I'm a Scientist, Get me out of here

Summative Evaluation Report

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About the Author

Jen DeWitt, PhD, is a researcher and evaluation consultant specialising in learning and engagement, particularly in informal settings. She is currently a Senior Researcher Fellow at UCL working on the Making Spaces project.

As part of the ASPIRES and Enterprising Science projects, Jen worked in the core team developing the concept of science capital.

In 2019, she conducted an evaluation of *I'm a Scientist* (IAS) activities to see how the experience might support students' science capital.

I'm a Scientist Ireland

The aim of this evaluation is to build on our qualitative work on science capital in the UK and, specifically, to gather evidence of the way in which *I'm a Scientist* may be supporting science capital among participating young people in Ireland. In order to explore this, a mixed-methods evaluation was conducted in December 2021.

Summary of findings

Supporting science capital among Irish students

This evaluation found evidence that *I'm a Scientist* (IAS) does support science capital among participating students in Ireland.

The survey data reflects that the activity is a positive experience for students, in which they can get their own questions answered by scientists who come across as 'normal people'. The activity also contributes to their understanding of scientists, their work and their lives.

Interviews with teachers confirmed these findings, with teachers reporting that the activities were an opportunity for their students to meet 'real scientists' – something that is simply not available to them otherwise – and come to appreciate that scientists are normal people doing jobs that they might aspire to themselves. Teachers also felt that a range of students were able to engage in the activities, at their own level, and to learn more about the range of jobs in science.

Finally, analysis of the Chat transcripts confirmed that a range of questions were asked and answered – about scientists' jobs, pathways into science and lives outside of science, as well as about science itself. It also provided insight into the way in which IAS supported these outcomes – with scientists clearly valuing students' questions, which often led to extended interactions in which a rapport could be seen developing between scientists and students.

Altogether, analyses from this evaluation align with our previous research around the way in which IAS supports science capital, suggesting that it likely does so for students in Ireland as well.

Viewed through the lens of the Science Capital Teaching Approach (SCTA) IAS would seem to create a learning environment where young people have the opportunity to contribute by drawing on their own experiences and interests (*'broadening what counts'*, the foundation of the SCTA). More specifically, in live Chats and in Ask, young people are invited to contribute questions (*'elicit'*). Scientists *value* these questions by responding — often in considerable detail. In the broader context of the Chat, these questions are *linked* back to science content. Because students are in control and ask questions of

interest to them (they are the ones deciding what to ask), the activity is necessarily *personalised and localised*.

Last but not least, this evaluation found evidence that IAS supports the development of dimensions of science capital. By providing the opportunity to ask about science content, it contributes to ***science literacy (Dimension 1)***. Because students can ask questions of interest to them personally, it can enhance science-related attitudes and values, helping students to see ***science as relevant to their everyday lives (Dimension 2)***. When students ask about qualifications, participation may improve their knowledge of the ***transferability of science (Dimension 3).***

Most importantly, however, IAS provides an opportunity to get to ***know scientists (Dimension 7)*** — about the paths they took to their current work, about a range of aspects of their work (e.g. travel, teamwork) and about their lives outside of work. Students even discover that scientists are normal individuals, albeit with interesting jobs. While we do not claim that this is the same as knowing someone in a science-related job personally, it contributes to a similar outcome: coming to see scientists as people 'like me', whose careers may be attainable, rather than distant and impossible.

Of course, IAS is a relatively brief enrichment experience and cannot be exclusively responsible for developing students' science aspirations and maintaining a sense that science is 'for me' over time. However, our evidence suggests that it has a valuable role to play in contributing to this process, especially for young people like those in the schools we studied, who may simply not have other opportunities to encounter people in science-related roles, much less to ask them questions of personal interest and relevance.

What we did

Pre and post-surveys

All participating schools were asked to have their students complete pre and post surveys. Aligned with surveys used previously, they aimed to capture students' reactions to and experiences of IAS, particularly aligned with the key dimensions of science capital that IAS supports. It also provides a rough sense of the science capital of participating students.

106 students from six schools completed surveys. Of these, we obtained matched responses from 67 students, as well as 27 further pre-surveys, and 12 additional post-surveys. (More may have completed both pre and post but we were unable to match them.)

