contribute to this.Maybe even how certain rocks break down due to chemical reactions. ;)”

Figure 17



Six themes have been identified in the definitions of Earth Science provided by the respondents. Only 60% of students (68) provided an answer to this question. Of those answers, 22 of them define “Earth Science” in a rather circular way, as the first example above.

The most common theme within the definitions is the idea of studying what the Earth is “made of”, so the composition, structure, chemistry, and formation of the Earth. Some of these composition-focused answers are quite specific and detailed, others are broad or straightforward. Almost half of the students who answered (30 students) refer in some way to these concepts, as in the second, third, and fourth examples above. Overlapping with these composition-focused answers, 15 answers specifically refer to the formation of the Earth over time, or how the Earth was formed, past tense. Another noticeable theme, perhaps due to the Junior Cycle Science grouping of “Earth And Space”, is the reference to other planets or celestial bodies or space itself. Several students (8) described Earth Science as being part of or synonymous to Geography. Only 2 of the respondents mentioned climate change or related terms (e.g. global warming, fossil fuel pollution) as part of their definition of Earth Science.

7. Are you interested in learning about the Earth? That includes the crust (rocks, volcanoes), the oceans, the atmosphere, fossils, what the Earth is made of and how old it is, the inside of the Earth, etc.

Check all that apply.

- Yes
- Some parts but not other parts
- No
- I'm not sure

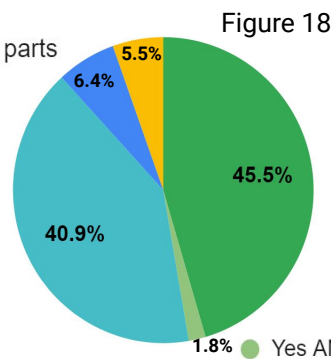


Figure 18

Hearteningly, almost half of respondents answered that they are interested in the learning about the Earth with no qualifiers, and a large majority (88.1%) are at least interested in learning about “some parts” of Earth Science.

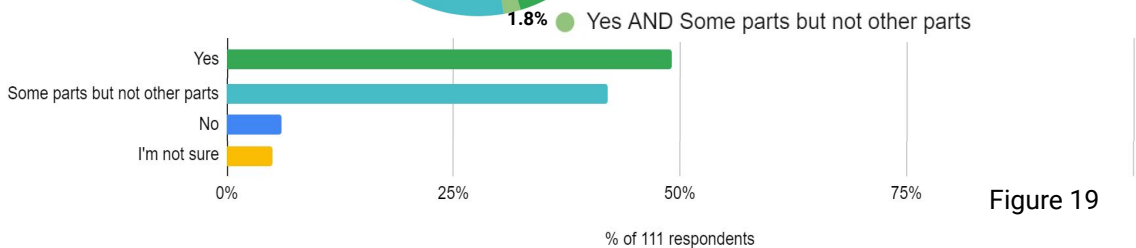


Figure 19

Since students could select multiple answers for this question and the next, along with the pie charts showing the proportion of students in each category of response, I have also provided bar charts showing the frequency of each response. Each student appears once in the pie chart, while each individual checked box appears once in the bar chart.

8. Do you feel it's important or useful to learn about the Earth?

Check all that apply.

- Yes
- Some parts are important but some parts are not important
- Some people need to learn about the Earth but it doesn't matter if most people don't know about it
- No
- I'm not sure
- Other

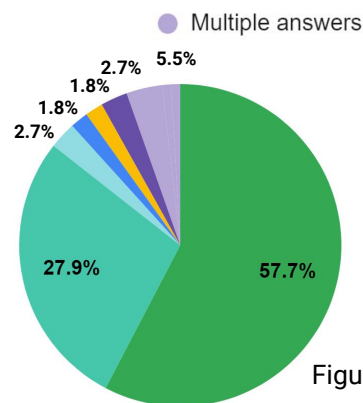


Figure 20

Almost all went on to say that learning about (at least some parts of) Earth Science is important or useful. More students (57.7% compared with 45.5%) gave an unqualified yes to this question, and almost all (just over 97%) gave at least qualified agreement. Only 4 respondents (3.6%) answered either “no” or “I’m not sure” to this question, 2 each, meaning the overwhelming majority of responses indicated some level of agreement. A further 3 students (2.7%) thought that only some people need to learn about Earth Science.

Cause we live here ~ Summary of Results & Analysis

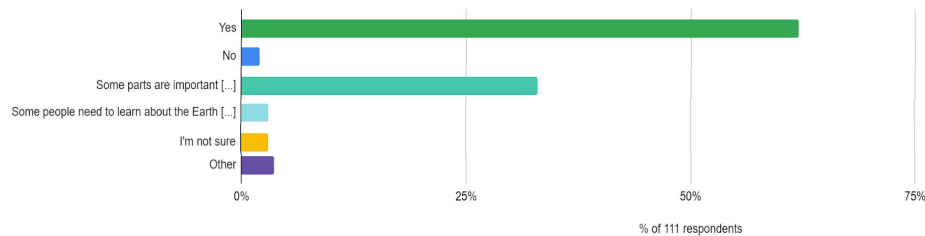


Figure 21

Most of the “other” answers were qualifying that at least some parts or some aspects are important. One of the “other” answers was simply “most things we learn in school are not necessary for every day life”, as a qualifier to an answer of “Some parts [...]” presumably to let me know that they would answer the same for other subjects.

Interestingly, it was not the same students who were not interested in learning about the Earth (answered “no” to Question 7) who indicated they didn’t believe it was important or useful to learn about the Earth (answered “no” to Question 8). This suggests that the questions were indeed taken separately, and students were not taking “interesting” and “important” as broadly interchangeable. This interpretation is backed by the CRAGs, who were confident both during the design of the survey and in discussing the results that students would do their best to differentiate between the two different concepts being explored here.

9. Why is it important or useful to learn about the Earth? Or why is it not important or not useful?

Ana wrote “It is important to learn about the Earth in order to take care of it”. Daire started off by saying “I think it is pretty important because...” and Casey started off by saying “I’m not sure if it’s useful because...”

“The simple answer to this question is that Earth is our home”

“We need to know how the earth functions and how we can take care of it, also the earth is beautiful why not learn about it”

“Learning about what we live on is important as there is currently a climate crisis happening educating students on the planet we live on is useful to help aid with tackling this crisis also it is just useful to know information about our home and our surroundings.”

“It is important to know more about the earth because it is our planet and we need to know how to take care of it just like how we need to know how to take care of our body”

“Cause we live ere”

A total of 99 respondents answered Question 9 - **“Why is it important or useful to learn about the Earth? Or why is it not important or not useful?”** - of which the vast majority indicated it is important or useful, as expected. Many of the answers were short and to-the-point, such as the final example on the previous page, but many others were fairly complex, expressing a balance of different themes and concepts. The second and third examples on the previous page both describe practical, action-focused reasons why it’s useful to learn about the Earth (“how we can take care of it” and “to help aid with tackling this crisis”) and also more philosophical reasons why they consider it to be important (“the earth is beautiful why not learn about it” and “information about our home”).

The answers divide into roughly 6 themes (two of which include sub-themes).

By far the most common theme in the answers, with almost 50% of answers touching on this, is the concept of “taking care of” or “looking after” or “protecting” the Earth, such as in the second and fourth examples on the previous page. Included within this theme is the sub-theme of the Earth being fragile or delicate, somehow in need of this care. And several students also specified that this care of the Earth is, or should be, undertaken for the sake of future generations.

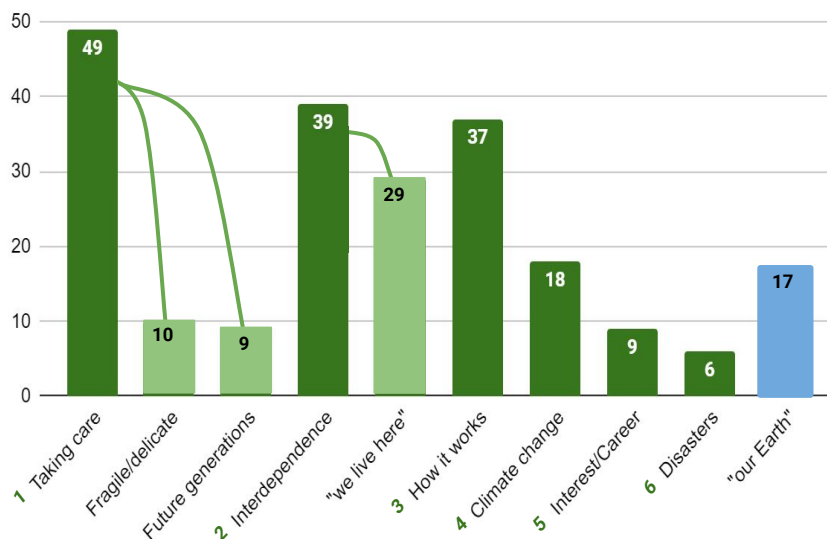


Figure 22: count of themes (dark green, numbered 1 - 6), sub-themes (pale green), and instances of language claiming the Earth/planet as “our” Earth/planet (blue) among student responses to Question 9

There is a possible bias in this question: one of the examples given for how to go about answering uses the phrase “in order to take care of it”. When designing the survey, the CRAGs and I wanted to include a full answer as one of the examples, to assure the respondents that a short, one-sentence answer is sufficient. We considered that to be more important than a potential bias, to encourage students to answer instead of being “overwhelmed” and skipping the question. Since 99 of 111 students answered, some with very short (but sharp and engaged!) answers, such as the below example, the follow-up CRAGs and I considered that to be successful.

“Cause we live ere”

The follow-up CRAGs who talked through these results with me were of the opinion that students wouldn’t write an opinion they didn’t actually hold, just because it was the example. They were confident that students would write what they believed. Respondents who used the phrase “take care” might be using that phrase (instead of “look after” or “be kind to” or similar phrases) because they just saw it written, but they wouldn’t express that idea just because they just read that idea. All the CRAGs agreed and emphasised that the example answers were useful and worth including, that they “help get your opinion out”, and a few people might copy-paste, but it’s worth it to be helpful, “especially for people with learning disabilities”.

The second most common theme is that of interdependence between human life and the Earth, such as humans relying on the Earth’s resources and the Earth being impacted by human behaviour. Within this theme, there is a significant sub-theme of “home”, mentioned in 29 of the 39 answers that described some kind of interdependent relationship. This was sometimes expressed formally (as in the example below) and sometimes very bluntly (as in the example above).

“The simple answer to this question is that Earth is our home”

Of note: of the 99 answers, 17 used the phrase “our Earth”, “our planet”, or “our home”, instead of “the Earth” or “the planet”. The example below uses a beautiful comparison to our bodies. During the follow-up CRAGs, students thought this kind of language indicated taking responsibility for Earth, and that “it’s theirs, not just there”.

“It is important to know more about the earth because it is our planet and we need to know how to take care of it just like how we need to know how to take care of our body”

Almost as prevalent as answers that discussed aspects of interdependence were answers that indicated it’s important or useful to know “how the Earth works”, that is, direct, concrete knowledge of Earth’s systems and processes.

Many, but not all, of these practical-focused answers overlapped with answers that mentioned climate change or related concepts. In all, climate change or related concepts were mentioned considerably more than in the previous open-box question on the definition of Earth Science, with 18 answers altogether discussing it in some form. During the discussion with the follow-up CRAG, it was suggested that young people would be more likely to give answers that said learning about Earth Science was important because of climate change than older people would, because young people feel like it affects them more. The CRAG thought that older people would see Earth Science “more like a side quest”, something worthwhile but optional, not part of the “main story”.

Several students mentioned, either as their whole answer or as part of their answer, that Earth Science might be useful to learn about for a future career, or simply because someone is interested in it.

A few students mentioned natural disasters (earthquakes, floods, etc.) as important to learn about, to keep people safe. These answers were quite general or global, which is understandable, as Ireland does not have many natural disasters (generally just the odd flood or storm event). Therefore, the answers focused more on humans in general learning about how disasters work to collectively manage them, rather than they themselves learning about local disasters to prepare on an individual or community level.

[no.] "because knowing how a volcanoes wont get me anywhere in life and it wont make me any smarter and wont get me a house"

"It is important to learn about the earth because we should be aware of the world around us. Learning about the earth, while important shouldn't be in 3 subjects: Geography, Science and CSPE."

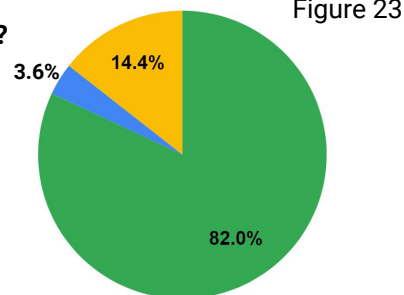
"I mean we need to know how to care for it but it does not have to learned in detail like it would be taught"

Only one respondent answered why it isn't important or useful to them (the first example above). But a few answers directed some criticism towards the way in which it is taught, generally that it is too detailed, too abstract, or appears in too many subjects. The follow-up CRAGs suggested that students didn't like covering the same or similar material with different teachers, especially "a subject that has a lot of opinions" like climate change, because if the teachers have different opinions or attitudes, it's confusing and "too much".

10. Do you pay attention to classes about the Earth?

Mark only one circle.

- Yes
- No
- I'm not sure



Very few (only 4) students answered that they do not pay attention to classes about the Earth. Interestingly, a fairly significant proportion answered that they were not sure. The CRAGs, during the design of the survey, were insistent that every direct (yes or no) question should also include an "I'm not sure", and that it should be that phrasing (as opposed to "I don't know") because it's softer and easier to admit. As mentioned before, the Earth Science topics in Geography are typically covered early in first year, so a suggestion was made during the follow-up CRAGs that perhaps the "not sure" students couldn't remember. However, only 2 of the 16 had done Geography only. Our leading theory during the CRAG was that "I'm not sure" covers a multitude: students who couldn't exactly remember, students who are interested in only certain topics, students who struggle to pay attention in any class, etc.

11. Which parts of Earth Science do you think are especially INTERESTING to learn about? (You can pick all of them or some of them or one of them or none of them. It's up to you! Pick any you think are very interesting or fun to learn about.)
Check all that apply.

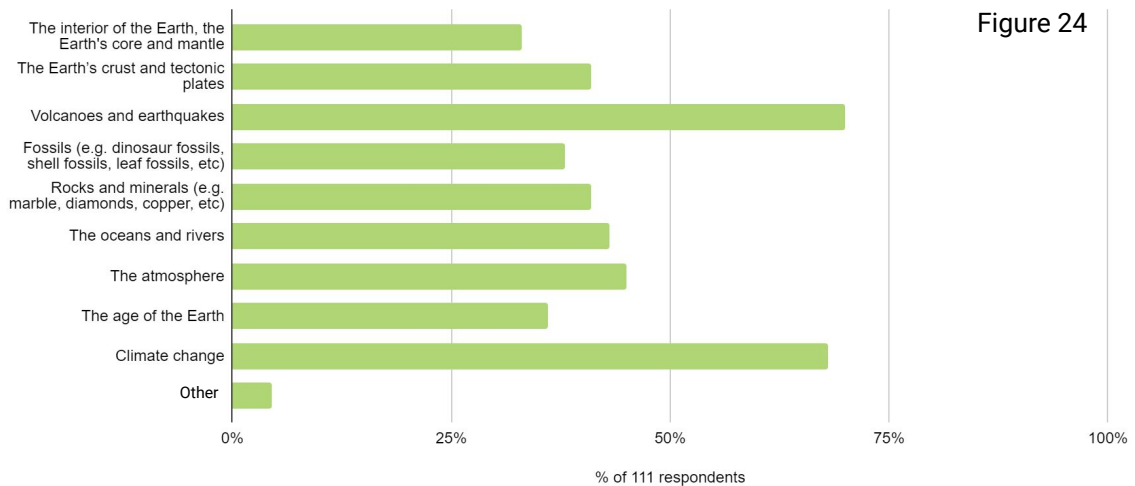


Figure 24

The first thing to jump out from this question, before I even compiled the lists fully to make the chart, is that if a given student only chose *one* item from this list, they were overwhelmingly likely to choose “Climate change” (over 8% of responses were climate change alone, no other topics indicated). This was the most common answer. The second most common answer, at just over 7%, was to choose all the options (except “Other”).

When the choices are compiled by frequency (bar chart above), it’s a close-run race but “Volcanoes and earthquakes” nudges ahead of “Climate change”, at 70% and 68% of respondents respectively. The rest of the suggested options cluster quite closely, with “The atmosphere” at 45% leading a fairly tight pack, and “The interior of the Earth [etc.]” just last at 33%.

Of the students who chose “Other”, one just wanted to say that while they only chose “Climate change”, that was because it was the “most interesting” and they did like the rest of it too. The other 4 input their own suggestions for areas they found most interesting, but only one (“soils”) was actually a topic that would be covered under any but the most meaninglessly broad definition of “Earth Science” (development, electricity, and natural selection). Still, as a science educator, it’s always enjoyable to see students expressing their interests and favourites!

12. Which parts of Earth Science do you think are especially IMPORTANT to learn about? (You can pick all of them or some of them or one of them or none of them. It's up to you! Pick any you think are important for students to learn about.)

Check all that apply.

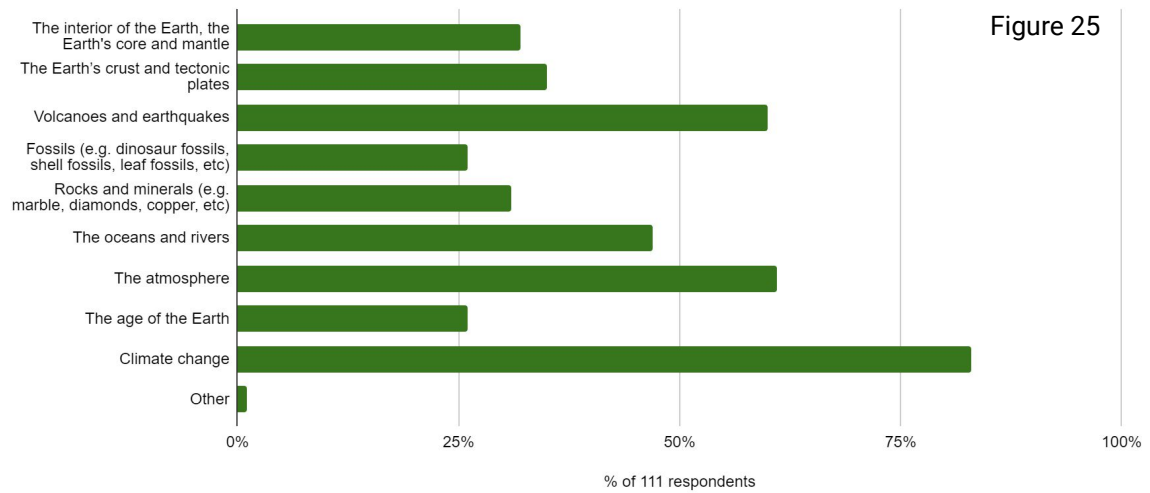


Figure 25

Even more so than the previous question, students who only chose one answer chose “Climate change”, and this was the single most common type of answer given. Just over 11% of students answered “climate change” alone. Again, the second most common answer was to click every option (except “other”), followed by the trio of options “volcanoes and earthquakes, the atmosphere, climate change” and the pair “the atmosphere, climate change”.

When the results are compiled by frequency, the dominance of “Climate change” is even more dramatic. This time, “The atmosphere” squeaks second place, a shade ahead of “Volcanoes and earthquakes”, at 61% and 60% respectively.

Only one student added their own answer (“study of population”), which is not something that would be covered under the classic definition of Earth Science.

