

How GSSfS Empowered Young Investigators

Isabel Zerafa and Ingrid Bonello describe Malta's vision for pupil-led, enquiry-based and inclusive science learning, linking with Great Science Share for Schools

STEM in Malta: a national priority

In today's rapidly evolving world, with global issues such as artificial intelligence, climate change, and space exploration amongst others, scientific literacy is not just important for aspiring scientists; it is foundational for every active citizen. STEM education equips pupils with the skills and mindsets they need to navigate complex challenges, solve real-world problems and actively contribute to society. In this context, it is highly important that education systems cultivate creativity, communication, collaboration and critical thinking – core 21st-century competencies (P21 Framework, 2009; OECD Policy Report, 2009; IEA 21st Century Skills Mapping Study, 2020).

In Malta, STEM education is recognised as a national priority (National Education Strategy 2024-2030, Ministry for Education, Sport, Youth, Research and Innovation, 2024). The Directorate for STEM & VET Programmes (DSVP), within the Ministry for Education, Sport, Youth, Research and Innovation (MEYR), is actively working to embed high-quality, equitable STEM learning across all educational levels. The Primary Science Team within DSVP mainly supports educators in the early and primary years (ages 3 to 11) by:

- designing and supporting the implementation of national curriculum programmes;
- offering professional development opportunities for educators;

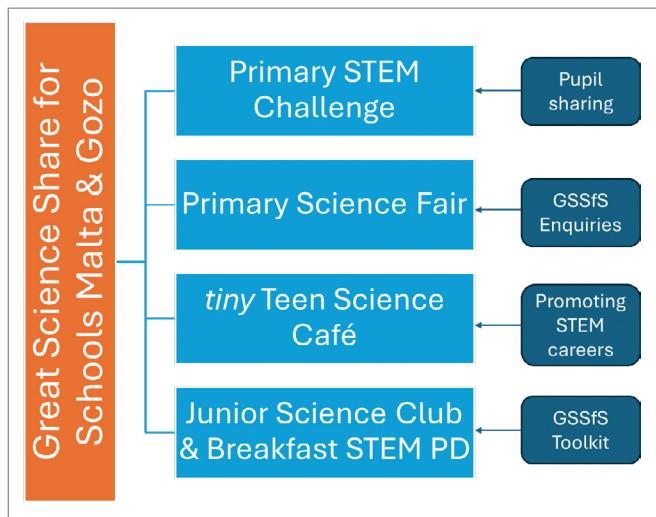
- developing and promoting innovative STEM initiatives at the national, college, and school levels.

At the individual school level, there is an increasing emphasis on equipping teachers with resources and continuous professional learning to increasingly create hands-on, enquiry-based experiences for all their pupils. Chiswick House School has embraced this approach by consistently providing its teachers with access to national and international professional learning opportunities designed to deepen subject knowledge in science and enhance the application of effective teaching strategies. Pupils explore scientific phenomena through various hands-on activities, enquiry-based learning approaches, nature exploration, field work, making real-world connections and utilising technology within the classroom whenever possible.

A key initiative that is gaining momentum in Malta is Great Science Share for Schools (GSSfS). The success of this international campaign encourages young people to ask scientific questions that matter to them, investigate these questions, and share their findings. The GSSfS ethos complements Malta's strategic focus on pupil-led learning, inclusivity, and real-world relevance in STEM. Following the introduction of Professor Lynne Bianchi and the GSSfS initiative to Malta through strategic activities such as head teacher conferences and support teacher training, this article describes the experience of the authors as they inspired teachers and pupils to understand the features, advantages and benefits GSSfS could have to enhance the shift towards enquiry-based learning in primary science classrooms. Two levels of intervention were trialed – national and whole-school.

National level integration of GSSfS across the islands of Malta and Gozo

The diagram shows five national STEM initiatives and how GSSfS was integrated in the trial phase to support these distinct initiatives.



Embracing the sharing concept within the Primary STEM Challenge

The Primary Science Team within DSVP has been working consistently to foster scientific thinking among young learners and offer varied opportunities through national STEM initiatives. The Primary STEM Challenge is designed for pupils from age 7-11 years and aims to engage them and their teachers or parents/carers in doing practical science investigations. In its 6th edition, 60 primary pupils and 15 classroom teachers came together with their pupils inspired to create investigations based on one of three themes: nature, colours or sound.