Analysis of chat transcripts

Transcripts of eight chats were analysed, chosen to ensure that a range of school characteristics (primary/secondary, rural/urban) and chats from both Zones (Sustainability and Magnesium) were included, but randomly selected within those criteria. The analysis had a particular focus on the types of questions asked (e.g. science content, motivations and paths taken into science, day-to-day job features, scientists' lives outside of work) and the ways in which scientists responded (e.g. which question types were answered, whether their personalities came through, whether they seemed to value students' questions). Transcripts were also examined for instances of the development of rapport between scientists and students, which has been found previously to be important in supporting science capital.

Teacher interviews

Three teachers were interviewed – one from a rural secondary school in the west of Ireland (Co. Galway), and two from Dublin schools. Of the Dublin schools, one was in an area of deprivation, while the other had a more mixed intake, with students from a wider range of backgrounds, although the majority were from families with no experience of higher education.

The interviews covered similar areas to those used in our previous work exploring science capital but particularly focused on student outcomes and experiences of IAS, as well as student background (e.g. trying to gain a sense of students' general engagement with science/science capital).

Due to IAS wrapping up so close to the holidays, we were unable to conduct any focus groups with students. However, the similarity in what the teachers reported, as well as the chat transcripts, with previous work in the UK suggests that students would have reported similar experiences.

What we found out

Survey

Survey responses were broadly aligned with our previous findings from surveys conducted in the UK. Overall, they suggest that students participating in IAS had low to medium levels of science capital and that the experience was likely to have supported their science capital.

On the pre-survey, only 24.5% agreed they 'would like to have a job that uses science', noticeably lower than the proportion of secondary students (Year 9/Second Year Junior Cycle, ages 13-14) agreeing with this statement on the ASPIRES survey (34.7%). This is also dramatically lower than the proportion agreeing with this statement in a previous IAS evaluation (48.5%). Of perhaps more direct relevance (as aspirations are an indirect indication of science capital and identity), over half (53.5%) of students said that they knew 'no one' who works as a scientist or has a job using science, and only 50% agreed (or strongly agreed) that one or both of their parents/guardians think science is interesting, which, again, would seem to be markedly lower than other research. Finally, only about one quarter (26.1%) reported talking about science frequently (at least once a week). Altogether this suggests that most students participating in IAS in November 2021 did not have high levels of science capital.

Encouragingly, evidence from the post-survey highlights that participating students in Ireland had a positive experience of IAS. In direct comparison with the pre-survey, the proportion of students agreeing that they knew what qualifications were needed to become a scientist increased, from 40.3% to 44.8% (matched students only), although this was not statistically significant (likely due to the small sample size). Moreover, in reflecting on their experiences of IAS, high proportions of the 89 students who completed the post-survey agreed or strongly agreed with the following statements:
After taking part in *I'm a Scientist*, I know more about scientists' jobs (70.9%)
After taking part in *I'm a Scientist*, I know more about scientists' lives (68.4%)
The scientists in *I'm a Scientist* seemed like normal people (87.3%)
I was able to get my questions answered in *I'm a Scientist* (74.7%)
The scientists in *I'm a Scientist* seemed interested in my questions (65.8%)
I felt comfortable asking questions in *I'm a Scientist* (83.5%)

It should be noted that these proportions are very similar to those found in a survey conducted in the UK in 2019, which had higher numbers of students. Moreover, these statements echo the kinds of sentiments students expressed in focus groups conducted

in previous research around IAS and science capital. That is, students felt that they had learned about scientists' jobs and lives – knowledge that individuals with lower levels of science capital are less likely to have. In addition, this understanding emerged out of an experience that was personal (being able to get their own questions answered) and in which these questions were valued by scientists (who seemed interested in their questions) – and an experience that was for people 'like them', in that they felt comfortable asking questions.

Crucially, students felt that scientists they had interacted with seemed like 'normal people', in contrast to the image of scientists they are likely to have encountered in the popular media. It is this sense of scientists as 'regular' or 'normal' that individuals with higher levels of science capital tend to have, generally drawing on their familiarity with people who are scientists or work in science-related jobs. Altogether, then, responses to the survey suggest that the experience was one that helped support the science capital of participating students, many of whom did not have high levels of science capital.