More students felt climate change was important than found it interesting, which is certainly borne out in the written text answers. The high proportion of students choosing “The atmosphere” is unsurprising in this context; the atmosphere is the vehicle by which the climate is changing.

Overall, these answers are not surprising to me as an Earth Science educator. Climate change is a topic growing in recognition and urgency, particularly in this demographic. It is probably the rising sea-level (bleak pun intended) lifting the atmosphere's boat in importance in the eyes of teenagers. Meanwhile, everyone I teach, from preschoolers to pre-teachers, thinks volcanoes and earthquakes are the most interesting and fun topic. (I do confess I've wondered now and then if it's my own comparative lack of passion for fossils putting my students off, when the stereotype is that they should be so excited for dinosaurs, and they're never really *that* enthused. But fossils came lagging in the middle of the clustered pack in the "interesting" question, with no direct exposure to me!)

None of the CRAGs spent much time on these latter two questions, but certainly there was nothing particularly surprising to them either.

So, I would say these particular results are unsurprising, but heartening. Students are interested in a range of Earth Science topics, but most especially climate change.

13. Do you feel it's important or useful to learn about climate change in school?

Mark only one circle.

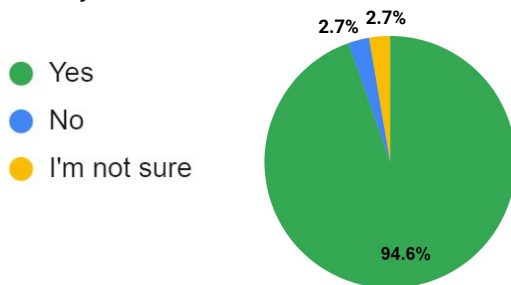


Figure 26

An agreement rate of almost 95% to this question tracks closely with the answers to the previous questions, and is unsurprising. The students in the CRAGs thought that, if anything, students would be even more supportive of climate change education than Earth Science generally.

14. Why is it important or useful to learn about climate change? Or why is it not important or not useful?

Daire wrote "It's important to learn about this so we can save the planet" and Barry wrote "It is important to learn about climate change because it is happening right now so we need to know more about it." Ana wrote "It's important but it's not useful like instead of teaching us how to prevent it they just teach us about it which basically defeats the point of learning about it if we can't stop it".

"THERE WILL BE NO POINT IN LEARNING ABOUT OTHER THINGS IN SCHOOL BECAUSE WE WILL NOT HAVE A PLANET TO LIVE ON"

"I think there should be at least one class a week dedicated to this topic to help get children and my peers informed"

"as especially recently we know that we have 12 years left till we can't do anything"

"reading from a book can only do so much"

"Because global warming is happening right now and it is affecting everybody no matter if you're rich or poor, young or old, male or female, gay or straight this is something that will affect us and our future generations"

"We must learn how to live eco-friendly and stop using fossil fuels and producing greenhouse gases in an effort to reduce carbon emissions."

"people can put pressure on the use of fossil fuels"

"It's not good enough to just listen to other people or hear it on the news we need to understand"

A total of 102 students gave an answer to this question, the most of any of the open-box questions. Again, almost all the respondents thought that it is important or useful to learn about climate change in school. Several students did give answers which were critical of some aspect of school-based climate change education, but no student indicated that climate change wasn't important. The last quote on the previous page is particularly striking. There is a genuine desire - expressed as a need by some students - to learn more about climate change; more information, more practical information, more political information, more in-depth information.

The most common theme in the answers, with 62 students' answers including this theme, is taking action, fixing or addressing climate change in a practical sense. Students believe it's important to learn about climate change in order to fix it, even that it is impossible to fix without learning about it (51 students frame things in this way). Several students (10) discuss the need for change, while others (6) refer back to the idea of "taking care" of the planet. Several (6) specifically mention wanting to do something practical in their own class or school to address climate change.

"It is important and useful because it is a major issue in today's world. But, we need to know more about what we can do to help, and perhaps do something about it as a class/school - maybe as a project?"

Another major theme is that of threat, that we need to "save the planet" (11 students use that exact phrase, while 29 allude to it in some way). Of these answers, slightly more (18 students, compared with 14) discuss the threat to the planet or to other life (animals, plants), as opposed to the threat to human life or human civilisation. It is clear that this topic is a significant concern or worry for many students, with some language used being quite dire and even morbid. The idea of the threat being "irreversible" or our actions already being "too late" came up in 14 answers.

"Because if not we will all die because the planet won't last"

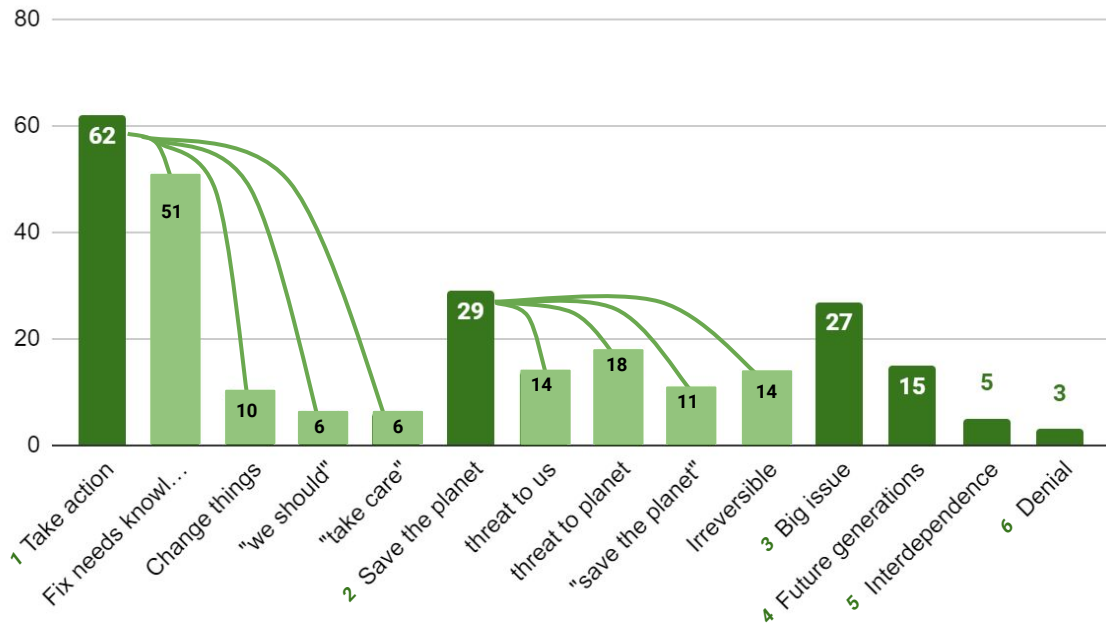


Figure 27: count of themes (dark green, numbered 1 - 6) and sub-themes (pale green) among student responses to Question 14

Almost as many (27 students) answered that it's important to learn about climate change because it's a big issue, that it's important to be informed about these things.

In 15 answers, students mentioned future generations (presumably of humans), and the concept of interdependence came up 5 times.

Only 3 students mentioned climate denial. This surprised me, but it didn't surprise the students who discussed these results with me in the follow-up CRAQ. They said that climate denial isn't discussed unless a particular teacher happens to consider it important. As far as these students are concerned, climate change is a fact not up for debate. The debate is how to manage it.

Uncertainty or lack of clarity or purpose is the main complaint from those students who used this opportunity to criticise climate change learning in schools. Several answers (6) were critical, such as the first example below, and the main theme of the criticism is that learning about this is in some way pointless, or too abstract. That students can't do much, and learning from a textbook isn't helping. Some of these students simply want to do more practical and solution-focused learning (which is also a theme that arises throughout the positive answers, under the broad theme discussed above of "taking action"). One student directly challenges the usefulness of learning about it at all, since teenagers aren't independent (second answer below). This student expresses the hopelessness and paralysis of learning through fear and guilt. Notably, this student doesn't at all argue that this isn't an important topic. In fact, its enormity is the problem, it seems too large and hopeless to address.

"A lot of teachers just teach us about it they don't tell us how to prevent it from happening."

"it really discourages you and makes it feel as though the earth is crumbling around us and that there's nothing we can do about it. It isn't useful, it's not like we actually do anything that has a major impact. To be honest, I'm really sick of hearing about climate change and how we should feel guilty. Why can't the countries that actually produce a mass amount of greenhouse gases do something instead of making non-independent young people learn about it."

A few students expressed strong opinions about climate change and climate activism generally, such as the quote below. The students discussing these results as part of the follow-up CRAAGs thought it was a good sign that students felt free to share their opinions, and that this student quoted above "has a good point anyway".

"but instead of blaming normal people they should put more of the blame on celebrities and people in power who preach about climate change but then go ahead and have their own private jets and yachts"

Throughout the answers to all three questions, there are occasional phrases or opinions that suggest to me that the student was thinking of someone or something in particular when they wrote their answer, without specifying what. None more so than this final quote, below.

"people who are not good at accepting change need to grow up and realize even the planet is changing and that is a bigger deal than someones relationship status"

The students who went through these results during the follow-up CRAGs all agreed quite confidently that these answers are generally typical of what they would expect to hear if they were discussing these topics - Earth Science and climate change - with their peers at school, or their friends of the same age.

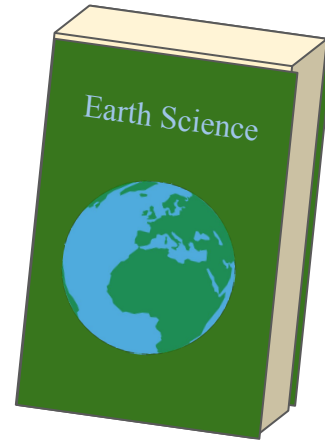
They thought the definitions of Earth Science "seem pretty good". One group suggested that they thought those students who had done Geography gave better answers to the definition of Earth Science than those who had only done Science or had done neither subject. I personally don't agree, but then, my conceptualisation of Earth Science is founded in my background as a geologist, and I consider Geography to be a related but separate subject.

The survey got more answers, and typically longer answers, to the second two open-box questions (Question 9. **Why is it important or useful to learn about the Earth? Or why is it not important or not useful?** and Question 14. **Why is it important or useful to learn about climate change? Or why is it not important or not useful?**) compared to the first one (Question 4. **If you were going to describe what "Earth Science" is, what would you say? Just use your own words.**) The CRAGs (both during survey design and in the follow-up discussions) said that students would be likely to be more nervous answering a "definition" question because "they'd be used to definitions being right or wrong". For that reason, we avoided the word "define" or "definition" in Question 4, but of course the students are well able to tell when they're being asked to define a concept as opposed to give an opinion.

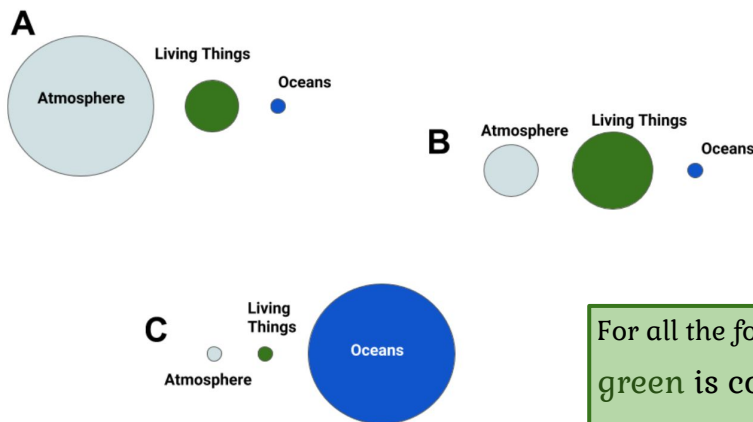
Something that came up in the discussions with the follow-up CRAGs is the topic of the School Strikes For Climate, Greta Thunberg, etc. The CRAGs were surprised that no one mentioned this, particularly as a significant number of students specifically mentioned that they wanted to do more actionable work on climate change.

Earth Science quiz questions!

These are some questions about things you might have learned about Earth Science. There are right and wrong answers for each question, but there's no marks or points. It's just to measure how many students have learned about these things.



Question 1



For all the following pie charts:
 green is correct
 blues are incorrect
 yellow is "I don't know"

Carbon is found in gases in the atmosphere; in the oceans; and in the tissues (bodies) of living things. Which of the above diagrams BEST represents the relative amount of carbon? A bigger circle means more carbon.

Mark only one circle.

- A
- B
- C
- I don't know

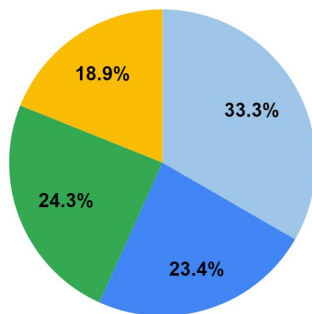


Figure 28

In retrospect, this was quite a difficult question to begin with. Less than a quarter of students got this right, and the students in the follow-up CRAIGs generally agreed this was medium to high difficulty. If I use this survey again, I will probably shuffle the order of these questions slightly.

Cause we live ere ~ Summary of Results & Analysis

Question 2



The map above shows the position of the Earth's continents and oceans today. The green areas represent land, and the blue represents water. Which of the following best explains why the oceans look the way they do?

Mark only one circle.

- Meteor impacts caused the oceans to form this way
- Continents moving caused the oceans to form this way
- The Earth cooling caused the ocean basins to form this way
- The Earth warming caused the ocean basins to form this way
- I don't know

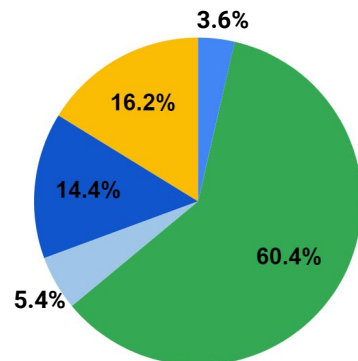


Figure 29

A majority of students got this question correct. Students were generally quite willing to use the "I don't know" button, which is more useful to see than guesses. Of course, it's impossible to know how many wrong (or right!) answers were random guesses.

Question 3: A light bulb converts electrical energy into light and heat energy. It is used to light a room for one hour, and then switched off. What has happened to the energy?

Mark only one circle.

- It changed to a different form but the total amount of energy stayed the same
- It doesn't exist anymore
- Some of the energy heated up the room slightly, but the total amount of energy is less
- I don't know

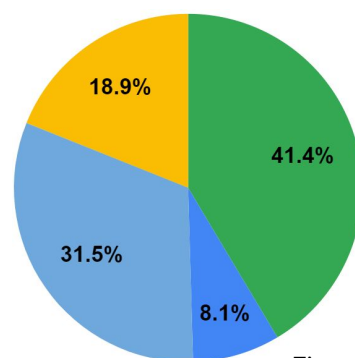
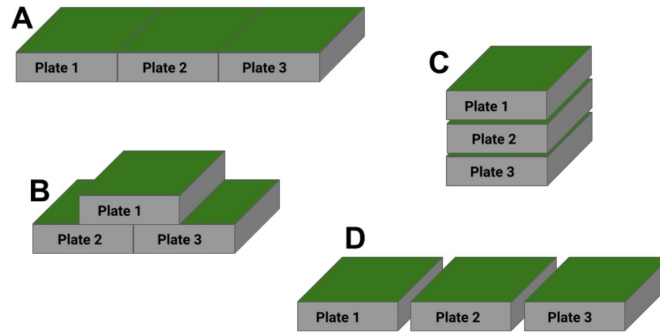


Figure 30

Students in the follow-up CRAQ discussions guessed that students who do Science will be more likely to get this question correct. Of the students who study Science, 43% got this question correct, while of the students who do not study Science (Geography only, or neither subject), only 28% got this question right. So perhaps the CRAQs' inference is correct, but as only 19 responses for this question come from students who do not study Science, it's hard to be completely confident.

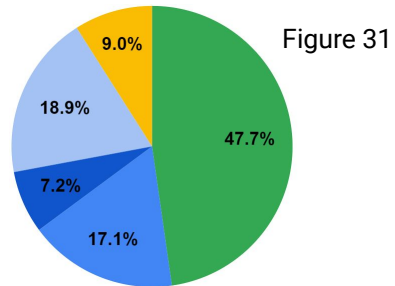
Question 4



Which of the diagrams represents how three of Earth's tectonic plates fit together?

Mark only one circle.

- A: touching one another
- B: some on top of others
- C: in a stack
- D: not touching one another
- I don't know



Almost half of students got this question right, which isn't too bad. One of the CRAGs looking at these results pointed out that in some school textbook diagrams of divergent plate boundaries, the plates are depicted more like D, potentially leading to confusion among students about how the plates actually work. They also said a question like this, asking for understanding of how the plates actually work, would "never be on an exam".

Question 5



The solid rock of the cliffs in the photograph is part of a continent. What is the relationship between the continent and the Earth's plates?

Mark only one circle.

- The continent is part of a plate.
- The continent is next to but is not part of a plate.
- The continent is on top of a layer of water that is above a plate.
- The continent is directly on top of a plate but is not part of the plate.
- I don't know

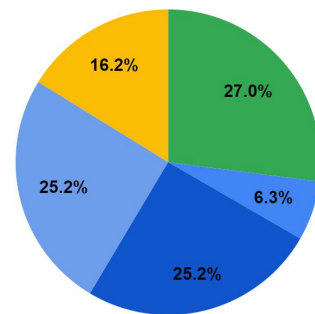


Figure 32

The distinction between continents and plates is something that anecdotally I have noticed is difficult for people to picture, perhaps because of the huge scale involved. More students got this right than chose any specific wrong answer, but overall, only a little over a quarter of students got it right. The opinion expressed in the CRAQs is that students “should get this question right”, but that many probably find it confusing.

Question 6: When fossil fuels are burned, carbon is added to the atmosphere. Where did that carbon originally come from?

Mark only one circle.

- It was created by burning the fossil fuels, it did not exist before
- It had been in the Earth, but it had never been in the atmosphere before
- It had been in the Earth, and before that it had been in the atmosphere a long time ago
- I don't know

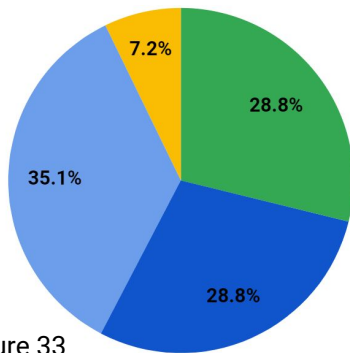
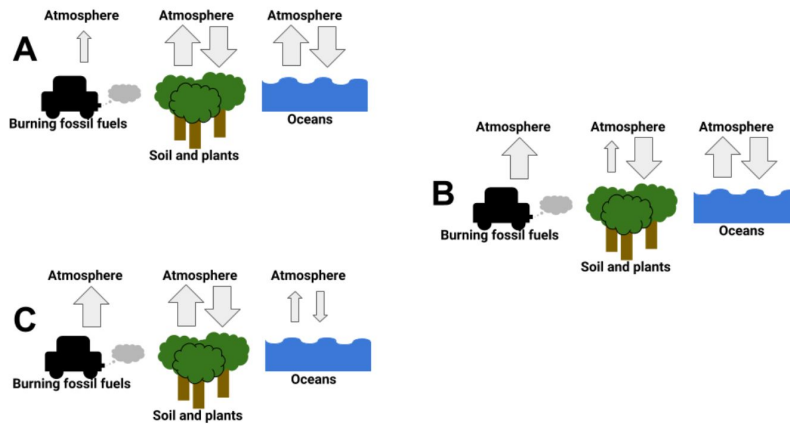


Figure 33

This is one of a few questions that really requires understanding of the carbon cycle, and while the concepts are familiar to the students and the rate of “I don’t know” answers is comparatively low, only about a third of students tend to get these questions right. In the discussions with the follow-up CRAgS, we talked about the likelihood that students have a strong association with carbon being added to the atmosphere when fossil fuels are burned, but haven’t been exposed to the concepts of where the fossils fuels come from in the first place. It was noted in the discussion that this question is possible to “logic out”, but only if you understand what fossils actually are.