All Primary STEM Challenge pupils were given the opportunity to present and share their investigations during the Primary Science Fair held at the Ministry's STEM & VET Curriculum Hub. Very much likened to a Great Science Share, here, pupils share their investigations with other pupils, teachers and parents. Pupils not only share findings, but notably develop valuable communication skills including explaining,



Primary STEM Challenge participant discussing whether colour effects the rate of photosynthesis during the Primary Science Fair

reasoning and questioning. This experience is a great way to enable them to learn from each other and grow in self-esteem and self-confidence.

'It was truly heartwarming to see children learning and interacting so enthusiastically with one another.' Parent

'What made it even more special was seeing my son confidently explaining his project and growing in self-assurance. A moment of pride and joy.' Parent

Embracing the GSSfS Enquiries within the Primary Science Fair

In its first edition, the Primary Science Fair is an initiative for 9-10-year-old pupils across the island and is open to all schools. The adults offering the workshops include university outreach staff, specialist support teachers, and STEM industry colleagues.

This year, we took the opportunity to integrate two of the GSSfS Great Guided Enquiries, namely Great Ocean Share and Great Electricity Share, as ideal resources for adult-led workshops during the fair and made some adaptations to contextualise them to our Maltese setting and the fair's theme of Great Inventions: Bridging Science and Society. This meant that visiting pupils investigated the effect of oil spills on marine life and then went on to design their own invention after exploring past inventions and how these have improved life today.

'Thank you for the opportunity to engage with the pupils. I hope I managed to spark their curiosity about the ocean—it was a pleasure to share my passion with them. I really enjoyed the thoughtful questions they asked.' Dr Anthony Galea, Department of Geosciences, University of Malta

Promoting STEM careers within the tiny Teen Science Café

Smart Pickings inspired the introductory presentation within another initiative within DSVP called the tiny Teen Science Café. This also comes to fruition within the Primary Science Fair and focuses on raising awareness of STEM careers.

We selected the biography of Ella Podmore, featured in the book, as a way to challenge gender stereotypes in STEM and to emphasise the message that anyone can be a scientist and do science anywhere!

Junior Science Club and Breakfast STEM PD

The Junior Science Club and Breakfast STEM Professional Development are two other national initiatives organised by the Primary Science team. Distinct in nature, both initiatives used the GSSfS Toolkit resources to encourage pupils and teachers to ask questions, make predictions and delve deeper into their enquiries.

GSSfS 'Prediction Prompts' were used by the educator-presenter during the *Junior Science Club* workshops held during the same Primary Science Fair. The prediction prompts guided pupils in making predictions when investigating themes such as camouflage, motion and electricity. This interdisciplinary approach helped pupils connect scientific enquiry with real-world impact, which is central to the ethos of GSSfS.

The *Breakfast STEM PD* brought together 150 educators and parents/guardians during professional development sessions held in various college clusters. Participants explored the theme 'weather' through interactive science and mathematics workshops. The GSSfS 'Question Teller' was used during the workshops to encourage participants to investigate phenomena such as rainbows, shadows, puddles and wind, further. Such tools sparked curiosity and prompted deeper questioning.



STEM educators presenting and referring to the GSSfS 'Question Teller' to encourage educators to delve deeper into their investigations during the Breakfast STEM PD workshops

The opportunity was open to all pupils as an optional and non-competitive enrichment activity. With a strap line of 'From Wonders to Investigations' pupils had been excitedly preparing for 10 weeks to come up with an investigation question and plan, which they would then work on and share with their peers in school in early May. This was a change to our first year and worked out to be even more liberating for the pupils, who had previously replicated an investigation they had already done in class. This year, teachers felt it worthwhile to give greater autonomy and choice – and the outcomes were truly 'great'!

During those preparatory weeks, teachers offered support during lunchtimes and dedicated 1.5 hours per week during our D.E.C. (Discover, Express, Create) lessons. Pupils were given the opportunity to work in their groups, whilst having their teacher present to guide as necessary. They researched, came up with a plan, shared roles and performed their investigation during this time. We also dedicated some time for pupils to design a poster to display during the share.