Chat transcripts

Analysis of eight Chat transcripts (from one primary school and seven secondary schools) reflected that a range of questions were asked and answered in each, as found in analyses of other IAS Chats. There were many questions related to scientific content – some were, of course, about Covid but most were not. That said, it is perhaps not surprising that some of the longest interactions around scientific content did focus on COVID. Nevertheless, the prevalence of content-related questions suggests that IAS was supporting students' science literacy, a dimension of science capital.

Where IAS is more distinctive compared to classroom lessons or even other enrichment opportunities is in its focus on the scientists themselves. Students often asked questions about why the scientists had chosen to pursue a career in science, as well as the path they had taken. Encouragingly, many of the answers about their motivations for pursuing science conveyed a sense of their being driven by interest and curiosity, rather than by being particularly 'good' at it (or exceedingly intelligent), which makes such a path seem more within reach of students. In addition, while scientists often provided answers to questions about subjects they had studied and length of study, several had taken more indirect paths into science, or had pursued other jobs along the way, which illustrates to students that there are a range of paths into science:

> ***Scientist:*** *I still teach drama part-time, and I have worked in restaurants as well. I have had some data science internships too.*

> ***Scientist:*** *I'm from Kildare and I wanted to be a farmer from a young age but I really fell in love with research in university and got to work on a few research farms in my work experience which really told me this was the area I wanted to work in.*

Many students asked questions about scientists' jobs (what their work lives are like and what the work involves), as well as about their lives outside of work. Answers to such questions convey a sense of how enjoyable the scientists find their work – how it is relevant to daily life (e.g. as evidenced by a scientist whose work focuses on making farming more sustainable, an area of particular resonance for students from rural schools), opportunities it gives for travel (e.g. a marine geologist who spends a lot of time on boats) and how it affords a good work-life balance (e.g. flexible hours, time for hobbies).

> **Student:** Why do you like computer science and what got you into it?
>
> > ***Scientist:*** *I think being decent in maths and realising I don't like to memorise biology or history :-).*
> > *Re why do I like it: because you can build things, you can make a difference, you can solve a problem better. And learning about computers and programming is also much easier these days.*
> > *Maybe to add: this job can be done remotely from anywhere in the world. This really helps especially if you have a family and small kids.*

Such replies help challenge the stereotype of science jobs as exceedingly demanding, as requiring a lifetime of aspiration and preparation, or as only for the uniquely clever. The responses piqued the interest of participating students, as further evidenced by some lengthy exchanges:

> **Student:** Hello! What does a marine geologist do?
>
> > ***Scientist:*** *Bonjour Nina :) As a marine geologist I study plate tectonics and the Earth below the ocean: how do oceans form? How do oceans move? those are questions I study :)*
>
> **Student:** Merci! That is very interesting!
>
> > ***Scientist:*** *You are welcome :) have you ever been on a ship?*
>
> **Student:** Oui!
>
> > ***Scientist:*** *That's cool, did you enjoy it?*
>
> **Student:** Oui! I particularly enjoyed the view of the ocean and

seeing the animals that can be found here and there.

Scientist: *Super :) I like seeing animals too, what have you seen? :)*

Student: Seagulls :D Sometimes I ride ships in tropical countries where I can sometimes see flying fish :0

Scientist: *Ooh j'adore les poissons volants ! :D I love flying fishes, they are soooo pretty*

Student: Oui! Also, what subjects did you study before going on to study Marine Geology in UCD? :0

Scientist: *In secondary school I could choose some subjects, and I chose Earth and Life Sciences, as well as History (I really like that). Then I studied Earth Sciences and geology more specifically at University in France where I did my PhD*
Do you already have ideas of a job you would like to do later? :)

Student: Non :(But I was interested in marine biology for some time so it piqued my interest when you said "marine geologist"! What was it like studying in France? Were your classes all French?

Scientist: *No worries, you still have time :) I choose my study and job when I was 16-17 years young ;p I loved studying in France, the courses in undergraduate were in French but I had some lectures in English in my master degree. You look like you know some French already, you would do well in France :)*

Student: Merci et oui, j'ai étudié le français pour mon Junior Cert :) Is there anything in particular that inspired you to start studying your chosen subjects?