Question 7



Which of the above diagrams BEST shows movement of carbon into and out of the atmosphere? The WIDER the arrow, the more carbon moves.
 Mark only one circle.

- A
- B
- C
- I don't know

Very few (only 7.3%) of students got this question right. Again, a thorough understanding of the carbon cycle is probably required. Furthermore, the students in the CRAgS pointed out that there is “an emphasis on qualification rather than quantification” in the Junior Cycle, and that they expected questions like these - asking for proportions or amounts - would be harder for students than questions asking for ideas or concepts. In general, this assumption has been borne out by the data, and the point is an insightful one.

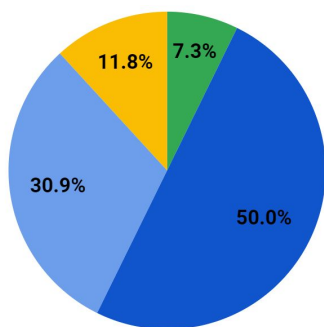
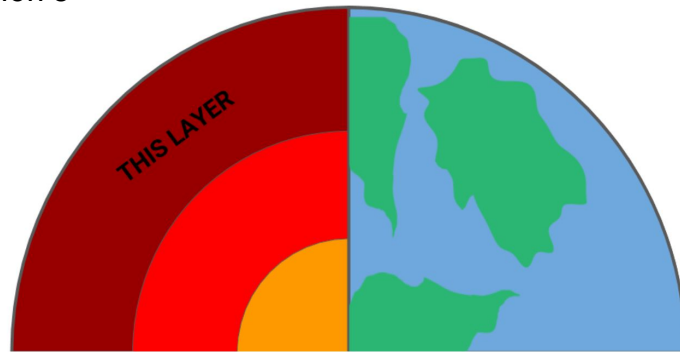


Figure 34

Question 8

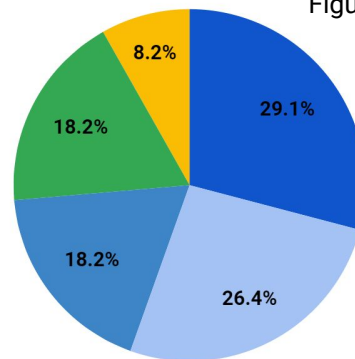


What is TRUE about the layer directly below the Earth's plates?

Mark only one circle.

- It is mostly solid rock.
- It is mostly liquid rock.
- It is mostly solid and liquid rock.
- It is mostly slightly softened rock.
- I don't know

Figure 35



I expected more students who got this question wrong to say “liquid rock”, as that misconception (that the mantle is essentially made of lava) is one I come across a lot in my work as an Earth Science communicator. The mantle is actually slightly softened rock, ductile over months and years, stiff but slightly mobile like toffee.

In fact, although more students thought that it was liquid than got the answer right (26.4% compared with 18.2%), even more students said that it is “mostly solid rock” (almost 30%). I could make the perhaps philosophically questionable observation that “mostly liquid rock” is *more wrong* (if there could be argued to be such a thing as more or less wrong) than “mostly solid rock”, even as “mostly slightly softened rock” is more right. In retrospect, I’m unsure about the validity of this question as it is actually perfectly reasonable for a person to describe “slightly softened” solid as “mostly solid”. The word “mostly” holds an ambiguous role in the answers: most of it is rock, which is solid? Or the rock which it is made of is only *mostly* solid?

Question 9: How much of the atmosphere is made of greenhouse gases (gases that make the Earth warmer)?

Mark only one circle.

- More than 30%
- Between 5% and 30%
- Less than 5%
- I don't know

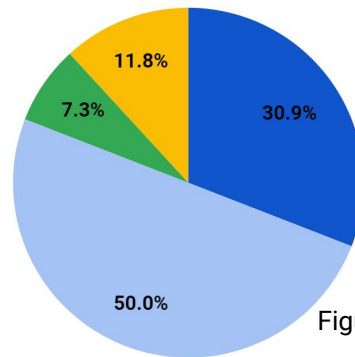
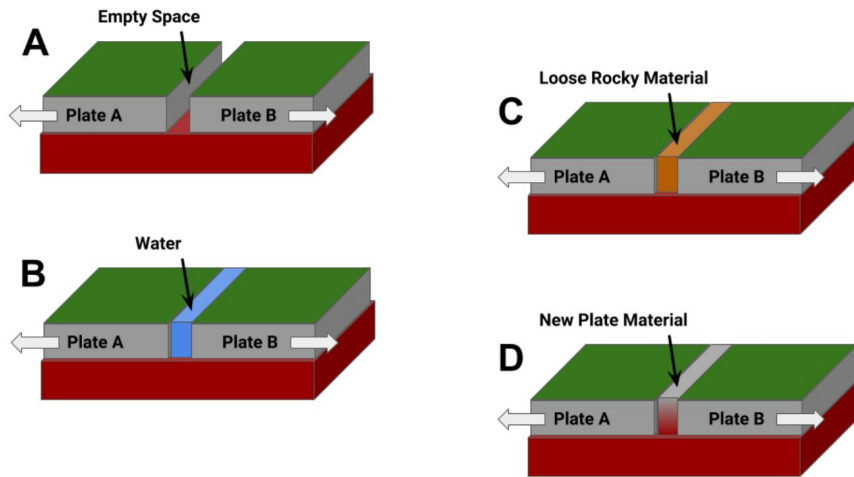


Figure 36

This is another question that relies on students having a good understanding not just of the concepts but of the amounts or proportions. This question is easy if you know a few facts about atmospheric composition, for example, if you know that Nitrogen makes up 78% of the atmosphere and Oxygen 21%, that obviously doesn't leave more than 1%. Or if you know that Carbon Dioxide is the proportionally largest of the greenhouse gases, but only makes up 0.037% of the atmosphere. Neither I nor the students in the CRAGs were surprised that very few students got this question correct.

Question 10



The diagrams above show a plate boundary where two of the earth's plates are continuously pulling apart. Which diagram is correct?

Mark only one circle.

- A. As the plates pull apart, an empty space forms between them that gets wider over time.
- B. As the plates pull apart, water immediately fills the empty space between them.
- C. As the plates pull apart, loose rock material immediately fills the empty space between them.
- D. As the plates pull apart, new plate material immediately forms between them, so there is no empty space.
- I don't know

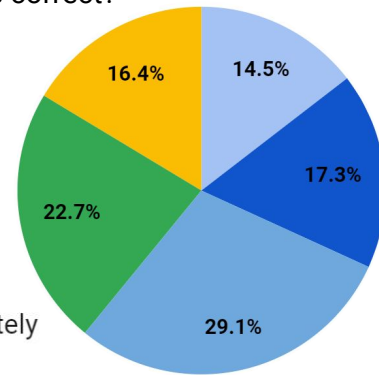


Figure 37

Cause we live here ~ Summary of Results & Analysis

The discussion with the follow-up CRAGs highlighted two aspects of this question where students may have been tripped up. One was the use of the word “immediately”, which is “difficult to imagine what it looks like”. The other is, as in Question 2, the diagram with the gap between the two plates (A) is not dissimilar to diagrams used to describe divergent plate boundaries, while the diagram with the water between the two plates (B) is reminiscent of the diagrams showing the opening or formation of oceans. However, around twice as many students chose C (filled with loose rocky material) compared with either A or B (29.1% compared to 14.5% and 17.3%). I suspect that some students haven't made the connection that “new plate material” is lava hardening to new solid rock, and therefore that a question that used that phrasing would be easier for them to answer, but that's just a guess.

Question 11



This is a photo of rocks and minerals on display in a museum. Are rocks and minerals alive?

Mark only one circle.

- Yes, rocks and minerals grow
- Yes, rocks are made up of minerals
- Yes, rocks and minerals are always changing
- No, rocks and minerals do not reproduce
- No, rocks and minerals are not made up of atoms
- I don't know

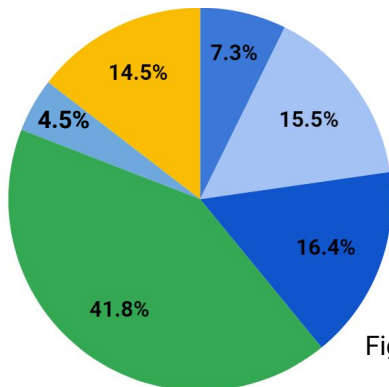


Figure 38

This is one of the few questions where the CRAgS working on the design of the survey differed significantly in opinion to the CRAgS who discussed the results with me. The former liked this question, they thought it was interesting and they immediately zoned in on any questions in the longlist that had photos or diagrams. They liked this photo. The latter thought this question was “weird” and “kinda confusing”. I’m inclined to agree with both! I do like the photo, to break up the quiz a little, but the double-answer (“no” AND “they do not reproduce”) is a little tricky. A minority of students (almost 42%) got this question right, but a larger minority than any of the other answers.

Question 12: Ice and snow are white and reflect the Sun's rays, but the ground underneath is usually dark and absorbs the Sun's rays. When the climate gets warmer, snow and ice melt. How will that affect the climate?
Mark only one circle.

- It will get warmer even faster, it will increase the rate of warming
- It will still keep getting warmer, but more slowly
- It won't have any effect, it will keep the rate of warming the same
- I don't know

The students who discussed these results pointed out that in fact, a careful reading of this question would allow them to figure out the answer. Almost 50% of respondents got this question right, but a relatively high proportion of respondents answered "I don't know" at just over 20%. During the follow-up CRAIGs, a few students pointed out that it's likely people would go through the quiz quite quickly, especially if they thought they could do something else on the computer if they finished early. On the one hand, perhaps more people would have gotten questions like this one correct if they took more time to think about them, but on the other hand, since I am trying to measure understanding of geoscientific concepts, and not trying to measure their ability to enact logical deduction, their quick yes-or-no reaction to the question might be more valuable anyway.

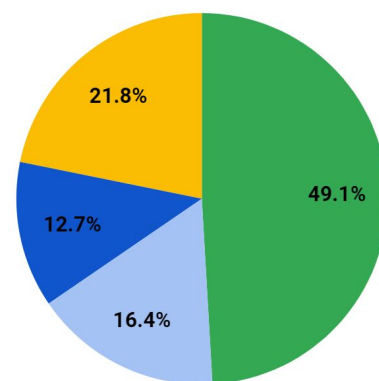
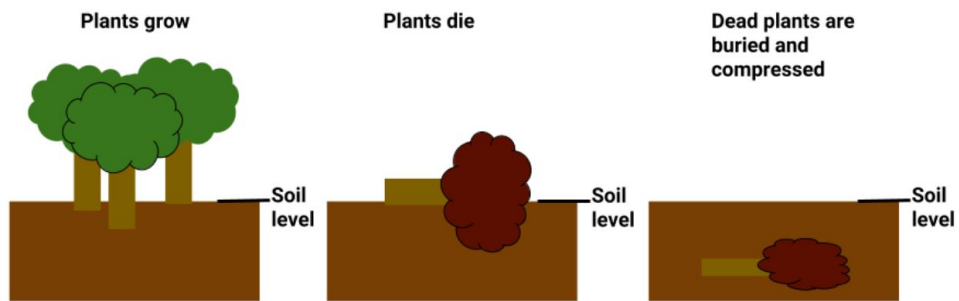


Figure 39

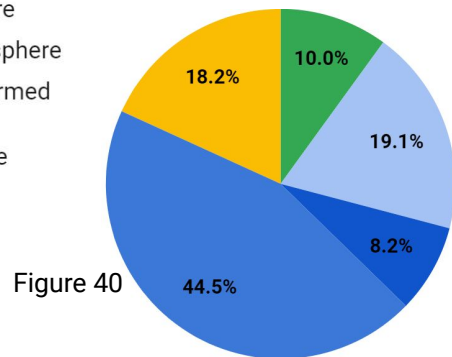
Question 13



The diagram above shows how fossil fuels are formed. What effect did this process have on the amount of carbon in the atmosphere?

Mark only one circle.

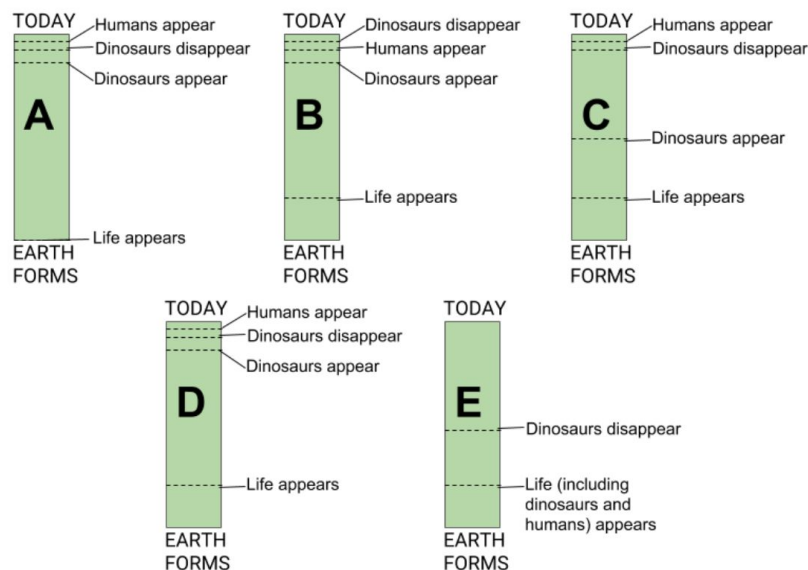
- It decreased the amount of carbon in the atmosphere
- It did not change the amount of carbon in the atmosphere
- The fossil fuels were formed when the Earth was formed and it didn't yet have an atmosphere
- It increased the amount of carbon in the atmosphere
- I don't know



Very few respondents got this question correct, just 10%. Almost twice as many answered “I don’t know”. The students in the CRAGs said this question was worded very differently than the kind of questions they usually see in school. Again, I suspect there’s such a strong association for students between “fossil fuels” and “amount of carbon in the atmosphere increasing”, without necessarily a deep understanding of the carbon cycle, particularly the very long, slow processes involved in the formation of fossil fuels. The geological timescale is a challenge for people...

... as evidenced by this question. Just about a quarter got this question right, which means almost 75% of students couldn't identify the correct order and relative age of events in the geological history of the Earth. The most common mistake was "C", showing the dinosaurs as appearing much sooner than in reality, but again, if I can be excused the idea of wrong answers being "more wrong" or "less wrong", I'm of the opinion that column C is "less wrong" than, for example, B showing humans and dinosaurs coexisting (which was the least-chosen answer among respondents, at only 8.2%). The CRAGs pointed out there's no way to work this one out logically by reading carefully, but it should be easy to narrow down your options if you know a few useful facts.

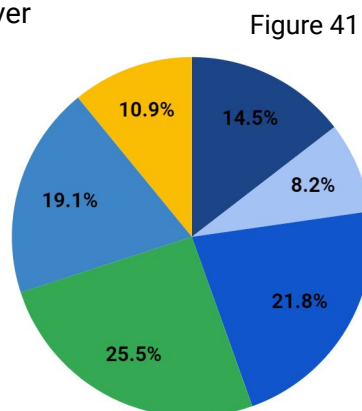
Question 14



Which of the figures above do you think most closely represents changes in life on Earth over time?

Mark only one circle.

- A
- B
- C
- D
- E
- I don't know



Question 15: Carbon dioxide can dissolve in water, for example, in the oceans. Warm water dissolves less carbon dioxide than cold water. When the climate gets warmer, the oceans will get warmer. What effect will this have on global warming?

Mark only one circle.

- It will make the warming worse, the climate will get hotter faster
- It will slow the warming down, the climate will get hotter more slowly
- It won't have any effect, it will keep the rate of warming the same
- I don't know

Just over half of respondents correctly identified the vicious cycle in this question, and again, the students in the follow-up CRAGs pointed out that this is a question you can work out if you read it carefully. It also lends itself to the impression a lot of school students seem to have about climate change, that it's getting worse as it gets worse. A fairly high proportion still answered "I don't know".

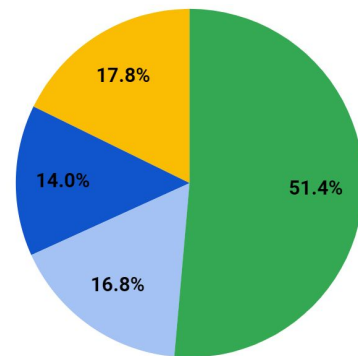


Figure 42

Overall, on average, 31.3% of answers were correct. Question 2 had the highest proportion of right answers, a shade over 60%, while Question 7 and Question 9 were equally "hardest", with only 7.2% of students getting either question right. Interestingly, these latter two questions also shared the same number of "I don't know" answers at 11.8% each, which is under the average for "I don't know" answers. Both of these questions are about the amounts of carbon in the atmosphere, identified during the follow-up CRAGs as particularly difficult to answer based on Junior Cycle knowledge. In general, "I don't know" answers made up 14.5% of answers, and were predictably much less variable, only ranging between 8.1% on Question 8 (for the composition of the mantle) and 21.8% on Question 12 (for the albedo effect of the sun's rays hitting snow vs ground).

One student got 12 of 15 questions correct, the highest number, and one student submitted 0 correct answers, but simply selected “I don’t know” to every question. Of course it’s impossible to tell, but it seems more likely they just skimmed through the questions hitting “I don’t know” than tried and failed. Four students got all but one question wrong (each a different right answer). The average student got only four questions right.

No students skipped the quiz questions entirely, but one stopped answering after the first few questions, and a couple more skipped the last question.

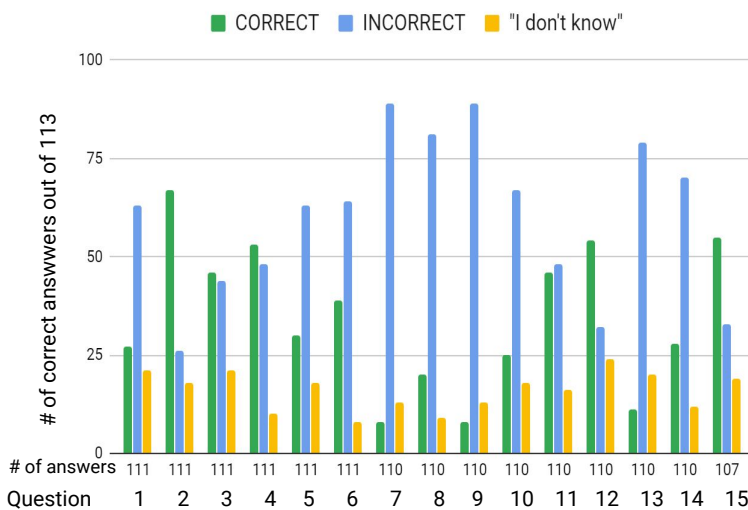


Figure 43: Bar chart of correct, incorrect, and “I don’t know” answers for each question. The number (111 to 107) under each group is the number of responses to each questions. The questions appear in order, from Question 1 on the far left through to Question 15.

Cause we live here ~ Summary of Results & Analysis

During the follow-up CRAQs to discuss these results, students touched on a criticism also alluded to in the answers respondents to the survey gave in the open-box questions; these geoscience concepts are not necessarily integrated when being taught. For example, students are taught about the composition of the atmosphere, and then separately taught about carbon being released into the atmosphere from the burning of fossil fuels. Or, students are taught about continents moving, and also taught about tectonic plates, and also taught about earthquakes in fault zones, but not necessarily guided to integrate those concepts together in a way that makes sense to them. Obviously this is something that comes down very much to the teacher in the classroom, and probably how clearly *they* conceptualise these concepts. I would be very interested in giving this quiz to a group of Junior Cycle Science and Geography teachers.