We kicked off this year's Great Science Share also with a special visit from science professionals who were from our parent body, who delivered engaging talks and hands-on workshops to our pupils. From exploring pressure in space and under the sea to tracing the journey of medicines through the human body, our pupils delved into a wide array of fascinating topics. They also took part in interactive games exploring chance and optimisation and learned more about the wonders of space science.

Held in the school hall, the CHS Great Science Share brought together pupils, who showcased their investigations and discoveries. The excitement filled a full school day dedicated to sharing the findings from the pupil-led work. Pupils had the opportunity

Whole-school level integration of GSSfS across Chiswick House School

This year the school hosted its second Great Science Share, with teachers and pupils from 3rd, 4th and 5th grades (7–10 years). The focus was to continue to enhance the school's commitment to transitioning from a dominant culture of teacher-led enquiry to more pupil-led/inspired enquiries, supported by teachers.



Junior Science Club presenter using the GSSfS 'Prediction Prompts' to help pupils develop their prediction

to visit each presentation, ask questions, and learn from their peers—celebrating curiosity, creativity, and collaboration in science.

What was the key change that took place in our practice?

The change from teacher-led to pupil-led enquiries required teachers to adapt their pedagogical approach. This year, pupils:

- were encouraged to 'own' each step of the scientific process, from producing their questions, forming their hypotheses, to designing and executing the investigations.
- were guided to find the materials they needed for the investigation themselves, rather than having them prepared by their teacher.
- used open-ended questioning to prompt deeper thinking and exploration.
- allowed greater flexibility in lesson planning to accommodate non-linear enquiry processes.
- offered targeted scaffolding, stepping in only when necessary.
- prioritised the assessment of scientific thinking and process over 'correct' outcomes.

We found that when teachers were moving towards pupil-led enquiry, it helped that they began with 'structured independence' supported by the teacher, and then to gradually increase the autonomy when pupils were more confident. While this approach required teachers to loosen control and allow for greater tolerance for uncertainty, it resulted in more meaningful engagement and the development of key scientific skills.

What outcomes did we observe?

It was truly rewarding that the number of pupils engaging in the science share doubled from the previous year and that they seemed to genuinely embrace questions that interested them, a few of which included:

- Does the size of a marble affect how fast it rolls down?
- What is the effect of different beverages on your teeth?
- Does the type of shoe affect how fast I can run?
- Which type of chocolate melts the fastest?
- Do bath bombs dissolve quicker in hot or cold water?
- Which material is best for soundproofing?
- Does basil survive better in direct sunlight or in the shade?
- How do different items dissolve in water?

Pupils are naturally curious about the world around them, yet we noticed that they found difficulty independently developing their initial ideas into testable scientific questions and plans. To tackle this, we recognised that preparation was key, and we introduced all our teaching staff to the GSSfS Toolkit to support each aspect of the scientific method.

We prioritised scientific question-asking this year, using the *Question Makers* and particularly liked the *Question Frame* and *Question Wonder Cards*. To support pupils with planning the investigation, we revisited the core components of the scientific method using the *Sticky Note Enquiry Planning Tool* and found these accessible and of great help because our pupils became confident in using these tools to plan their own investigations.

The fact that they had been exposed to scientific vocabulary and tools certainly helped our pupils and those needing additional support to actively participate and remain engaged throughout the whole process, from the planning stages to the share day.



Chiswick House School pupils sharing their findings during their Great Science Share

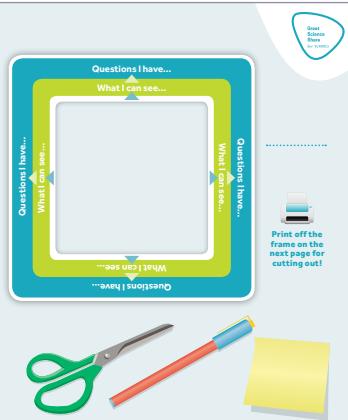
Question Frame

What you need?

A pair of scissors, a pencil, an object that you're curious about, sticky labels (optional).

How does it work?

- 1 Make a frame out of an old cardboard box or use the printable. Be careful when cutting out the window in the centre.
- 2 Place the frame over an object or image, so that it appears in the window.
- 3 Observe what it looks like and describe what you can see.
- 4 Now, think about questions you have and jot them on a sticky note around the side of the frames.
- 5 Select the question(s) you wish to share.