Scientist: *Wow je suis impressionné :) Très bon niveau! Yes I have been inspired by my grand father who communicated his love for the sea to me, and by my teacher in Earth Science in school, she was so great, after I had her I wanted to become a geologist, and I choose marine geologist later in College*

Student: Wow! It's cool that you've had some really inspirational and influential people in your life :'D Do you have any book recommendations related to Earth Science and/or Marine Geology and/or the sea in general?

Scientist: *I can not think about a book right now, but I recommend you to follow iCRAG on social media to get news on Irish research on oceans :)*

The above wide-ranging interaction clearly reflects the student's interest in the marine geologist's career. It feels very informal and conversational in tone, and yet a considerable amount of information is communicated: about what a marine geologist does, the path to such a career (and that it was something that did not have to be decided from an extremely young age), and some of the benefits of such a career – around spending time at sea. Additionally, the way in which French is peppered into the conversation, along with emojis, as well as the shared interest in being on ships and seeing animals such as flying fish, signals the development of a rapport between the student and the scientist. The conversation finishes with the scientist responding to a request for advice from the student about where to find out more, which also suggests the possibility of a longer-term impact.

Although the above example is particularly lengthy, shorter exchanges also offered opportunities for students to find out more about scientists and their lives:

Student: Did you ever play any sports?

Scientist: *In college I did rowing for 1 year, and now I've started social badminton with other researchers. That's the good thing about being a PhD student, your timetable is very flexible and you can take time to do sports in the middle of the day!*

In other interactions, students gained a sense of scientists' backgrounds, and could potentially see that they were not necessarily unlike their own (or those of others they might know):

> **Student:** Do you like workin with cows?
>
> > ***Scientist:*** *Definitely. I come from a beef farm and so I love working with cattle.*
> >
> > **Student:** It's all go so.
> >
> > ***Scientist:*** *Definitely is, keeps me busy anyway!*

Most chats also included questions about whether scientists ever got frustrated, made mistakes or were tempted to give up. Responses reflected that this happened with some regularity, that a range of things could go wrong (experiments not working, equipment not working, things going wrong at the last minute) and that scientists are not infallible geniuses but often struggled with some concepts, just like students would.

> **Student:** Did you ever feel like giving up on science?
>
> > ***Scientist:*** *Not science as a whole, but some of the particular concepts I found unnecessarily difficult (like some in physics!)*

These sorts of responses are key in combating the stereotype of scientists as unnaturally clever and unusually driven, to the exclusion of all else. Rather, they offer insight into scientists as 'normal people' doing interesting jobs – jobs that have a range of benefits (including time for hobbies and families) and that could also be attainable for 'people like me'. In doing so, the chats are a key way in which IAS supports students' science capital – by helping them get to know people in science-related jobs, at least to some extent. The potential for such interactions, in which students can get to know scientists and gain an understanding of what their day-to-day jobs and lives are like, to impact on students' aspirations, or at least considerations of science paths, is reflected in the following example:

> **Student:** What does your job consist of?
>
> > ***Scientist:*** *I do a lot of reading, I work with a lot of data which I try to interpret, I keep my pet male and female neurons alive which I then treat with different drugs*

Student: Very cool, that seems really interesting. I would love that kind of work!

A sense of getting to know scientists was further supported by the way in which most scientists responded to students' questions. They often come across as personable and having a sense of humour. While such characteristics were perhaps more apparent in questions about their lives outside of work (with pets, food, films and video games being particular areas of interest for students), humour could also come through in responses about their work:

Student: Did any chemicals explode when you mixed them?

Scientist: *Yes - this is called an exothermic reaction and happens a few times, keeps things interesting!*

as well as in questions about interests and hobbies outside of work:

Student: What is your favourite movie?

Scientist 1: *Jurassic Park *rawr*

Scientist 2: *Fave movie: National Treasure (which doesn't make sense with history as my least favourite subject!)*

Student: What soccer team do you support?

Scientist: *Luxembourg – we got our bums kicked by Ireland alright.*

and in other exchanges:

Student: Are you smart?

Scientist: *No but I am good at pretending*

Student: What's your favourite tractor?