EEN: So I think that's everything, that's all the stuff I wanted to ask, um, but if there's any parts you want to go back to, or if you want to talk about it more, I'm really happy to stay on and chat and go through whatever. But it's been... oh wow, well over an hour! So I don't want to take up your whole afternoon. I mean, we're basically all stuck at home anyway, right? But if you need to go, go ahead.

NG: Cool, thanks.

JOC: Thanks, it's interesting. Can we, like, find out what happens next or?

EEN: Oh! Yeah so I'm writing this up, and when I'm finished, yeah, definitely, I think I'll probably just email it to everyone--

ÚD: Yeah, I want to know!

EEN: Great! Yeah, a few people have asked to hear about it, so I'll just email the whole thing to everyone but like, seriously, it's long and it'll probably be pretty boring in places so you definitely *definitely* do not have to read it if you don't want to! But I'll just send it to everyone who helped at all because I don't want to leave anyone out.

JOC: Oh cool, sure.

ÚD: Thanks!

CW: Yeah, thanks.

EEN: And yeah, if anyone's interested in this stuff? Next year, my research group... So at Trinity there's a group of us who study all science education stuff, like education in schools and also in things like museums and that kind of thing, and my area specifically is this, Earth Science and climate

change education. And we'll be doing more of this kind of thing next academic year, so if anyone's interested, um, well I'll definitely be in touch with Ms McMuinteoir again and hopefully if any of ye would like to, you could do another discussion group? Or maybe similar stuff. It'd be great to have you do more, and maybe if schools get to open properly I can come and visit in person, or else we can do it online again like this.

NG: I'd definitely like to.

ÚD: Yeah it's interesting, I kinda like seeing how this stuff works!

JOC: I think it's a really important topic?

CW: Is it going to be like the same as this one?

EEN: Well, yeah probably pretty similar, but not exactly the same. This specific one is being finished up now because it's my PhD, like I said at the start, and my PhD is almost over, I'm finishing next month! So it won't be this exactly, it'll be similar.

ÚD: Good luck!

EEN: Ha, thank you! It's a bit scary trying to get all this work done but I think it's a really important topic too. And I want to do more work on this stuff, so like one of the things I really want to do is some international comparisons? Maybe looking at how Ireland teaches about Earth Science and climate change and then comparing it to other countries, so for example like, France or Japan or Scotland, like some countries that are similar to Ireland and some countries that are very different. Or that have some things similar but other things different. And then we could learn from each other.

CW: That'd be cool.

NG: Yeah I'd like that, I'd do that.

EEN: Okay well I'll definitely be in touch with Ms McMuinteoir so I really hope we'll get to chat again! We might be making more surveys and things and I think designing the survey is a really fun part, so that'll probably be one of the first things.

ÚD: Thanks!

NG: Thanks, it was nice to have something to do today.

CW: Yeah I'm pretty bored with the pandemic like.

JOC: I'm gonna go now but, like, I took some notes? Do you want me to send them to you or?

EEN: Oh definitely, yes please, if anyone has any notes, or like I said, if you think of something later and you're like, oh damn I should've said that, just email me. Or text, or whatever suits. I'll take my own notes from it and delete it.

NG: Cool I'll send you my notes here. It's not very much.

EEN: Literally, whatever you have is really helpful, thanks so much!

CW: I'll send you what I wrote down too.

JOC: Bye, thanks!

NG: See you, thanks for this.

ÚD: Um would it be okay if I asked you about like, studying science at college?

EEN: Yeah of course! Anyone who has to go, feel free to log out, and thanks again! I'll stay online for a bit, if anyone has any questions about this stuff, or things like studying at college, or whatever, I'd be really happy to answer!

Finally finished the CRAGs and into the very last phase of the project. Feels a bit surreal.

I am disappointed things were so slow and fragmented over the last year. Between the baby and the pandemic, things have been very difficult. I have been trying since the beginning of the PhD to get used to the idea that there's no such thing as a perfect PhD, that setbacks and obstacles are useful learning experiences, and that the important thing is to finish the PhD to be able to move on to do other things. It's still something I'm struggling with really accepting!

I "should" have done the follow-up CRAGs in January/February, in retrospect. But on the other hand, if I had been faster, given up on additional recruitment to the survey sooner, and pushed to get back to schools asap after Christmas, I wouldn't have learned anything about doing online discussion groups. It wasn't possible to do online discussion groups with my original ethics (it wasn't even an option when I was submitting that first ethical application!) and I really did not want to. I resisted the idea even as I clearly saw the pandemic coming to swallow so many other things whole. I would have so preferred to have been really quick and organised and got the CRAGs done early in 2020! It would have been more fun and rewarding. I love going to schools, the early CRAGs were probably the most enjoyable part of the whole project. Meanwhile, the online CRAGs were awkward and draining. They were stressful and imperfect to set up. The students were considerably more reticent to share any opinions; it took ages to get into it. I felt completely wiped out after every one. But, now I can say that I have experience running discussion groups with teenagers in schools *and* online. I can say that I can convene a discussion group over Microsoft Teams. I can say I've learned how to get students' opinions even when it's not possible to meet them in person and make those connections face-to-face. That's really valuable.

(This isn't even what I set out to write today in this journal, this is me figuring this out. This is me telling myself. I often forget to write these journal entries, but when I do, they're also really valuable!)

So, was it "worth it"? I reject that question when people ask it about these kinds of things. I didn't, wouldn't, literally couldn't, choose a pandemic or influence when or how a global catastrophe plays out. Whether or not something is "worth it" is only meaningful if the cost was something you chose to pay. I can't separate the "choice" of doing online CRAGs from the bizarre and unprecedented circumstances that led me to "choose" them. The only other "choice" at that point would have been to interpret the data without student input, which I would have considered to be a breach of my principles as a researcher. It is what it is, and I did what I could.

> Women in Academia Support Network

> New posts



Emma Esme Hudson Doyle

18 July 2020 at 02:42

Hello WIASN! I thought we could start a thread on researcher anxiety and how people managed. A number of students get very anxious about collecting qualitative data: interviews, focus groups, etc., and I'd love to build a list of strategies etc. that I could share with them. I know myself, if I haven't collected data in a while, I can sometimes get anxious too: how will I recruit? Will I make a fool of myself? What if I don't get enough participants? What if there is no interview rapport? What if I lose track of the interview thread? Etc., etc. So I thought it could be useful to have a thread where we acknowledge our anxieties, and how to manage them? I'd love to be able to provide more useful pointers to students than "write down what's worrying you" (which is what I do). 😊



Emily Ellis-Neenan

18 July 2020 at 10:49

I've just finished doing a series of discussion groups with teenagers for my PhD, and I have a lot of anxiety, so here's what I'm using to manage that:

1) Always, with any anxiety, have people to talk to who are good at listening to my worries and talking me down when necessary! My supervisor is very encouraging, and my mother, partner, and best friend have been really kind (and patient!) in listening to me. Shoutout to [Kathryn](#) <3

2) Also with any anxiety, have some simple coping/grounding techniques to pull on. Best if you've practised them while not actively anxious! I use slow breathing and the 54321 grounding technique (focus in turn on 5 things you can see, 4 things you can touch, 3 things you can hear, 2 things you can smell, and 1 thing you can taste).

3) Be as organised as possible. I fell down on this and it made things worse. Plan out your dates, make a list of what you need, try to complete any instruments in advance, get feedback on them, and get yourself really comfortable with what you're going to use, and how, and when.

4) Take the day. I dunno about anything else but discussion groups with teenagers are DRAINING. I don't schedule anything else except a quick email catch-up on those days. They're not writing days, or data days, or long days, or even full days. I get set up, review things, do the discussion group, jot down any notes, and then I do a last email check just for anything urgent, and take the rest of the day off.

5) Pilot/practice. It was really helpful to do just a log-in fake meeting with my supervisor and colleague to make sure the platform was working (obviously doing these discussion groups remotely at the moment). And the first one I scheduled was a small group that I didn't need anything specific or vital from, so it acted as a pilot version, to make sure it worked and see how long it took to go through the basics with them.

6) This one's maybe a bit vague, but self-reflection. I thought deliberately about my persona and how I wanted to come across, bearing my methodology in mind. My methodology is grounded in feminism and children's rights so, for example, I made the deliberate decision to watch myself for using "teacher voice" with the teenagers and to let myself use "unprofessional" slang and (mild) curse words because I wanted to keep a vibe of a conversation, not a classroom. Doing that self-reflective work made me more confident in how I would manage the discussion.

7) "I'm learning, and mistakes are part of learning". I struggle SO much with this but I try to tell myself, if I have a "bad" discussion group that's good, because that's maybe not going to teach me much about teenagers' attitudes to climate change but it's going to teach me LOTS about How To Do Discussion Groups and that's really important and useful. Especially as I'm still a student.

... Oh dear. Sorry for the essay!!! I hope it's helpful to someone!

👍 10



Emily Ellis-Neenan

18 July 2020 at 10:50

Oh hey! I'm writing my thesis as an epistolary with emails, articles, journal excerpts, etc, and social media posts. I'm totally going to put my essay here straight into my thesis!!

👍 4

Attitudes Towards Earth Science And Climate Change Among 15 Year Olds In Ireland

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Here we present an analysis of a study measuring attitudes towards Earth

Science and climate change topics among Irish school students in their early teens, and also their understanding of key Earth Science and climate change concepts. A survey was co-designed with discussion groups of students representative of the demographic, and the results were also co-analysed in this discussion format. Our results confirm that Irish second-level students are highly interested in Earth Science, and particularly climate change, and that they consider the topics important and useful to study at school.

However, we also find that many students struggle with the actual concepts underpinning these topics. Our results suggest that there is scope to further develop and expand the place of Earth Science, particularly climate change and related topics, in the formal education environment. Furthermore, the methodology used in this research has considerable potential to be developed further to incorporate student voice in future research, development of interventions, and curriculum design. Students are engaged and emotional about the threat of climate change, and many feel worried or powerless. As researchers, educators, and policymakers, adults have a responsibility to lift up and listen to their voices.

Introduction

Earth Science is a key sector in both education and the economy, particularly in light of the growing threat of irreversible and catastrophic climate change. There is a shortage of students studying Earth Science and related subjects at third-level (Sherman-Morris & McNeal, 2016 [1]), and in particular, there is a gender disparity, with the loss of women in the field, particularly at post-doc level and beyond (Holmes et al, 2015 [2]). At junior second-level in the formal education system (approximate ages 12 - 15 years), students are becoming more independent, engaging in topics on deeper levels, and beginning to consider their priorities and goals for their future studies and careers. This is a crucial juncture for student engagement with the Earth Sciences, and with topics related to climate change. For a full overview of the background to this study, see Neenan & Roche, 2016 [3].

This investigation was carried out over the 2018/2019 and 2019/2020 school years, targeting students just after the Junior Certificate State examination taken by most students around 15 years of age. The survey used in this project was co-designed with two groups of students (one group of six and one group of eight), at two different schools, one school in the capital city and one in a regional town. These Children's Research Advisory Groups (CRAGs) contributed significantly to the project design. The respondents to the survey had recently completed the Junior Cycle, consisting of the first three years of second-level education, ending in a formal State examination, the Junior Certificate. A total of 111 students across 5 schools responded to the survey. The results were co-analysed with four CRAGs, representing four different schools (via online video-conference, due to the COVID-19 pandemic). The survey broadly divides

into two sections; the first asks students' opinions and thoughts on Earth Science and climate change, and the second presents a series of 15 questions adapted from the Geoscience Concept Inventory (Libarkin & Anderson, 2006 [4]) and Climate Change Concept Inventory (Jarrett & Takacs, 2020 [5]) intending to measure students' understanding of key concepts related to Earth Science and climate change. For further discussion of the work with student co-researchers, see Neenan et al, 2020 [6].

Teen Attitudes Towards Earth Science And Climate Change

This research confirms that Irish second-level students are particularly engaged on the topic of climate change, and are interested in Earth Science generally. 88.1% of students are interested in learning at least “some parts” of Earth Science, with 97.3% of students giving at least qualified agreement that Earth Science is “important or useful”. A large proportion in both cases (47.3% and 57.7%) gave unqualified, direct agreement. On the topic of climate change specifically, 94.6% of students agreed that it was important or useful to learn about. This survey was conducted in general classes; therefore, the results are not particular to students involved in climate activism or other environmental-focused concerns.

Respondents were asked to provide feedback or explanation for their answers in open text fields. Data generated thusly was coded separately by three researchers working independently, and a high degree of intercoder reliability was achieved (Lombard et al, 2002 [7]). Several students took the opportunity to criticise the provision of climate change material in the formal education system in Ireland. The most common criticism from students is that there isn't a strong

enough focus on action in their classes on climate change. For some students, this is a relatively gentle criticism; they enjoy the classes and want to learn more. For others, it's born of frustration; they feel the classes are pointless, that they have little power or autonomy, that climate change isn't their fault, so why make them feel scared and guilty about it when they aren't the ones causing it? These data make a strong case that policymakers and teachers must consider the students' emotional responses to this topic, which they view as much more of a threat to them than it is to the age-group of people currently setting national policy. A further criticism from several students is that they don't like it being covered in three different classes (it is a topic in Junior Cycle subjects Science, Geography, and Civic Social and Political Education). Even those students who did not find the topics interesting, or who provided incisive criticism of the provision of these topics in the formal education system, tended to agree that the topics are important.

Teen Conceptual Understanding On Key Topics

Fifteen "concept questions" were selected, adapted from the Geoscience Concept Inventory and Climate Change Concept Inventory, in order to measure student understanding of key Earth Science and climate change topics. The students found the concept questions challenging, with no student getting more than 12 of 15 questions correct, and the average percentage of correct answers to a question only 31.3%, and ranging between 60.4% for the "easiest" question and 7.2% for the "hardest". "I don't know" answers made up 14.5% of answers, and were much less variable, ranging between 8.1% for the "most certain" question and 21.8% for the "least certain" question. The average of correct answers to a set

of 15 questions was only 4. While it would be unrealistic to expect students to get all these questions right, particularly those that pertained to concepts the students may not have covered in depth, the low rate of correct answers even on topics such as the tectonic plates, divergent plate boundaries, and fossil fuel origins, suggests that more could be done to build a solid understanding of Earth Science concepts in junior secondary school students.

Demographic Considerations

In terms of demographics, the sample included significantly more female students than male students (82.9% to 15.3%) and one non-binary or other student.

There were no noticeable differences between the genders in the language used in the answers to the open text box questions. Like the bulk of the survey responses, the responses from male students ranged from short and straightforward to fairly long and detailed. Male students were just as likely as female students to use “caring” language (“take care of the Earth”, the Earth is “fragile”, etc.) and to use “our” when referring to the Earth (e.g. “our planet”). Several of the minor trends were absent from the male students’ answers, but none of the major trends. Further research is necessary to confirm this finding, but it is unlikely that there are major differences in the kinds of answers female, male, and other students would give, if a larger sample were to respond, based on these data.

In terms of the conceptual questions, of the students who got more than half the questions correct (13 students of 111), 8 are girls, 3 are boys, 1 is non-binary or other, and 1 preferred not to indicate their gender. Therefore, the proportion of boys in this group is 23.1%. Of the students who came in under the

average, with fewer than 4 correct answers (35 students), 30 are girls and 5 are boys, with a proportion of boys of 14.3%. The presence of the non-binary student and the student who did not disclose their gender in the top-scoring group makes it impossible to say whether the slight increase in boys compared to girls in the top-scoring group is meaningful. And again, the sample size and the gender skew in the sample means we are not confident making statistical inferences. However, this is a crucial point for further research.

No significant trends were observed between larger schools and smaller schools, or urban schools and rural schools. Again, further research is required to confirm these findings.

Change To The Curriculum

These findings demonstrate that Irish ~15 year old teenagers are highly engaged with Earth Science, particularly relating to climate change. There is scope to develop and expand Earth and environmental studies within the curriculum. However, it is important to do so in a manner that suits the students themselves. Adding more climate change content to the curriculum must be done in a way that balances across the three subjects in question, to minimise repetition, as the majority of students will take all three subjects. Furthermore, a large number of students appear to have a poor understanding of key concepts, even ones which have been covered in class, with only 2.7% of students getting 10 or more right answers of 15 concept questions. It is vital that any expansion of these topics does not simply add more concepts to be “learned off” without facilitating a deeper and more secure understanding. It is particularly important to avoid confusion and misunderstandings, especially when the topics may be covered in different ways

by multiple teachers across different subjects for the same class group. For these reasons, ideally the process should be guided by the students themselves.

Methodological Importance

A secondary finding of this study offers a template for student-guided curriculum reform, further research, or development of interventions. The project demonstrates the utility of the student CRAGs, which were highly successful at all stages of the project. This method has considerable potential to be developed further and used in a range of contexts (Neenan et al, 2020, in review [6]).

Including the student perspective in this practical and student-oriented way ensured any potential misunderstandings between the researchers and the participants were minimised, and gave an additional and highly valuable dimension to the data analysis, resulting in a highly effective combination of both a broad overview and in-depth insights from the same dataset. As student activists and Earth scientists alike raise the alarm on climate action, studies centring the voices of young people are both useful and necessary. It is particularly important to develop and verify methods to include students in research, policy, and decision-making, such as CRAGs.

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31st July 2020

Minister Norma Foley,
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A chara,

I would like to share some findings from my current research with you, as they may be useful in the development of policy on education, particularly second-level education on Earth Science and climate change. This is a vital area for many reasons, and a topic which many students are highly engaged with and interested in. This research was funded by the Irish Research Council, which has acknowledged the necessity and timeliness of research in this area.

Over the last few years, I have conducted research into student attitudes towards and understanding of Earth Science and climate change in Irish second-level schools, focusing at Junior Cycle level. The data were generated from a survey that has been co-designed and co-analysed with groups of Junior Cycle and Transition Year students from a number of schools. Therefore, while this research was carried out primarily in the greater Leinster region, I am confident that findings are representative of the attitudes and perceptions of students across the country.

For the sake of practicality, I will outline some key implications from this research in this letter. I would be very happy to expand on any points, produce a formal report, or discuss this topic with you or your representative. I have three main recommendations, which are interconnected.

To Whom It Does Concern ~ Implications for Policy

Firstly, Irish students want to learn more about climate change, and they want their classes on climate change to be focused and practical, grounded in action, not theory. An overwhelming majority of respondents consider climate change, and Earth Science generally, to be “important”, “useful”, and “interesting”. Critical feedback on current climate change education in the Junior Cycle was almost all focused on it not being actionable, or when it is, the actions feel futile. Students learn and know plenty about sustainability. By Junior Cycle, they either already recycle and turn off their lights, or they don’t see the point when giant companies and billionaires are emitting unthinkable amounts of carbon. There is an appetite among students to connect key Earth Science issues to their power as citizens, consumers, and future voters. Meanwhile, their actual understanding of key concepts in Earth Science, including atmospheric carbon and the carbon cycle, is shaky. I recommend development of more content dealing with the socio-political side of climate change, management of natural resources, disasters, etc., particularly in CSPE and Geography, and more foundational work on the actual processes of carbon emissions, natural resource management, etc., particularly in Science.

Secondly, connected to the first point, there is fatigue among some students in covering the same content on climate change across, for many of them, three subjects: Science, Geography, and CSPE. Some students find this boring, some find it confusing, some find it difficult if different teachers put different emphasis on the topics. Of course, not all students do all three subjects, but the majority do. Having discussed this in some depth with several groups of Junior Cycle and Transition Year students, I would recommend adjusting the curriculums to significantly emphasise different aspects of climate change in the three subjects, so they tread less of the same ground. As above, there is scope for more of the socio-political impact of climate change in Geography, more emphasis on the physical concepts in Science, and perhaps CSPE is the place for the action-focused learning the students are enthusiastic for. I would also urge caution in introducing any Junior Cycle short courses tackling climate change. Covering similar material in potentially four different classes with four different teachers is not what the students would choose.