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Question Wonder

What you need?

Scissors, pen.

How does it work?

- 1 Print and cut out the Wonder Bubble Cards.
- 2 Spend some time looking or walking around the spaces you're in.
- 3 Carefully, look, listen, hear, touch and smell the things around you.
- 4 Shuffle the Wonder Bubble cards and use as many as you wish to describe different wonderings you have.
- 5 If you can, share a few wonderings with someone else and find something that you both are curious about. Write this into the big bubble and share it with us!



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GSSfS in Malta & Gozo – what did we learn and what next?

As science education leads on the island it is inevitable that we may receive feedback that pupil-inspired or pupil-led investigations can be more time-consuming when compared to pre-planned ones by teachers. We acknowledge and appreciate this as a symptom of an approach that has shown great benefit and engagement for our pupils. For us, it comes back to why we are science educators in the first place – and as the Ministry for Education, Sport, Youth, Research and Innovation (MEYR) and teachers at Chiswick (and indeed many other participating schools in Malta this year) we value and work to develop the skills and attributes for our young people to thrive as future scientists, science communicators and citizens.

The Great Science Share for Schools campaign has become something we are committed to using – whether woven into existing programmes at national level, or by adopting it as an annual campaign to promote enquiry-learning across our schools. We recognise that by being part of the GSSfS international

Sticky Note Enquiry Planning Tool

Our question is...

We could change



We could measure/observe



We will change



We will measure/observe



We will keep these the same...



When I change:



What will happen to:



We predict...

Because...

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community we are working with many others who share the same values and our professional learning and reflections across Malta, and with other educators worldwide we are all finding out more about how best to implement and support this way of learning.

As the Ministry for Education, Sport, Youth, Research and Innovation (MEYR) and science leaders continue to support the transition from teacher-directed learning we learned that:

- Pupils are more capable than we often assume – given the time and the right support, pupils can pose thoughtful scientific questions and engage with fair testing.
- Ownership drives motivation – pupils were eager and more invested in their investigations when they were based on their own questions.
- The scientific method became more meaningful – rather than ticking off steps, pupils began to understand why each step of the investigation process is essential.
- Science becomes a language for understanding the world – pupils started becoming more inquisitive about everyday situations. We also observed an

increased ability in applying their knowledge in real-world contexts.

Whether at a national scale or through school-based initiatives, Great Science Share for Schools has made an impact in Malta, with room to evolve further. As DSVP we have ongoing meetings with Professor Lynne Bianchi and her team to discuss and plan how to integrate GSSfS and collaborate further. The success of GSSfS in Malta is not only about a single event or initiative. Rather, it reflects a broader cultural

shift toward pupil agency, collaborative enquiry and equity in science education. In this context, our aim is to introduce and support educators at the primary level with the valuable GSSfS resources to continue enhancing the teaching of science through enquiry. Through joint efforts between national bodies and individual schools, we continue to support pupils with the tools and the voice to engage with science meaningfully. As we continue this journey, we remain inspired by a simple yet powerful idea 'Ask, investigate and share scientific questions that matter to you.'

Five key takeaways

1. Malta's National Education Strategy (2024–2030) highlights STEM education as essential for developing creativity, critical thinking, and problem-solving from an early age. Policy makers and senior leadership endorsement is critical to the initiation of new programmes in new contexts – in Malta the involvement of the Directorate for STEM & VET Programmes within the Ministry of Education and individual non-state schools led to a strategic agreement to profile the campaign.
2. Alignment with Great Science Share for Schools (GSSfS): The GSSfS campaign supports Malta's vision for pupil-led, enquiry-based and inclusive science learning. Adopting the GSSfS approach inspires other educators thus finding opportunities to link, align and embed practice across cultures and curriculums.
3. Teacher and specialist support staff training was key. A virtual approach was supportive but not enough to leverage change. Headteachers and teachers benefitted from direct development from the campaign team.
4. An agreement-over-time means that learning cuts both ways. It has been essential that the GSSfS campaign team learnt from Maltese teachers about their areas of strength in STEM education and their areas of development. Modelling approaches to address their growth areas was important.
5. Timing and flexibility are necessary ingredients for embedding a new programme in a new setting. The inclusive nature of GSSfS meant that the team were open to adapting the campaign to really make a difference to teachers and pupils.

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