Scientist 1: *I have no opinion on tractors.*
Scientist 2: *Shiny red ones!*
Scientist 3: *I would go with red too. They are faster.*

Scientist 4: *Massey.*

Scientists also came across as personable in the way they introduced themselves and asked questions of the students:

Scientist: *You can ask me anything you want! How are you all today?*

Scientist: *Have you chatted with scientists before?*

In other instances, scientists came across as quite emotional – reacting to experiences in a way that would be relatable to participating students, and combating the image of scientists as cold and unfeeling:

Student: When you were studying the jobs you have now, did you have to move far or at all from home?

Scientist: *Oh my gosh yes! I moved from the Caribbean where I was born and raised to do my masters and I cried a lot that first year cuz I missed home so much!!*

Student: My dad was also super sad to leave for studies as well! Thanks for answering!

Some exchanges clearly highlighted the way in which the chats could support a sense of science as personally relevant, and at times seemed to encourage questions which felt quite personal:

Student: You are studying the difference between the effects of diseases between men and women. Is there also a difference considering transgender people. Does it affect them differently?

Scientist: *Oh big time. So a big part of my job is trying to understand what are genetic causes and what are hormonal causes. This is crucial to transgender people who pursue hormone replacement therapies.*

Student: Thank you!

Scientist: *So doctors know what their patient may be at an increased risk of. Be it male genetics and female hormones or vice versa. My work helps doctors make more informed decisions:)*

Student: What is different to the brain of someone with ADHD?

Scientist: *This isn't very well understood but we think it has to do with the way their brain regulates motivation and reward.*

Student: Okay, thank you!

In addition to the types of questions asked and scientists' responses, the nature of the interactions themselves likely further contributed to supporting students' science capital. In particular, the way in which scientists **valued** students' questions (i.e. by thanking them for their questions, or providing detailed, thoughtful responses) signals to students that their questions have merit and their ideas belong in a science-related experience. Valuing students' questions and experiences is a key aspect of the Science Capital Teaching Approach and is also something that made a strong impression on students we interviewed in previous evaluations. Those young people were impressed by the way in which scientists seemed to really 'listen' to their questions and were interested in what they had to say. Evidence for similar valuing was found in the chats analysed from Irish schools.

Lengthy interactions, such as the one between Nina and Gael (about marine geology, and ships) certainly reflects valuing and a genuine interest in what the student had to say. Valuing is also apparent in shorter interactions, when a scientist praises a student's question and then goes on to give a thoughtful answer:

Student: Why do we dream?

Scientist: *Such a cool question. When we sleep our brain is still working, often saving memories we gained and trimming memories we don't need. We think that dreaming is how our brain trying to interpret these signals which is why dreams can be strange*

Student: Have you found much info about gut bacteria that could change our diet habits?

Scientist: *Great question. Fellow scientists at the APC have done research on "prebiotics", which are compounds that are found in certain fruits and vegetables, that helpful bacteria can use as a food source. The goal is that these "prebiotics" could be added to other foods in our diet to make them healthier and improve our gut health, and even reduce stress. Thank you for the question.*

Another key characteristic of the student-scientist exchanges was the development of **rapport**. At least once in every chat analysed (and generally far more frequently), there were exchanges in which it was possible to observe a rapport developing between a scientist and a student. Although in the interaction between Gael and Nina above, the interaction revolved around a science career, these conversations were often about life outside of science, including topics such as TV programmes and video games:

Student: Is Breaking Bad accurate?
Scientist: *Chemistry wise: yes*
Student: Rate the show.
Scientist: *9.5/10*
Student: Why not 10 :/ I'm disappointed
Scientist: *I like your high standards. Keep it up.*

At other times, the conversations felt even more informal, with a sense of humour coming through.

Student: WHATS YOUR OPINION ON GLOBAL WARMING
Scientist 1: *IT IS REAL AS MUCH AS YOUR CAPS LOCK*
Student: IT'S A CHOICE
Scientist 1: *I RESPECT YOUR CHOICE* ***Scientist 2:*** *IT IS BAD, WE SHOULD STOP IT*

Although such conversations may not directly support students' science knowledge and skills, they contribute to a sense of scientists as 'normal', or someone students can just have a friendly chat with. In focus groups in an earlier science capital evaluation, students remarked on how the scientists were 'easy to talk with' and how they could talk about a range of things, and they identified this as contributing to their impressions of scientists as 'normal people'.