Thirdly, on a broader note, the methodology used in this research has been highly successful. The student co-researchers in the discussion groups have been interested, dedicated, and insightful. Drawing on their lived experiences embedded in the context of Irish second-level schools is very valuable. They raised points and made inferences I, as an adult now several years removed from my own second-level education, would have missed. I know student feedback has been key in the recent curriculum reviews. I strongly recommend the further development of student advisory groups to actively consult on all stages of curriculum reforms, not just for

climate change, but generally. They have a lot to contribute, and they have universally been very generous and helpful. This research demonstrates that all policy decisions, and particularly those relating to climate change and geoscience education, should ensure that the voices of the students are considered. I would be happy to offer my assistance to you and your Department with the implementation of student advisory groups to ensure that they adhere to international best practice.

As we've seen over the last couple of years with the School Strikes For Climate, these issues are very important to our young people. But these answers weren't just coming from student activists. The surveys were conducted at school, with whole classes participating, and 93.7% of students answered that it was important or useful to learn Earth Science. An even higher proportion, 94.6%, said the same of learning about climate change. For the direct feedback, even the students who were critical, fed up, demoralised, or uninterested answered that it was still an important issue. Many students were quite emotional in their language. And there is a real desire to learn more, engage with this topic, and take action.

As one of the students put it:

“It's not good enough to just listen to other people or hear it on the news[,] we need to understand”

I hope you will consider what these students have expressed. I'm well aware this is a strange and difficult time, and the emphasis must, above all, be on student and staff safety for the time being. I would be delighted to explore any of these points in more detail, in whatever manner suited you, particularly the use of student advisory groups, which I believe would be extremely valuable in a wide range of contexts.

Finally, allow me to congratulate you on your appointment as Minister. It's a difficult job to have at the best of times and the fallout from a global pandemic is very far from the best of times! The pandemic has been an acute demonstration of the need for researchers and policymakers to work together, and I hope to play my part.

Is mise,



Emer Emily Neenan

His Excellency António Guterres,
Secretary General of the United Nations,
United Nations Headquarters,
760 United Nations Plaza,
Manhattan,
New York City,
New York 10017,
United States.

Dear Secretary General,

I am delighted to see that you will be convening a Youth Advisory Group on climate change.

I am currently researching climate change and related topics in the context of the Irish education system, using a methodology founded around youth advisory groups. My research, which will shortly be published, strongly confirms that this is an issue teenagers and young people are highly engaged with, interested in, and worried about. Even students who are not involved with climate activism or the school strikes movement overwhelmingly agreed that it was an important issue, one they wanted to tackle more directly in school.

Over the course of the past two years, I have convened a series of both in-person and online youth advisory groups on this topic. These have been highly successful. I would like to offer my expertise in this area if it could be at all useful to you in your vital work tackling the climate crisis with the assistance and perspectives of young people.

Is mise,

A handwritten signature in black ink that reads "Emer Emily Neenan". The signature is written in a cursive, flowing style.

Emer Emily Neenan

Green Teen Zine

A Fictional Zine
by Emer Emily Neenan



The 🙌 World 🙌 Needs 🙌 Women 🙌
The "Climate-Justice-is-a-Feminist-" Issue

Why is there a gender disparity in the Earth Sciences?

At the 2nd International Day of Women and Girls In Science, hosted by the United Nations, which my mother and I participated in¹, the rallying cry was “The world needs science, and science needs women”. The same goes double for geoscience, as the world faces climate catastrophe. Climate justice is a feminist issue; women lead the climate movement, and disproportionately bear the consequences of climate devastation².

Addressing gender has been an aim of this project from the very first meeting between Joseph and me. In the event, the respondents of the survey were so overwhelmingly female that it became difficult to find any significant trends; the number of boys who responded is small enough (only 17 of 111) that it's hard to be confident any apparent trend isn't a fluke. For example, literally no male student answered “no” to the question about the importance or use of learning about climate change (Question 13). But only 3.3% of female students answered “no”, so it seems very likely if 100 male students answered it, a similar proportion might answer “no”.

One respondent is “non-binary or other” and one respondent answered “prefer not to say”. Obviously it's impossible to guess any trends for non-binary or other students from a single respondent.

1. Neenan, E.E. & O'Neill, A. (2017). Addressing the impact of the media on the gender gap in science: 2nd commemoration of the International Day of Women and Girls in Science conference review. *Journal of Science Communication* 16(02), R01. Retrieved from <https://doi.org/10.22323/2.16020601>.

2. Robinson, M. (2018). *Climate justice: hope, resilience, and the fight for a sustainable future*. London: Bloomsbury Publishing.

Rolling out this survey to a larger group is the most obvious of the avenues of further research I discuss in Section 27, and more data on potential gender differences is the biggest reason I would like to do just that. It is important to see if statistically significant differences in the answers emerge over a larger sample size.

If there are measurable differences in attitudes or language use between genders, this could be very useful to identify in order to address gender imbalance later, at higher level education or beyond. As discussed (document 23), there was a slightly higher proportion of boys in the top-scoring group compared to the under-average group; further research is required to determine if this is a trend or just a fluke. If there were found to be disparities between genders in terms of conceptual understanding, that would be worrying, and would be crucial for schools to address.

On the other hand, if a larger-scale rollout of this survey found no noticeable differences between genders, in attitude or understanding, at the age of 15, that would be strong evidence for tackling underrepresentation and discrimination. It would indicate the problems lie elsewhere, later in the trajectory of a typical young woman who wants to study Earth Science but eventually leaves the field.



So what can I say with this data?

Girls are not uninterested in Earth Science. If you chose a 15-year-old girl at random from one of these classes in an Irish secondary school, she would probably be interested in learning about Earth Science and tell you Earth Science is important to learn about. She's quite likely to be especially interested in climate change, volcanoes, and the atmosphere. The loss of young women from Earth Science specialities as these students progress from school to college to postgraduate and beyond cannot be pinned on girls beginning with some inherent lack of interest compared to the boys in their class. No research has yet been done on the loss of women from the geosciences in Ireland, but globally, it is well-documented^{3,4}.

Even between Junior Cycle and Senior Cycle at secondary school level, this might be starting to happen. At Junior Cycle, according to State Examinations Commission data⁵, boys make up 50.85% of all students sitting the final exams, and 50.6% of students sitting the Geography paper. But Geography is mandatory in many schools; 91.7% of people take it. What happens when that drops to 43.5% of students taking Geography at Senior Cycle, when it's no longer a mandatory subject in most schools? Now boys make up 55% and girls have dropped to 45% (there are no data on non-binary or other students from the State exams). Is this where the geosciences start to lose girls?

3 Holmes, M. A., O'Connell, S., & Dutt, K. (Eds.). (2015). *Women in the geosciences: Practical, positive practices toward parity*. Hoboken: John Wiley & Sons.

4 Popp, A. L., Lutz, S. R., Khatami, S., Van Emmerik, T. H., & Knobon, W. J. (2019). A global survey on the perceptions and impacts of gender inequality in the Earth and space sciences. *Earth and Space Science*, 6(8), 1460-1468.

5 State Examinations Commission. (N.D.) *State examinations statistics*. Retrieved from <https://www.examinations.ie/?l=en&mc=st&sc=rl6>

It doesn't seem so, at least in Ireland – statistics from the Higher Education Authority (HEA) on the gender breakdown (again, with no provision for non-binary genders) of students entering third level education, sorted by subject choice, suggest there are plenty of young women entering the Earth and environmental sciences⁶. In 2018, 28 women and 20 men entered Earth science courses, while 26 women and 31 men entered environmental sciences. Those figures cover direct entry, and many students who will in practice study geology or similar subjects will enter under Natural Sciences (235 women and 289 men), and specialise. The figures for choices during undergraduate are not available. But certainly anecdotally, there is not a disproportionate shortage of female students in Earth Science at undergraduate level in Ireland. As elsewhere, women disproportionately leave the field after undergrad.

This is a problem in science, and even in academia generally, not just in geoscience. Women earn 53% of undergraduate degrees globally, but only 43% of PhD degrees, and hold only 28% of research posts, with the numbers getting narrower and narrower as you go “up” from ECR to university presidents (if you'll forgive my use of the hierarchical up/down metaphor arising from the inherently unfair kyriarchal power structure that is the status quo). But it is also a geoscience-specific question; there are geoscience-specific barriers that are exclusionary to certain groups. For example, the traditional emphasis on long days out in the field, followed by a good session in the pub. (Full disclosure: you make me spend all day in the field, I'm going to thoroughly enjoy the pub!)

⁶ Higher Education Authority. (N.D.) *Statistics archive*. Retrieved from <https://hea.ie/statistics-archive/>

It's good to have traditions and bonding experiences. It's bad to have those traditions and bonding experiences be (a) mandatory (or "optional"-but-we'll-judge-you), and (b) inherently exclusionary to certain people and groups.

People with disabilities are still being shut out of geoscience in 2020 because of the emphasis on field trips, and the lack of emphasis on accommodation, inclusivity, and flexibility⁷.

Women are still being frozen out of geoscience because they know the reaction they'll get if they say they need the field trip to be restructured so they can safely change a tampon⁸.

Queer people are still too often forced to choose between key opportunities in countries with discriminatory laws and their safety⁹ (in July this year, Imperial College London announced they would no longer run a geoscience field trip in Oman, thanks to the emotional labour of queer people self-advocating)¹⁰.

7 Feig, A. D., Atchison, C., Stokes, A., & Gilley, B. (2019). Achieving inclusive field-based education: Results and recommendations from an accessible geoscience field trip. *Journal of the Scholarship of Teaching and Learning*, 19(2).

8 Giles, S., Greene, S., Ashley, K., Dunne, E., Edgar, K., & Hanson, E.: Getting the basics right: a field-teaching primer on toilet stops in the field. *EGU General Assembly 2020, Online, 4-8 May 2020, EGU2020-11723*. Retrieved from <https://doi.org/10.5194/egusphere-egu2020-11723>, 2020

9 Pickrell, J. (2020, March 11). Scientists push against barriers to diversity in the field sciences. *Science*. Retrieved from <https://www.sciencemag.org/careers/2020/03/scientists-push-against-barriers-diversity-field-sciences>

10 Murphy, V. (2020). *Geoscience course stops running Oman fieldtrip to be more inclusive*. Retrieved from <https://www.imperial.ac.uk/news/198915/geoscience-course-stops-running-oman-fieldtrip/>

This study didn't have a fraction of the scope needed to address these issues. But I feel it would be remiss of me not to mention them. I hope to add my part to the work being done by Callahan et al¹¹, and Vila-Concejo et al¹², and all the others tackling this issue. It's past time these fossils of sexism, exclusion, and thoughtlessness are relegated to a thoughtfully contextualised museum where they belong.

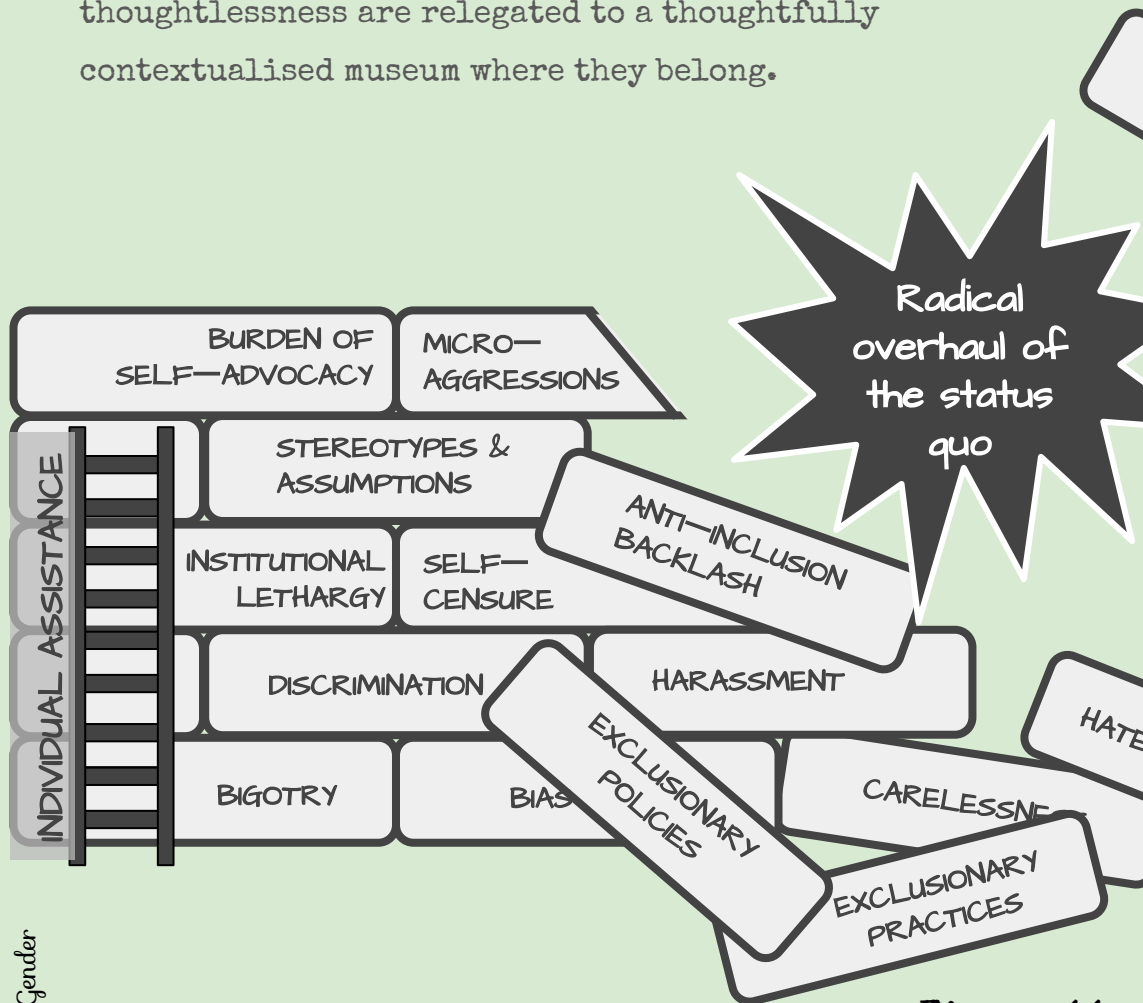


Figure 44

11 Vila-Concejo, A., Gallop, S. L., Hamylton, S. M., Esteves, L. S., Bryan, K. R., Delgado-Fernandez, I., ... & Power, H. E. (2018). Steps to improve gender diversity in coastal geoscience and engineering. *Palgrave Communications*, 4(1), 1-9.

12 Callahan, C. N., Libarkin, J. C., McCallum, C. M., & Atchison, C. L. (2015). Using the lens of social capital to understand diversity in the earth system sciences workforce. *Journal of Geoscience Education*, 63(2), 98-104.

★★★☆☆ Wishlist ☆☆☆★★

Throw tarnished pennies in a wishing well,
Call on my patron saint of all postgrad.
Please listen well as I would like to tell
Of limitations, all I wish I'd had,
The could-be-better, if not outright bad,
The could-have, should-have, would-have, wanted-to...
But this is not intended to be sad
It's all the things I wish I did or knew
Now these are lessons from what I've been through
Since I have seen and wished and cursed and learned
And next time I'll know better what to do
I'll bring the hard-won wisdom I have earned
So here's my 2020-vision rhyme
The "if I'd had more luck and cash and time..."

★ Ten or more additional schools to join the survey

The most important addition I would have liked to make to this project, all else being equal, is a larger sample for the survey. The initial CRAGs and I put together an interesting and detailed survey on this topic, which I am very happy to stand over, some minor tweaks notwithstanding (see below), but as events played out the way they did, recruitment for the survey was significantly curtailed. A total of 111 responses over 5 schools (3 mixed gender schools and 2 all-girls schools) is less than I had planned or hoped. Furthermore, with the vast majority of the responses being from female students, I wasn't able to extrapolate trends by gender with confidence.

These rooms are mutually exclusive. How do you place a single sink so that a person using a wheelchair, and a tall person who struggles with balance can both use it? How do you design your subtitles so they aren't off-putting or distracting to people with dyslexia and some people with ADHD, while being conspicuous and functional for people who are D/deaf, people who have hearing impairments, people who struggle with auditory processing, or *other* people with ADHD?

Accessibility is something that I considered from the beginning of the project, but wasn't able to give as much attention as I would have preferred. The CRAAGs were helpful, particularly in discussing what they thought would be useful for people with learning disabilities, often phrased as things like "people who have trouble understanding", without particular judgement as to why they might have trouble. The CRAAGs were, rightly, insistent on including a wide selection of images in the survey, and I wasn't able to integrate alt-text on the images for use with screen readers, due to the limitations of the survey software. I make a considered effort to include alt-text on my images on social media, and to provide auditory descriptions of my slides and images in any talks I give, so this was something I was really missing with this survey, and something I would have liked to have addressed.

As far as the CRAAGs themselves are concerned, in future I intend to make more of an effort to emphasise that accessibility requirements will be facilitated to the best of my ability at all stages. I was relying on volunteers for the CRAAGs, and decided to address accessibility requirements as and if they came up. But, on balance, I think it would be better to be upfront about my willingness to be inclusive, because I suspect students whose accessibility needs are not met by default often don't feel particularly motivated to volunteer for things, when it

students over time, to do really in-depth CRAGs with students who feel very comfortable being honest with me.

(And of course, it's entirely possible a few students in the CRAGs *are* this type, were totally uninterested in my project, and were just being very polite to me!)

★ **Deeper triangulation with in-depth interviews**

In this incredibly well-funded, leisurely fantasy wherein I spent two or three years building a close relationship with a couple of schools, I would also consider supporting the survey with a selection of in-depth interviews, to really explore the themes that arose from the data, and particularly the students' criticisms.

The most frustrating part of the analysis of data from a survey (with the possible exception of stubborn spreadsheet niggles) is reading really interesting responses and having no way to follow up on them.

The CRAGs were extremely useful in verifying and talking out the data. But one-on-one or small group interviews on the topic, generating data, not just analysing it, would be both very interesting and very valuable, to tease out the themes in more depth.



Figure 45

Emer Emily Neenan: Hello?

Joseph Roche: Hi!

EEN: Hello, good to see you! Laura's connecting...

Laura Bell: Hi, is this working?

JR: Yup, perfect.

LB: How are you guys? You're getting so much written, Emily!

JR: Yes, loads of progress! You'll be finished in no time!

EEN: God I hope so! Yeah I'm pretty happy with how things are going. I have to write the future work, avenues of future research, next steps, sort of stuff, and then it's really just the conclusions. Did ye get the limitations document?

LB: Yes, got it, I'll proof-read it and get it back to you.

Wishlist ☆
*** ~ Limitations

JR: It looks great - another poem! Wow!

EEN: Ha, thanks. I didn't intend to write that one, it just sort of happened. It's a Spenserian sonnet, I like the rhyming scheme. More fun than Shakespearian.

LB: Oh yeah, that normal relatable feeling when you just sort of randomly accidentally write a sonnet.

JR: Mood! ... Did I get that right?

EEN: It's a real problem you know! Anyway, have I done enough on the limitations? I could add more, I mean, there's basically an infinite amount of things one *could* fix or improve in a research project with enough time and money, right? Like I'm not sure where to stop. I'm very imaginative and anxious!

JR: I would say, I think you've done a good job with the limitations, I would take anything else you're considering and start framing them as opportunities for future work!

EEN: Right, I'm not sure where the line is between "something I should have done" and "something that could be done in the future!"...

JR: Well it's good to be realistic about the limitations, but it's even more important to show all the very cool things this research could lead to. So try not to be too anxious, and definitely move on into the future work now!

Five Times A Research Student Fantasised About A Future Postdoc
And The One Time She Wrote A Proposal

by Emer Emily Neenan

Congratulations, Dr Neenan!

Oh, thank you!

So, what are your plans?

Well, I'm already working on a major expansion of the survey I used for my PhD work. It's such a valuable tool, co-designed with the students, that it would be a real shame not to use it again. I had wanted to recruit more schools during the project, and in particular I want to look for trends associated with several key variables, expanding on that initial sample. I have a much better idea how to approach schools and teachers now. I'm a lot less shy for one thing!

So I'm recruiting classes in 60 Irish second-level schools, 20 all-girls, 20 all-boys, 20 mixed-gender, including schools in Dublin, in regional towns, and in rural areas, from across Ireland. Several of the CRAGs that worked on the survey or results have agreed to reconvene to look at this larger dataset.

I'm particularly looking to see if there are any differences between different genders. Even if we can't find any specific barriers to girls' involvement in the geosciences, that will at least mean we can rule more possibilities out.

involvement in the geosciences, that will at least mean we can rule more possibilities out.

I'm also interested to see if there are any statistically significant differences between larger schools and smaller schools, or urban and rural, and so on.

The survey is more or less the same as it was for the first study, but I've switched out one question, with the assistance of the CRAGs. Instead of asking generally if students "pay attention" to classes about geoscience, which was too broad to give us any meaningful data, we've instead inserted a question about the teacher(s) who cover this material with them. Anyone and everyone can tell you that teachers are so influential to our educational experiences, and I think it could be very valuable to check if there's a correlation between a "good" teacher (allowing the students to define that for us as they see it) and higher engagement on these topics.

Great! Can't wait to see what you come up with!

~*~★~*~

Miss? Can you give an example of science education in policy?

Okay, so, first of all, absolutely no need to call me "miss", and generally your other university lecturers won't want you to either! It's a big change from school, right?

To answer your question, let me tell you a bit about the work I'm doing at the moment, when I'm not lecturing ye or the other Science In Society module. Do you remember I told ye before about my PhD work on the Junior Cycle? I met with the Minister for Education about that work, and especially about co-designing and co-analysing with groups of Junior Cycle students. That study revealed some interesting things about attitudes of students in Junior Cycle towards Earth Science and so on, but the methods used were especially important; co-designing the survey with students and co-analysing the results too.

Now we're working with the Department of Education to roll out similar investigations at primary level and at Senior Cycle level. So for those of ye in this class who didn't go to Irish second-level school, Senior Cycle is the final two years of second-level school, ending with the national State examination, the Leaving Certificate, which is how most students in Ireland qualify for third-level education.

We're in the early stages, but I'm expecting we'll see similar trends to the Junior Cycle study, that young people are interested in this topic and want to learn more and especially *do* more about climate change. I'm excited to see any differences at the different levels, and especially anything that will help us identify areas where we can make policy recommendations as the curriculums at both primary and secondary level are updated. Does that answer your question?

~*~★~*~

So before we get started, I just want to say thank you for this opportunity. I'm really excited to work on this project with you!

Well, I'm absolutely delighted you'll be joining our research group. And please, ask me any questions, or if you prefer, go to your co-supervisor. Your co-supervisor is going to be Joseph Roche, right?

Yep, that's right, Professor Roche. But he said this project was mainly yours, so he was going to be pretty hands-off?

Yeah, but he'll be there for us if we need him!

Now, I know you saw the overview of the project, but I'd just like to run through the study you'll be working on, from the start, just to make sure we're very clear on our aims, okay?

Okay, that sounds good. I'll take notes.

So, this whole project came from my PhD research, the year before last. We've been successful in getting some funding to explore some avenues arising from that study, which is the money we're paying you with. That study was focused on the students, and one whole section was dedicated to measuring student understanding of key geoscientific concepts, like tectonic plates, atmospheric carbon, and so on. It turns out that a lot of students have trouble with these concepts, and in my analysis, I couldn't help but wonder how well the teachers were taught these concepts, since many of them won't necessarily have

any geoscience background. They equally would have learned these concepts as teenagers themselves, possibly from confusing textbooks and from teachers who didn't have any geoscience background... and so on.

So for your Masters work, you're going to be conducting the same kind of measurement of conceptual understanding with the teachers, and then discussing the concepts with them. We want to find out firstly if the teachers do have solid conceptual understanding, and then for those that don't, how can they be facilitated to develop these concepts without putting burdensome extra work on them.

You'll be able to tie in with the other work that's going on within our research group. Particularly with the work I'm doing with two other Masters students. Emiko is doing a similar project to yours, but climate-focused, using Libarkin's climate change understanding instrument¹. And Alice is working on developing Continuous Professional Development materials for teachers who want to develop more targeted and engaging classes on climate change.

I think it'll be a really good project and I'm very excited to work with you!



1 Libarkin, J. C., Gold, A. U., Harris, S. E., McNeal, K. S., & Bowles, R. P. (2018). A new, valid measure of climate change understanding: Associations with risk perception. *Climatic Change*, 150(3-4), 403-416.

Our keynote speaker today is Dr Emer Emily Neenan, who has just returned to Ireland from a fellowship at Edinburgh University. Dr Neenan?

Hello everyone, and thank you so much for the opportunity to share some of my current research. This is work that actually originally arose from my PhD, a couple of years ago, and has been something I've touched on a few times with the various projects on science education in the Irish and European context. I'm working with second- and third-level students to design and implement a study aiming to identify the most effective methods for encouraging those students who have not historically felt welcome in the geosciences, or considered the geosciences as a potential pathway in education or for a future career, to find a place.

Much progress has been made in the last couple of years, since the anger of the climate strikers in 2019 and the hopelessness of the pandemic in 2020, but it's obvious that Ireland in particular, and the world generally, will continue to need students to enter the geosciences. But some change is slow; Earth Science still doesn't have the kind of "brand recognition" of the big three Sciences that are standalone subjects at Senior Cycle - Physics, Chemistry, and Biology. And for those students who do decide to study one of the Earth Sciences at third level, they're too often still faced with the lack of diversity - of gender, of race, and of physical ability - that has dogged the field since... well, since the very beginning!

Barriers to entry into the geosciences, particularly for women, for ethnic and racial minorities within Ireland, and for students with disabilities, must be identified and addressed.

This research aims to encourage more students who have an interest in Earth Science to consider it at third level. But encouraging students to enter Earth Science departments at third level is worse than useless, arguably bordering on unethical, unless it is matched by policies and cultures in those Earth Science departments that ensure those students feel welcome when they arrive and are facilitated to reach their potential. A great deal of progress has been made, particularly in the last ten years, but there is more to do.

First of all, I'm going to give you some background, the current figures for diversity in the geosciences in Ireland, from a survey of the field we completed already. Then I'm going to describe the methodology we're using, which involves several layers of consultation and cooperation with representative co-researchers from different backgrounds, ranging from current school students to early career researchers in the geosciences, who are paid consultant experts on this project. And then I'll describe what we're hoping to identify; in short, barriers to inclusion, focusing for the moment on gender, race, and disability, hopefully to expand to other marginalised groups in a later phase. So let me go to my next slide...

~*~★~*~

So, Dr Neenan, tell us a bit about your new book.

Well, this book has been haunting me, if that word isn't too dire, since my PhD several years ago. When I started my PhD, I thought I would study the impact of a particular geoscience outreach program, the Seismology In Schools or Seismolaíocht sa Scoil program. This program has a special place in my heart, because I worked as the Assistant National Coordinator on it quite a few years ago now, when I was working on my Masters in Seismology at the Dublin Institute for Advanced Studies. In the event, I focused in my PhD on the general Junior Cycle, but I still felt that flexible science outreach programs like the SIS program have a lot to offer, both in terms of what they teach the students directly, and also in what they could teach us about how to engage students on these vital topics.

So you went back to study these programs?

Yes, I wanted to expand on the work I had done on my PhD and since then. I have spent the last three years evaluating Earth Science outreach initiatives, here in Ireland and in a handful of other countries, on two levels; do they teach what they set out to teach? And what can we take from them that may be applicable in other contexts, particularly in the formal education system? This book brings the reader through a selection of case studies, building up a picture of a highly effective and engaging Earth Science classroom. It was a lot of fun doing this research, joining in these activities and events, and it was really win-win for me and for the various organisers and directors of these programs. Each of them got a tailored evaluation of their

program, plus I helped out in my various capacities, acting as a speaker or as a seismologist, or in one case, as a poet! And I got really valuable data.

And you worked with different groups of students on this too? Is that your trademark as a researcher?

Absolutely. It's really important to me that I include the students in this research, in all my research. As we say in the disability community, "nothing about us without us".

But this isn't your first book, is it?