In addition to the above examples and others in the chats (e.g. the conversation about enjoying working with cows), developing a rapport – in which students can start to become comfortable with asking questions – can also support asking questions about

scientific content. That is, some questions may act as a bit of an 'opener', allowing students to feel more confident in asking more in-depth or content-related questions.

Overall, then, analysis of these eight randomly selected Chats (selected only to come from a range of schools and Zones) provides clear evidence of the mechanism by which IAS likely contributed to students' science capital.

Teacher interviews

Findings from the teacher interviews were aligned with and confirmed the findings from the surveys and the Chat analyses. Teachers noted the range of questions asked by students, and agreed that they were likely to have learned some scientific content (reinforcing students' science literacy). Moreover, they noted that the Chats allowed students to ask questions and engage at their own levels, thus leading to meaningful interactions for a wide range of students. This stands in contrast with some science enrichment activities, which often primarily reach those who are already engaged or are higher attaining. Perhaps not surprisingly, what teachers valued most about IAS was the opportunity it offered their students to 'talk to real scientists' – an opportunity that is simply not available to their students otherwise, particularly those in rural areas.

Within this dimension of meeting real scientists ('actual, real people'), teachers articulated a range of benefits for their students, including learning about different areas of science (and that it is possible to work in these different areas) and coming to see it as more relevant to them:

> *There's more to science than just what they see in the classroom*

> *Scientists looking at things that they're aware of, and actually kind of investigating them, that does therefore make the science more relevant … I think this time, there was someone that looked at things to do with COVID. And straight away, that's something that they have a reference to and can access because they've got some background knowledge, at least.*

Teachers also valued how students could find out about pathways into science careers and, especially, come to see scientists as 'normal' people.

> *So they were interested to know what they would need to do to start that journey which was interesting as well, and what kind of subjects at senior cycle level they would need, as well*.

They actually related, they were like "he likes the same TV show as me," or "this person likes that," so I think what they get from that is they are just real people. Sometimes I think, especially in our school where their ability mightn't be the best and they think jobs like that, they're too smart, I wouldn't be able to do something like that. But then when they see they're real people and they like normal things like they do, then I think they can relate a bit more so that bit, I think for our school and students, is good.

It is relatively kind of informal, and they can ask them questions, and the scientists can respond with kind of emojis and in ways that they're going to relate to.

I think it was good that they saw them as regular people and that this was their day job.

These benefits primarily emerged from the experience of the live Chats but were also reinforced by reading the scientists' bios. Such benefits were also viewed as particularly valuable for these schools, which were struggling with disadvantage and also often had limited science provision. Moreover, these sorts of outcomes were likely to be realised by most participating students, as teachers recognised that most were engaged, including those who might be hesitant to raise their hands and ask a question in an in-person interaction.

Finally, while not necessarily something that impacted all participating students, teachers felt that for some, it could influence their aspirations, or at least come to see that the scientists were people 'like them':

They get to actually talk to someone who works maybe in a job that they might do down the line…

I think it's all part of the bigger picture of enabling them to see university, see further study, as a viable opportunity for them, and that it's not just done by other people; it actually can be done by people like them.

So even though a lot of the scientists were farmers and it was great because a lot of the kids were like "I know what he's talking about," and they were getting onboard and saying "that's what he does, OK, right," and these were PhD obviously graduates or whatever. They were starting small, talking about their farming backgrounds, talking about how they were making their farmers more sustainable and how I think they done a lot of the background of knowledge for their PhDs and their attitudes were just "OK, and this is just a regular guy and he knows what I know, he knows coming from the same sort of background." That was a big benefit because a lot of them, there was a buy-in there

straightaway.

In sum, the teacher interviews corroborated evidence from the surveys and Chats – that many participating students were from disadvantaged backgrounds, or certainly had limited science capital, yet most were engaged in the experience, which offered them an opportunity to interact with scientists that they would not otherwise have. Moreover, it was a range of students – not just the most able or those already connected to science – who were able to engage and, from their perspective, gain the benefits of learning more about scientists, their careers and their lives.