No, it's my third! Directly after my PhD, I wrote a book on chronic fatigue, which is something I've really struggled with, particularly during my 20s. You'll remember that was the time of the COVID-19 pandemic. I finished my PhD in 2020, during quarantine, so a book about post-viral chronic fatigue was very timely. But let me tell you what I'm proudest of: my book for young children about zircon, which I published when my daughter was 2 years old, which had to meet her critical standards! It's still a favourite in our house!

~~~★~~~

京都へようこそ !

*Welcome to Kyoto!*

ありがとうございます！また日本に来てよかったです！

Thank you! It is great to be back in Japan!

ええ？エミさんは日本語を話しますか？

*Oh? Do you speak Japanese?*

勉強しています。しかし、難しいです！

*I'm studying it. But it is difficult!*

*No, no, you are very good. But we will speak English instead, to be convenient to you. Please tell me about your visit to Japan.*

Of course, one reason for me to visit is that Japan is very beautiful and I enjoy learning the language and learning about Japanese culture, eating Japanese food, and watching Japanese anime! I will also visit several friends; tomorrow I will go to Osaka to see my friend and colleague Ryota, whom I met several years ago now at a summer school I did during my PhD. But I am visiting this time to do some research. For my PhD, I studied Earth Science education at junior second-level school, so the same level as 中学校 middle school. Now I hope to learn from other countries how Irish schools might be able to improve their Earth Science education. Japan is a very interesting country to compare to, as Japan and Ireland are very different geologically. Ireland is extremely quiet, we have only very small earthquakes, and no volcanoes. Japan's geological volatility means that there are many examples of geoscience outreach, and these topics must be covered in school. But Japan is also a rich island nation, similar to Ireland, vulnerable to climate change in similar ways.

While I am here in Kyoto, I will convene discussion groups with second-level students, including some students doing climate strikes. I

hope to also facilitate some discussion groups with Irish students back home. During the pandemic last year, we developed a system to do these discussions remotely, so hopefully the Irish and Japanese students can also talk to each other. Of course, since Irish students do not learn Japanese, we are necessarily limited to those Japanese students who can speak conversational or fluent English.

I'm very excited to learn from the Japanese experience teaching Earth Science topics.

... This *is* exciting!

I'm going to write this up as a proposal.

I need to talk to Joseph!



## COALESCE Funding Proposal

### Abstract.

#### **Please provide a short description of the proposed research project**

Geoscience is crucial to Ireland's ability to manage our natural resources and mitigate against natural disasters, and particularly to meet Ireland's goals on climate action and sustainable management of environmental resources. This proposed project incorporates an international systematic literature review of pedagogy of geoscience education; a repeated measures public engagement survey over a range of geoscience outreach programs in Ireland; an international comparison of geoscience education, curricula and outreach based on observation and benchmarking of best practice in Earth Science teaching in Japan; and the production of draft policy recommendations to underpin a national communications strategy and guidelines for Government departments and other agencies in the communication of geoscience information to the general public. It is anticipated that this project will have a significant impact on both the Irish formal education curricula pertaining to geoscience education (Science, Geography, etc) and also on the standard of geoscience outreach and communication generally in Ireland. Geological Survey of Ireland (GSI) is the primary partner on this project. Outreach programs administered by GSI and by the Irish Centre for Research in Applied Geoscience (iCRAG) will form the basis of the evaluative phase. Children's Research Advisory Groups (CRAGs) will be convened to incorporate learner voice into the research.

## **Lay Abstract.**

### **Please provide a short description of the proposed research project for a non-expert reader**

Geoscience is the study of the Earth, and includes everything from volcanoes and earthquakes to where the metals in our phones come from. It is crucial that the next generation of Ireland's citizens have a good understanding of geoscience, as Ireland strives to meet our National Strategic Outcomes, including Sustainable Management of Water, Waste, and Environmental Resources. This project aims to improve both how geoscience is taught in school and also how the Government and other agencies communicate geoscience to the public. In order to do this, we intend to first review all the studies that have been done up to this point on geoscience teaching and learning, especially recent studies that examine how new technologies can help us teach this subject. We will evaluate geoscience programs that are already running in Ireland, for example, the Geological Survey of Ireland (GSI)'s information stand at the BT Young Scientist Exhibition and the iCRAG Girls Into Geosciences program. As well as examining Irish programs, we will visit Japan and gather data on their classroom teaching and their informative outreach programs, to see what techniques or technologies they use that we could adopt. Using all of this information, we will write our recommendations for how best to communicate geoscience in Ireland. These recommendations can be adopted by the Government, schools, and agencies, and hopefully improve the Irish public's understanding of geoscience.

## **Project Description**

### **Overview**

The proposed project incorporates a systematic literature review, an observation and benchmarking investigation of geoscience education and outreach in a world leader (Japan), and the formation of draft policy recommendations to inform formal curricula, a national communication strategy, and guidelines for geoscience outreach undertaken by agencies and Government departments.

Dr. Joseph Roche of the School of Education, Trinity College Dublin, will be PI on this project. He is ideally suited to the task of undertaking the proposed research, as he has significant expertise in the evaluation of science education and public engagement initiatives.

Emer Emily Neenan will be the postdoc on this project. She is currently finishing her PhD on geoscience education in the Irish formal education system. She is ideally situated to progress this research, following on from her postgraduate work.

This project will review international best practices for teaching geoscience in the formal education system and in informal outreach capacities. As a secondary aim, it will investigate any gender-specific barriers to geoscience education, as there is a shortage of women entering geoscience careers (Holmes, O'Connell, Frey, & Ongley, 2008).

The Geological Survey of Ireland (GSI) will play a vital role in this project. A nominee of GSI will sit on the steering committee, and GSI will provide the scientific and technical content for the draft policy recommendations and any pilot programs.

There have already been preliminary meetings with the Irish Centre for Applied Geoscience Research (iCRAG) with regard to this project, and iCRAG have offered to play a collaborative role. Outreach initiatives run by iCRAG will be evaluated as part of this project, with iCRAG's cooperation, and iCRAG may be in a position to implement pilot programs arising from the draft policy recommendations. iCRAG will also provide a nominee to the steering committee.

**Provide comprehensive details of the proposed approach and research methodology.**

The ontology and epistemology of this project arises from social constructivism, with the consideration that concepts such as "attitudes," "learning," "interest," etc, are co-constructed in a social context, as are students' or learners' understanding of concepts such as "resources," "environment," "heritage," etc, and that more needs to be taken into account than simply the technical content of the message and access to the desired audience. The research approach draws from the work done by Lundy, Welty, Murphy, et al, (Lundy & McEvoy 2012; Welty & Lundy, 2013; Murphy, Lundy, Emerson, & Kerr, 2013) on learner voice, and specifically on the practical implementation in education research of the principle of "voice" as derived from the United Nations Convention on the Rights of the Child.

The primary aim of the project is to evaluate current geoscience education and outreach in Ireland, in comparison to international examples, in order to inform formal education curricula, particularly at second level, and Irish geoscience outreach initiatives.

A secondary aim is to identify any specific obstacles which affect female students with regard to geoscience education through second and third level.

The objectives of the project, in order to achieve these aims, are as follows:

1. Complete a systematic review of the literature on geoscience education and geoscience outreach initiatives, in Ireland and internationally. This is to include both peer-reviewed studies and published national curricula, etc.
2. Identify and gather data on suitable geoscience education case studies internationally, in order to complete a selective international review of best practice in both formal (i.e. school classroom) and informal (e.g. museums, visitor centres, etc) settings. Work on this objective will prioritise identification of specific case studies that offer potential data on the changes in formal and informal learning environments precipitated by the advancement of educational technology, e.g. virtual reality systems, online educational resources, virtual field trips, augmented reality, etc.
3. Evaluate the efficacy of Irish geoscience education and outreach initiatives, in comparison with established international good practice examples, in order to identify areas of growth, particularly with regard to the implementation of technology as a learning tool. This would include both formal geoscience education, and geoscience outreach conducted by Irish geoscience bodies e.g. GSI, iCRAG, DIAS, etc.

The research questions are as follows:

1. Based on a selective international review of best practice, what specific geoscience education techniques, particularly with regard to the use of technology in learning, can Irish schools and Irish geoscience bodies adopt in order to provide world-class geoscience education opportunities to their students or target demographics?
2. What specific actions can be taken by Irish schools and Irish geoscience bodies to ensure female students are facilitated to access the same opportunities for study and career options in geoscience as male students?

The research methods will include a systematic literature review, a public engagement survey, and observation of case studies in Ireland and Japan.

The systematic literature review will cover learning mechanisms, teaching styles, and pedagogy internationally and specifically focus on (a) the implementation of teaching/learning technology and (b) gender as a variable in geoscience education engagement.

The public engagement survey will be a repeated measures survey designed using best practice in social science survey methods and will be guided by the PI's experience of diverse public engagement evaluation (Roche, Cullen, & Ball, 2016; Roche, Stanley, & Davis, 2016; Roche, et al., 2017). The survey will be implemented across several major geoscience outreach initiatives in Ireland, e.g. iCRAG's Girls Into Geoscience Ireland (GIGI) program, GSI's BT Young Scientist interactive stand, GSI's National Ploughing Championship stand, etc.

Japan has been chosen as a suitable international comparison as it is one of few countries to provide geoscience education via Earth Science teachers and classes, as opposed to including geoscience under general science, natural science, geography or chemistry (King, 2008). Japan also has world-class public geoscience education and outreach, due in large part to the high levels of volcanic and seismic activity in the Japanese region. Japan is a world leader in the development and integration of new technology, and observations of learning taking place at public outreach initiatives such as the Geological Survey of Japan's Geological Museum at AIST will lead to useful data on the potential implementation of new teaching technologies. It is anticipated that one researcher will travel to Japan during the final six months of the proposed project, for two weeks, to conduct classroom visits and observations.

These data gathering operations will be supported by implementation of Children's Research Advisory Groups (CRAGs), which provide representative learners with the opportunity to act as co-researchers, providing valuable perspectives on the research instruments and the results. It is anticipated that 8 to 10 CRAGs will be convened in a diverse cross-section of Irish schools, including mixed and single gender, urban and rural, DEIS schools, etc.

The proposed project seeks to achieve excellence in research addressing two interconnected national and global challenges which are crucial to tackling resource management as populations rise and demand on our planet's resources grows. The first challenge is the effective communication of geoscience to the general public, particularly with regard to natural resources such as minerals, metals, Rare Earth Elements, etc, and how these resources can be managed.

The second challenge is equipping the next generation with the knowledge and skills needed to address issues such as resource management and climate change, by ensuring accurate and engaging geoscientific content is delivered through the formal school system.

**Demonstrate the potential of the proposed research to inform policy and/or practice.**

This project will inform and support the current and future formal education system in teaching geoscience and related topics (e.g. the natural environment, Earth and Space, etc) in Irish primary and secondary schools. It will also significantly contribute to efforts by governmental and other agencies in communicating useful and accurate geoscience information to the general public, including information about natural resources used in Ireland, e.g. minerals, metals, Rare Earth Elements, etc.

The project aims to assess geoscience education best practice via an evaluation of Irish geoscience education and outreach programs in comparison with selected international case studies.

International reviews of both geoscience education and geoscience communication will be carried out via a systematic literature review and selective international case studies.

Expertise in education research will be brought to bear on teaching styles and learning mechanisms, in order to develop new insights into aspects of geoscience education practice, including use of technology in the formal learning environment, communication of natural resource management, and gender-specific barriers to engagement with geoscience.



These data will be used to develop evidence-based recommendations in order to facilitate the development of national communications strategies in the geosciences, including communication tools, outreach programs, support for the formal curricula, etc. This will also facilitate the development of guidelines for major stakeholders in the geosciences and in education, many of which will be positioned to both contribute to and benefit from this research by an invitation to participate in or provide nominees to the project's steering committee. GSI, of course, will be represented on the steering committee, and invitations will also be extended to representatives from the Host Institution (Trinity College Dublin), iCRAG, the Dublin Institute for Advanced Studies (DIAS) Geophysics Section, the Department of Education, the National Council for Curriculum and Assessment (NCCA), the National Parents Council (NPC), the Irish Science Teachers Association (ISTA), the Irish Association of Women In Geoscience (IAWG), etc.

Furthermore, this foundation of effective communication about the management and use of Ireland's natural resources will tie in to Ireland's ability to meet the Sustainable Development Goals pertaining to Climate Action and Responsible Consumption and Production.

**Demonstrate the potential of the project to contribute to the future development of research in the topic area.**

Geoscience education, particularly in Ireland, has not yet been researched in depth (Neenan & Roche, 2016). This proposed project would lay the groundwork for a wide range of potential further research in this area.

The use of CRAGs will facilitate the collection of rich data and will themselves provide potential perspectives on the results that may lead to further research.

The recommendations arising from this research may be implemented on a pilot basis in geoscience outreach, for example in the outreach conducted by the collaborative partner, iCRAG. These pilots could later be expanded. The implementation of the recommendations may form the basis for a follow-up study to investigate their efficacy.

**Identify and elaborate on the innovative aspects, on policy collaboration and on the impact the project will make.**

Little research has been conducted globally on geoscience education specifically (King, 2008; Lewis & Baker, 2010) and almost none on Irish geoscience education (Neenan & Roche, 2016). The proposed project would be a significant addition to an under-studied field. In particular, the proposed comparative observational study between geoscience education in Ireland and geoscience education in Japan is an innovative approach that has the potential to yield useful and actionable data.

The utilisation of CRAGs in science education research is in its early days, but is a promising and important development with the potential to improve the quality of the research (Murphy et al., 2013). The PI of this project is currently supervising the proposed postdoc researcher's PhD in geoscience education which includes the use of CRAGs in the formal school environment. This ongoing project will inform the proposed project and the expertise being developed in this method will be applied to the CRAGs convened for the proposed project.

It is envisaged that at least one peer-reviewed publication would arise from each of the three main objectives. High impact journals will be targeted, such as Nature Geoscience (impact factor 12.508) and the Journal of Research in Science Teaching (impact factor 4.10).

The recommendations arising from this research will facilitate the development of a national communication strategy for geoscience, which will have a significant effect on public geoscience outreach going forward. These recommendations will also form guidelines to be adopted into the existing structures and agencies communicating geoscience (e.g. Department of Education, National Centre for Curriculum Assessment, Department for Communication, Climate Action and Environment etc.)



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29th July 2020 at 12:37 am  
From: Emer Emily Neenan  
To: Joseph Roche

Hi Joseph,

Now that the project is winding up and the COALESCE proposal is in, I took tonight “off” from fixing graphs to write and submit two abstracts to AGU for December. It’ll be a “mostly virtual” meeting, apparently. EGU was pretty successful, with a lot less prep time, so I’m optimistic it’ll be worth it, even if I’m disappointed not to get a chance to go to San Francisco.

I’ve submitted to a session on Climate literacy (Youth Engagement, Education, Action and Empowerment Towards the Phenomenon of Global Climate Change) which I think will be a pretty good fit for my project findings, and particularly for showcasing the CRAGs.

I also submitted a SONNET ABSTRACT to take part in a session that’s a geoscience-themed poetry slam!! I thought about being more “sensible” but actually, I think this is sensible, I want to network with (and hopefully impress) precisely those people who are excited about a geoscience-themed poetry slam.

Find the abstracts attached below. Back to graphs!!

E xx

ATTACHMENT:

AGU\_ED011\_Neenan

AGU\_ED025\_Neenan

## **It's Our Future, Ask Us: Including The Voices of Children & Teenagers in Geoscience Research**

*Emer Emily Neenan and Joseph Roche, Trinity College Dublin, Dublin, Ireland*

The world is facing a future of rising temperature, rising sea levels, and rising incidences of natural disasters. Decisions in environmental, scientific, and educational policy being made now will determine what kind of world today's children and teenagers will inherit when they come of age in an era of climate change. This paper arises from ongoing educational research undertaken in Irish secondary schools, examining student engagement with and understanding of geoscientific topics, and particularly climate change. Central to this research is the use of Children's Research Advisory Groups (CRAGs). Building from the work of Lundy & McEvoy (2009) and Murphy et al. (2013), CRAGs are a method of including and centring children's and teenagers' voice in geoscience research that will affect them including, for example, geoscience/climate education research, policy-oriented research on climate-related issues, or local environmental research. This paper will detail the implementation of this highly successful method for sharing all phases of geoscientific and climate-focused research with children and teenagers, from initial scoping, to research instrument design, to data analysis, and right through to dissemination. A recent study on Earth Science in the Irish formal education system will be used as an example. A key finding from this study is that an overwhelming majority of current junior secondary school students in Ireland, irrespective of demographics, consider climate change an important issue, one that worries them. They want to be better equipped to engage with it and tackle it. The CRAGs method shares power and influence with young people, equipping them with knowledge, skills, and purpose to respond to a changing climate, in their role as co-researchers. In turn, the young co-researchers improve and deepen the data collected, providing valuable insight and a different perspective. Building climate engagement among young people, without burdening them with fear, guilt, and hopelessness, is vital. In order to do that, the voices of children and teenagers themselves must not only be included, but centred, and the use of CRAGs is a practical method for doing just that.

AGU\_ED025\_Neenan

**Obsidian: Reflections of a Wandering Geologist**

*Emer Emily Neenan, Trinity College Dublin, Dublin, Ireland*

Consider this submission for the slam,  
A sonnet for an abstract, just for fun!  
(I'll take the chance to do this, since I can.)  
My PhD is very close to done,  
The journey's been a long and wand'ring one,  
And I am not quite where I thought I'd be  
If you had asked when I had just begun  
But there has been so much to do and see.  
I found my own place in Geology,  
And I will share some knowledge that I've learned.  
It's int'resting, I think you will agree,  
The path to the degree that I have earned.  
Allow me to present this poem (or rap);  
It is my metaphorical field map.

**Temperatures rising**  
**Sea levels rising**  
**Student risings**


**Did your schooldays prepare you to take care of the Earth?**

**Teach exams**  
**Teach facts**  
**Teach skills**  
**Teach care**

**Should they have?**

neenane@tcd.ie

Assessing Irish students' readiness for future geoscience challenges  
 Emer Emily Neenan | School of Education | Funded by the Irish Research Council

 Trinity College Dublin  
 Coláiste na Tríonóide, Baile Átha Cliath  
 The University of Dublin

Trinity Long Room Hub  
 Arts & Humanities Research Institute

**Inspiring Generations**  
 The Campaign for Trinity College Dublin




Figure 45: “Did your schooldays prepare you to take care of the Earth?”



How does a research student  
trying not to lose the  
momentum, precarious  
in a scary rush to finish up,  
during a global catastrophe,  
trying to catch some sleep,  
find the time to rhyme a line  
about her process?

So...

When I was maybe four years old  
I thought about it hard, and told  
my mother that one day I'd be  
Professor Emer, listen to me!

She said I'd need a PhD.

A winding path; from Physics to Geology,  
a half-turn back, Seismology,  
then sideways, to where I'm meant to be  
a Science Education degree

Begun in the summer of 2016,  
That year everything seemed to split  
Into before and after, remember it?  
Pokémon GO on every phone screen  
EU's crisis of refugees to admit  
And Britain and the US going to--  
make historically questionable decisions. But,

I started this.  
This journey, this learning,  
this fire I set burning.  
For all or for naught.  
At 26, unmarried, childless,  
And neurotypical (I thought)  
Ready for four years or a while less.

A first paper, intentions,  
A wedding and honeymoon,  
Opportunities, summer schools  
Forgetting, remembering,  
Delays and fits and starts and slog,  
Tears and laughter, the odd blog,  
Finding a place in the Arts & Humanities,  
Finding a way to deal with a pregnancy,  
Meanwhile I get diagnoses by degrees,  
And clutter myself with stress and anxieties, but

I started this  
As a positivist, positively passionately restricted  
Certain, stiff but brittle, but I learned to stick with this  
Discomfort, little by little, the seduction of the dutile,  
Constructing a conversation and exploring philosophy--  
Turns out I'm a philosopher!  
A whole new world of ontological puzzles  
I love it.  
I defined myself within pragmatism  
As I find my self-created baggage isn't a failing  
Ignoring it is  
I can bring my whole person to this  
And I did.

And I'm a perfectionist, but I know  
That flaws are inevitable, in research doubly so  
All we can do is note and learn  
Go with the flow  
And try our best to earn  
Wisdom to bring with us where next we go

And

Here I am.

See, they noticed I was “gifted”  
When I was pretty small  
They noticed lots about me  
But they didn’t notice all  
I am  
a girl become a woman whose

Attention  
Definitely  
Has  
Directionality

So...

What is it to be  
thirty, third degree,  
interrogating, waiting,  
third generation, lucky, looking,  
weighing downs and ups  
and oops and luck?

Getting stuck.

And look, the path between the trees  
The seeking weeds, the thawing freeze  
That eases very soft and slow  
Releases all at once, and no  
I will not come this way again  
A sharp spring day, a breath of air  
A prying disbeliever’s prayer  
I cannot come this way again  
I walk back home, I raise my pen

or touch the keys

Word

by word

tapped

out

but sometimes at once all too many come flooding too fast to

catch.

So...

How does a writer--

Am I a writer?

Who is a writer?

A night or two of panicked queries,

Half-remembered theories,

But listen. This is how it goes.

Everything changes us.

Sometimes a lot.

I don't know what I am

Till I see what I wrote.

So...

How does an all-or-nothing  
young wan  
pale and sickly, all go  
too-fast, too-slow, bimodal  
researcher queer as any folk,  
Feminist, fed up of this,  
obsessed with the poetry of prose,  
now a mammy on top of it,  
keep going?

Word

by word.

From the desk of Emer Emily Neenan  
Government of Ireland Postgraduate Scholar  
School of Education  
Trinity College Dublin  
Ireland

6th August 2020

Dearest Reader,

I hope you have enjoyed reading this thesis. I hope I've succeeded in what I set out to do; bring you on a journey close to the "action" of this research, from inception through the background, the theory, the methods, the implementation, the results, the findings, and the implications and speculations. I hope you feel as though you understand this study at least as well as one written in a traditional thesis format.

Many of the documents in this thesis have found their own places elsewhere. I performed the mixed methods poem at the 10th anniversary of the Trinity Long Room Hub Arts & Humanities institute celebratory showcase, and I shared the self-reflection poem as part of the ResearchMATTERS Identities In Transformation series. One of the papers has been published (the position paper), and two have been submitted for review. The letters to the Minister for Education and the Secretary General of the UN have been sent. Until now, it has been a living thesis, growing and changing and interacting with the world. Now it lithifies.

But this thesis, this study, is just the beginning for me, and just a small piece of the puzzle for geoscience education research. This is a vital area, and one of my biggest problems will be narrowing down the options for what to focus on, when there are so many different aspects and perspectives to explore here.

Possibly the most important thing I want you, dear reader, to take from this thesis is the fantastic scope and value of CRAGs. Working with the students has been a real highlight of this experience (and it's a crowded field, because I've been very lucky to enjoy a lot of this PhD - particularly the travel). I began this project with some ill-defined principles of feminism and children's rights, with an idea of some kind of participant involvement, and the expectation that it might be useful. I end this project with an unwavering belief in the absolute requirement to meaningfully centre students in education research, and young people in climate change research, at every stage. I also end this thesis with the tools and skills to do so. Whatever specific areas I end up researching next, I know I'll be doing it with cooperative discussion groups. Wherever I end up going next, I know I'll be introducing student or participant voice methodology and insisting on its development and use.

But I also don't want the success of the CRAGs to distract from the vital findings of the survey itself. They are perhaps unsurprising, especially for anyone clued into the school strikes movement. But it is important to have this evidence that these issues are not just the domain of a handful of passionate student activists. These activists are the voice of a generation; an engaged and increasingly enraged generation. Irish school students are broadly very interested in these topics; they are worried about the Earth, our Earth; and they consider these topics to be important and useful. They struggle with many of the concepts, and some of them have valid criticisms of how they're being taught this information, but they near-universally consider it important that they *are* taught about it. They want to learn more, they want to do more, and they want *us* to do more.



I hope that this work will contribute to improvements in Earth Science education in Ireland. However, to be perfectly frank, the traditional formal education system moves too slowly to effectively tackle the topic of climate change. It's impossible to keep a physical textbook up to date on a multifaceted and accelerating global megacatastrophe. It's very difficult to even keep a person abreast of the ongoing research into the devastation already being caused by climate change, and if that person is a full-time teacher juggling multiple classes, it's even harder. The emotionality of this topic adds another layer of complexity. How can a teacher discuss these issues honestly while preserving the mental and emotional wellbeing of young people who are already worried, even scared? Furthermore, even if a teacher successfully navigates the emotional quagmire and delivers an engaging lesson, with the latest figures and case studies, the students, understandably, want actionable material, they want to learn how to *do* something about this. "Sustainability" in the context of a modern Irish household is akin to bailing out a sinking ship with a thimble, and the students know it. The leak is obvious, but the rich and powerful are making money off it, so it's not being fixed. Individualisation of blame and guilt for the climate crisis, and environmental-flavoured greenwashed consumerism (buy a keep-cup! buy an electric car! buy a metal straw!) are almost as toxic as climate denialism, draining and deflecting energy from the real fight. But how can we expect the school system to teach the kind of radical activism required to hold corporations, governments, billionaires, etc., to account? Formal education systems are built to progress slowly, for the sake of continuity and certainty, and they are constructed by and within the same power structures that are causing the climate crisis: capitalism, imperialism, kyriarchy. The ecological devastation caused by climate change is moving faster than curriculum reform ever can.

But we can do what we can do. And the pandemic has proven that governments, industries, and educational institutions can move extremely fast when they really have to. Between the first and final draft of this letter, UN Secretary-General António Guterres announced the formation of a Youth Advisory Group on Climate Change “to provide perspectives, ideas and solutions that will help us scale up climate action”. I feel confident in my now-expert opinion that such a group has a huge amount of potential. I hope it will be implemented in a way that gives real power to the people involved. Perhaps the pebbles and scree are starting to shift before the landslide.

Finally, I hope this work stands as proof of the epistolary format as an engaging and effective way of communicating a research project. And that it’s possible and worthwhile to crumple up the “rules” and design from first principles, even for something as ostensibly set in stone as a doctoral thesis. If you read this far, please tell me you did at [e3neenan.ie/thesis](http://e3neenan.ie/thesis) because I would love to hear from you, whoever you are.

Thank you for reading. I hope you had fun. I did!

Is mise,

A handwritten signature in black ink that reads "Emer Emily Neenan". The signature is written in a cursive, flowing style with some loops and flourishes.

Emer Emily Neenan

(Stone puns all intended!)





# Appendix I

## ~ Thesis Personae ~

## ~ Thesis Personae ~

*in which are listed all persons who appear in this work,  
real or fictional, designated as such,  
in the following order*

I. those members of  
the School of Education, Trinity College Dublin

II. those members of  
the Trinity Long Room Hub community  
at Trinity College Dublin

III. those members of  
the wider community of Trinity College Dublin

IV. those students, teachers, and principals  
who contributed to the research

V. those who attended the Erice School of Science Journalism in 2017

VI. those who (virtually) attended the  
European Geosciences Union online meeting #ShareEGU in 2020

VII. those members of the  
online Women In Academia Support Network #WIASN

VIII. those close family and friends who lived with the thesis  
(mo theaghlach)

Emer Emily Neenan ~ the author of the work  
(A.K.A. Emer Emily Ellis-Neenan, Emily)

## I. The Trinity College School of Education

|                      |        |                                                              |
|----------------------|--------|--------------------------------------------------------------|
| Dr. Joseph Roche     | ~ real | ~ the author's supervisor & enthusiastic meme connoisseur    |
| Prof. Colette Murphy | ~ real | ~ the author's co-supervisor & storyteller                   |
| Laura Bell           | ~ real | ~ research coordinator, beta reader, smol bean               |
| Dr. Aidan Seery      | ~ real | ~ philosopher                                                |
| Dr. Ann Devitt       | ~ real | ~ Chair of the Ethics Committee                              |
| Prof. Nóirín Hayes   | ~ real | ~ internal examiner for confirmation                         |
| Lauren Boath         | ~ real | ~ doctoral researcher, mentor                                |
| Angeliki Lima        | ~ real | ~ doctoral researcher, TLRH alumna, ray of sunshine          |
| Autumn Brown         | ~ real | ~ doctoral researcher, TLRH alumna, bright spark             |
| Mags Amond           | ~ real | ~ doctoral researcher with a sparkle in her eye              |
| Tanya Zubryski       | ~ real | ~ doctoral researcher, TLRH alumna, companion in dark humour |

## II. The TRINITY LONG ROOM DUB

|                      |        |                                    |
|----------------------|--------|------------------------------------|
| Prof. Jane Ohlmeyer  | ~ real | ~ Director of TLRH<br>(as was)     |
| Francesca O'Rafferty | ~ real | ~ Events Promotions<br>Officer     |
| Carlos Oliveras      | ~ real | ~ TLRH alumnus &<br>poet           |
| Jessica Garska       | ~ real | ~ TLRH alumna &<br>kitten-wrangler |
| Louise Kari-Mereau   | ~ real | ~ TLRH alumna &<br>cynic           |

## III. TRINITY COLLEGE DUBLIN GENERALLY

|                      |        |                            |
|----------------------|--------|----------------------------|
| Prof. Linda Doyle    | ~ real | ~ Dean of Research         |
| Dr. Shaun O'Boyle    | ~ real | ~ science communicator     |
| Dr Lisa Maria Reilly | ~ real | ~ Trinity Sociology alumna |

## IV. CONTRIBUTING SCHOOLS

|                   |             |                        |
|-------------------|-------------|------------------------|
| Ciara McMuinteoir | ~ fictional | ~ science teacher      |
| Fionn Preevidja   | ~ fictional | ~ school principal     |
| Niamh Gallagher   | ~ fictional | ~ Junior Cycle student |
| Jane O'Ceallaigh  | ~ fictional | ~ Junior Cycle student |
| Úna Daly          | ~ fictional | ~ Junior Cycle student |
| Connor Whelan     | ~ fictional | ~ Junior Cycle student |
| Colm O'Brien      | ~ fictional | ~ Junior Cycle student |



## V. The Erice School of Science Journalism 2017

|                             |             |                                                      |
|-----------------------------|-------------|------------------------------------------------------|
| Katrine Skovgaard Rasmussen | ~ real      | ~ Danish science communicator & children's author    |
| Ryota Okunishi              | ~ real      | ~ Japanese science journalist & musician             |
| Amy Dobos                   | ~ real      | ~ Australian communication strategist & photographer |
| Anwasha Chakraborty         | ~ real      | ~ Bengali science/culture researcher                 |
| Silvia Franceschini         | ~ real      | ~ Italian science communicator                       |
| Daniela António             | ~ real      | ~ Portuguese science communicator                    |
| Bryce                       | ~ fictional | ~ Scot                                               |

## VI. EGU

|                  |             |                                                      |
|------------------|-------------|------------------------------------------------------|
| Fergus McAuliffe | ~ real      | ~ EGU convener & iCRAG Communications Manager        |
| Jen Roberts      | ~ real      | ~ EGU convener & lecturer, University of Strathclyde |
| Jade Steinmann   | ~ fictional | ~ EGU attendee                                       |
| Rochelle Clacher | ~ fictional | ~ EGU attendee                                       |
| Anna Arnaud      | ~ fictional | ~ EGU attendee                                       |
| Arkaitz Peña     | ~ fictional | ~ EGU attendee                                       |
| Stanford Mason   | ~ fictional | ~ EGU attendee                                       |
| Shinju Ishiyama  | ~ fictional | ~ EGU attendee                                       |

## VII. #WIASN

|                        |             |                 |
|------------------------|-------------|-----------------|
| Emma Esme Hudson-Doyle | ~ real      | ~ #WIASN member |
| Amalea Carter          | ~ fictional | ~ #WIASN member |

## VIII. mo t̃heaghlach

|                              |        |                                                        |
|------------------------------|--------|--------------------------------------------------------|
| Stuart Ellis-Gorman          | ~ real | ~ the author's husband & consultant medieval historian |
| Kai Alexandrite Brídín Ellis | ~ real | ~ the author's daughter & proprioception consultant    |
| Áine O Neill                 | ~ real | ~ the author's mother & consultant biochemist          |
| Frank Neenan                 | ~ real | ~ the author's father & vexillology consultant         |
| Barry Neenan                 | ~ real | ~ the author's brother & consultant librarian          |
| Kathryn Lambe                | ~ real | ~ the author's confidante & psychology consultant      |

## Appendix II

“Hi, would you mind if I included you as a “character”  
in my weird thesis?”

*Appendix II: Hi, would you mind if I included you as a “character” in my weird thesis?*

*This appendix includes a selection of communications about the epistolary thesis between me and the people who helped with and/or appear in it. It is not intended as an exhaustive record but a glimpse “behind the scenes”.*

*In this case, unlike the main body of the thesis, people’s words are generally directly their own. The only exception is the first email exchange between me and Joseph, which is semi-fictionalised based on a real conversation, in the manner of our exchanges in the thesis proper.*

*Appendix II: Hi, would you mind if I included you as a “character” in my weird thesis?*

24 November 2017 at 00:45

From: Emer Emily Neenan

To: Joseph Roche

Hi Joseph,

Okay hear me out.

I want to write my thesis in an alternative format. And I think I should write it as an epistolary. What do you think?

E.

24 November 2017 at 01:10

From: Joseph Roche

To: Emer Emily Neenan

Hi Emily,

Well, first of all, I'm afraid I don't even know what an epistolary is! So I'm already one step behind you on that, at least.

But generally speaking, I'm not sure it's the best idea. You're very capable of writing academically, you should have no trouble producing a thesis. I know the thesis can be a bit boring, but maybe it would be a better use of your ideas to follow up the thesis with an interesting book on the topic? I could help you pitch it, I'm sure we'd find a publisher that would suit. The thing is, no one really reads theses!

Still very curious what an epistolary might be - feel free to explain it to me and we can discuss it!

Best wishes,  
Joseph

*Appendix II: Hi, would you mind if I included you as a "character" in my weird thesis?*

24 November 2017 at 11:11

From: Emer Emily Neenan

To: Joseph Roche

Thank you for the vote of confidence!

I've checked all the Trinity and School of Education regulations and guidelines on theses and there's nothing that says anything about the actual format the information is presented in. Let's discuss it at our meeting tomorrow - I think I can convince you!

Aside from anything else, maybe no one reads theses because everyone knows that no one reads theses, so why bother making it readable or interesting? Just play it safe.

I don't want to play it safe!

E.

*Appendix II: Hi, would you mind if I included you as a "character" in my weird thesis?*



Kathryn Lambe

last seen today at 5:02 pm

Monday 19 March 2018

so I want to put some social media / chat logs into the thesis 2:49 pm

can I put you in? I will write your side of the "conversations", so it won't be you, it'll be a fictionalised character of Kathryn Lambe (or whatever pseudonym you prefer) 2:49 pm  
and can I use your profile photo (and which one) in it? 2:50 pm

2:53 pm oh wow, I LOVE that idea

2:53 pm yes of course you can ^-^

thank you! 2:54 pm

3:02 pm what sort of conversations are you going to show?

haven't totally decided 3:11 pm

but I'm thinking of including "you" to discuss some of the personal impact stuff 3:11 pm

3:13 pm ah cool!

3:13 pm well I would be honoured!! <3

Appendix II: Hi, would you mind if I included you as a "character" in my weird thesis?

21 May 2020 at 15:45  
From: Emer Emily Neenan  
To: Fergus McAuliffe, Jen Roberts

Dear Fergus & Jen,

Thanks again for a great session during EGU - it was really valuable and surprisingly enjoyable, even if it wasn't as much fun as we might have had in Vienna!

I have a small request concerning my thesis.

As I said in the session, my thesis is an epistolary, comprised of many discrete but connected documents (emails, journal excerpts, papers, even poems and short stories). I've attached an example (I'm sure I don't have to ask you not to share it further). I write everything myself, even the emails/messages "from" others (Colette and Lauren, in the example), because obviously it's my thesis so I have to write all of it. When I'm writing in the voice of someone else, I base it on my memories or notes from the conversation I'm fictionalising. Almost everything is based on real events. exchanges, experiences, etc.

Which brings me to my request: I would love to include a "chat log" from EGU, as though it's the section of EOS9.1 where I presented and answered questions. It's an important experience in my PhD journey and I think it would be a valuable addition to the section I'm now forced to write, about the impact of the pandemic and adjustments I'm having to make to the final stages of the research. I am perfectly happy to include fictional "attendees" to ask the questions, but if you wouldn't mind, I would like to include you both as convenor and co-convenor. I would write a few short messages "from" Fergus and Jen (welcome to the session, "Next we have Emer Emily Neenan's...", a couple of questions) based on my notes from the session.

If you would like to review it before I include it, I am very happy to send you the section for you to do that. And if you would prefer, I won't include you at all (I will probably reframe to avoid having a convenor in the section of the chat log I write). Your names will still appear as the convenors, either way, as the basic details of the session are included, similar to a reference.

Hope you're both well and managing the vagaries of pandemic life!

Best wishes and stay safe,  
Emily.

Appendix II: Hi, would you mind if I included you as a "character" in my weird thesis?



21 May 2020 at 15:59  
From: Jennifer Roberts  
To: Fergus McAuliffe, Emer Emily Neenan

Hello,

This is superb. Absolutely do name me for chat and online comments, whatever  
"I" "ask".

Let me know if you'd like anything else from me.

//J

.....  
Dr Jen Roberts  
Lecturer - Chancellor's Fellow in Energy  
MRes Director Civil & Env Engineering  
GEMaP CDT Co-Director  
Civil & Env Engineering, University of Strathclyde

21 May 2020 at 16:33  
From: Emer Emily Neenan  
To: Fergus McAuliffe, Jen Roberts

Brilliant, thank you so much!

Would you mind if I include this email exchange in the appendix also? I'm  
including the process of asking for permissions so the examiners know exactly  
what was going on with the fictionalisation. This will just be verbatim, as a  
record. If you prefer, I'll just note that I asked and you agreed. But I think it's fun  
to have the real emails!

I'll share the semi-fictional EGU chat log when it's finished so you can see  
"yourself"!

Best,  
E.

*Appendix II: Hi, would you mind if I included you as a "character" in my weird thesis?*

21 May 2020 at 16:34  
From: Jennifer Roberts  
To: Fergus McAuliffe, Emer Emily Neenan

Of course you may\*

\*this of course makes me wonder if I should adopt a more professional email conduct (answer = of course no!)

Super. Have a great weekend When It Comes.  
Jen

21 May 2020 at 16:59  
From: Fergus McAuliffe  
To: Emer Emily Neenan, Jen Roberts

Hi Emily,  
Sounds great to me and am happy to be included.  
Am also happy I made a (misspelled) reference to Samuel Beckett in the EGU chat too!

**Dr Fergus Mc Auliffe | Communications and Engagement Manager**  
iCRAG (Irish Centre for Research in Applied Geosciences)

21 May 2020 at 17:03  
From: Emer Emily Neenan  
To: Fergus McAuliffe, Jen Roberts

Thank you both! I'm looking forward to seeing what you think of "you" in the chats. I'll be working on them over the next few days so I'll send a version soon.

And I'll be sure to include the Beckett reference with great fidelity for you, Fergus!

Have a good (albeit socially distanced) weekend,  
E

*Appendix II: Hi, would you mind if I included you as a "character" in my weird thesis?*

[4:18 pm, 21/05/2020] Emer Emily: can you do me a help?

[4:19 pm, 21/05/2020] Barry Neenan: What's up?

[4:19 pm, 21/05/2020] Emer Emily: I need three or four fake attendees for a fictionalised version of my online conference for my thesis

[4:20 pm, 21/05/2020] Emer Emily: my brain was immediately like tHeY sHOuLd hAVe mEaNinGfUL nAMeS

[4:20 pm, 21/05/2020] Emer Emily: but actually I don't have time for that bullshit

[4:20 pm, 21/05/2020] Emer Emily: but then I was like, wait a minute

[4:20 pm, 21/05/2020] Emer Emily: I know someone who likes coming up with Meaningful Names

[4:20 pm, 21/05/2020] Barry Neenan: :3

[4:20 pm, 21/05/2020] Barry Neenan: You do!!!

[4:20 pm, 21/05/2020] Emer Emily: if I give you some Themes could you make a few meaningful names for me?

[4:20 pm, 21/05/2020] Barry Neenan: HELL yes

[4:21 pm, 21/05/2020] Barry Neenan: this is the best kind of favour

[4:21 pm, 21/05/2020] Emer Emily: :D :D :D

[4:21 pm, 21/05/2020] Emer Emily: yaaay!

[4:21 pm, 21/05/2020] Emer Emily: also I'm putting this exchange in the thesis

[4:21 pm, 21/05/2020] Barry Neenan: i'm gonna be famous

[4:24 pm, 21/05/2020] Emer Emily: okay so themes include: the intersection of Social- and Earth Science / I wish we were in Vienna but we are instead online / rocks are fun / graphic design for scientific purposes

[4:24 pm, 21/05/2020] Emer Emily: names should be a mix of nationalities, mainly European

[4:25 pm, 21/05/2020] Emer Emily: if you could also pair them with appropriate institutions that would be amazing, e.g. if you make a French name google me a French university that has a Geology/Geoscience department

[4:25 pm, 21/05/2020] Barry Neenan: Yes, I was going to specifically ask about ethnicity

[4:26 pm, 21/05/2020] Barry Neenan: Okay! I'll get started

[4:26 pm, 21/05/2020] Emer Emily: thank you!!!

[5:01 pm, 21/05/2020] Barry Neenan: okay i'll be honest; based on the applicability of those themes to What Does Your Name Mean websites, I went all-in on "rocks are fun"

[5:02 pm, 21/05/2020] Barry Neenan:

**Jade Steinmann, University of Vienna (attendee)**

**Rochelle Clacher, University of Edinburgh (author)**

**Anna Arnaud, University of Antananarivo (author)**

**Arkaitz Peña, University of the Basque Country (attendee)**

**Stanford Mason, University of Minnesota (author)**

**Shinju Ishiyama, Kyoto University (author)**

[5:21 pm, 21/05/2020] Emer Emily: omfg :P

[5:21 pm, 21/05/2020] Emer Emily: I love them :D

[6:07 pm, 21/05/2020] Barry Neenan: Glad to hear it!

[6:07 pm, 21/05/2020] Emer Emily: thank you :D

[6:07 pm, 21/05/2020] Barry Neenan: :3

Appendix II: Hi, would you mind if I included you as a "character" in my weird thesis?

30 July 2020 at 23:32  
From: Emer Emily Neenan  
To: Jane Ohlmeyer

Dear Jane,

I hope you're well and staying safe and sane in this very strange summer.

As you might remember, I'm writing my thesis as an epistolary, with semi-fictional documents mainly written in my voice(s) but also including contextual information written by me but as though "from" other people. May I include the character of Jane Ohlmeyer in her capacity as Director of the Hub?

Speaking of which, congratulations on all your successes in that role, I know you'll be sorely missed. I hope to still see you at some Hub coffee morning or seminar when it's safe to be back on campus.

I'm submitting my thesis very soon but will be continuing to work with my same research group on a COALESCE project I co-wrote the proposal for, so I'll be around for at least a while longer.

Best wishes,  
Emer Emily

31 July 2020 at 09:42  
From: Jane Ohlmeyer  
To: Emer Emily Neenan

Dear Emily Emer

Great to hear from you and to know all is well.

I've never appeared as a character in a thesis (or anything) before but am more than happy to! I'll look forward to see what I have to say!

Best of luck with finishing the thesis and hope to see you soon.

As ever  
Jane

Professor Jane Ohlmeyer, MRIA, FTCD, FRHS  
Erasmus Smith's Professor of Modern History (1762)  
Trinity College Dublin, the University of Dublin  
Dublin 2, Ireland

Appendix II: Hi, would you mind if I included you as a "character" in my weird thesis?

> Erice SJ 2017

> New posts



Emily Ellis-Neenan

Hi everyone, you may or may not remember I asked ye about geoscience / Earth Science in secondary school in different countries, and I got lots of really useful information. I'm going to submit my PhD thesis next week and I just want to double check that it's okay to mention ye, specifically, [Katrine](#), [Ryota](#), [Amy](#), [Anwasha](#), [Silvia](#), [Daniela](#)? I'm writing my thesis in an alternative format, as an epistolary with semi-fictional sections, so I've written this section as a short story about Erice with the "characters" of Emily, Katrine, Ryota, etc., discussing this topic, like it was one of the wonderful topics we discussed at lunch every day! I will only use your name if you want me to and tell me it's okay, otherwise I will give the "character" a different name! Hope everyone is well ❤️



7



[Silvia Franceschini](#) Of course! And the idea for your thesis format is amazing, I'd love to read it!



1

[Emily Ellis-Neenan](#) I will share it when it's finished! It will be published in my university's open access archive so I should be able to share a link very easily!



1



[Daniela António](#) That is so cool! I'd be happy to have a character with my name! Thanks for asking, please do share when you publish it :)

[Emily Ellis-Neenan](#) Great, thank you!



[Katrine Skovgaard Rasmussen](#) Sounds very exciting. Good luck 😊

[Emily Ellis-Neenan](#) Thank you! Is it okay to use your name, Katrine?

[Katrine Skovgaard Rasmussen](#) Yes. Go ahead 😊

Appendix II: Hi, would you mind if I included you as a "character" in my weird thesis?



Anwesh Chakraborty A character with my name 😊 thanks for making it immortal. Please do so 😊

Emily Ellis-Neenan I'm glad you approve! :D



Amy Dobos I am intrigued about my character portrayal hahaha 'crazy drone flying australian' but yes go ahead. Amazing!

Emily Ellis-Neenan "Suddenly, Amy sprints past chasing a drone!"  
(Thank you!)

Amy Dobos Glad I am keeping the 'out there' Australian stereotype alive haha



Ryota Okunishi I'm glad to be used!!  
I've never heard the thesis containing semi-fictional section and that sounds wonderful!

Emily Ellis-Neenan Thank you! I really can't wait to share it! <3

Appendix II: Hi, would you mind if I included you as a "character" in my weird thesis?

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All of the references are within the body of the thesis, at the end of the document in which they are referenced, or in footnotes, as appropriate. Below is a full alphabetical list of every reference.

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# A brief note on fonts

It's probably obvious that I really enjoyed picking out suitable fonts for all the different sections and voices in this thesis, so for the curious; this thesis was written primarily in Google Docs & Slides, and the fonts are a mixture of standard and additional fonts available through Docs.

This font is Gabriela, and I use it mainly for my own voice when I'm expressing my personality or opinions.

If I'm being a bit more formal, I switch to Garamond. Those two are the default fonts throughout the thesis.

I use Sofia for embellishments and signposts.

Times New Roman is used for academic papers and similar. But Arial is used for proposals and forms.

A keen eye will pick out that the emails are all in Helvetica Neue, while other instant/social/online interactions are generally written in Roboto (including the video chat transcripts in Roboto Light). The survey itself is also in Roboto, as mentioned before.

*I defaulted to Kite One for longer handwritten sections as it's clear and not too annoying to read in longer paragraphs, but for shorter sections and quotes...*

Coming Soon is cute,

I like Just Another Hand too,

**PERMANENT MARKER DEFINITELY SAW USE,**

*and Pacifico is real teen vibes,*

while Architech's Daughter is my go-to for "drawings" like those in the zine or on posters.

Speaking of the zine, it's written in Special Elite.

**Finally, particular headings, such as the Appendices, are written in Uncial Antiqua, which might honestly be my favourite!**



### **Perchance To Dream: Efficacy of Direct Dream Manipulation on Mental Health Outcomes of Self-Isolating Single Adults**

Use of self-isolation measures to mitigate the spread of COVID-19 must be weighed against the detrimental effects that loneliness, boredom, and lack of control have on mental health, particularly on those living alone. This paper describes the successful pilot of a program to investigate the efficacy of the implementation of the Somnioencephalagic Alteration of Neurotransmitters for Dream Synthesis (SANDS) technique, developed by Lu & Laby (2016), to alleviate the impact of isolation. Via SANDS, predetermined dream topics are “seeded” in the waking mind, resulting in a high degree of influence over the atmosphere and “story” of the dreams subsequently experienced in later phases of REM sleep. Initially developed for military applications, this program has the potential to provide nightly excursions, entertainment, and “social” activities to those self-isolating (Lu & Sid, 2020).

Recruitment of self-isolating neurotypical single adults living alone took place via phone due to social-distancing requirements. Dream-seeding was completed over three days, and participants' dreams were recorded nightly via remote theta-wave harvesting and participant journalling, from 7 nights before seeding began to 14 nights after initial seeding. Participants completed weekly self-assessments measuring three self-isolation mental health impact factors: loneliness, mental resilience, and depression. In all, 32 participants (17 F, 15 M) underwent dream seeding, and 29 completed the study (two participants withdrew, one participant was lost in the dreamscape). Initial results have been extremely promising, with statistically significant decreases in all three measures, particularly loneliness. A large majority of participants (27) have reported via dream journal how "real" it feels to speak with "friends" in the dream. Interestingly, 13 participants describe striking up a new "friendship" with a "gentleman" in the dreams. Recruitment of up to 3,000 participants is currently ongoing for the full study, and it is anticipated the program could be offered to the general population within months.



**Dr Aisling Lu** holds a Bachelor's degree in Neuroscience from NUI Tara, a MSc in Practical & Applied Oneirology, and a PhD on the ethics of non-invasive dream-harvesting, both from the Mung Seung Centre of HKU. She is currently Professor of Oneirological Studies at Quaternity College, University of Dublin, and PI of the SANDS-NOD research group. Her research interests include dream manipulation, remote and gentle dream-harvesting techniques, sleep paralysis, and dreamscape mapping. She has published widely on dream manipulation and related topics, including 2019's *Domesticated Dreams: Modern Techniques For In-Dream Learning*. In her spare time, she enjoys collecting names and butterflies.

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