

BACKGROUND

The field of quantum technologies is a fast-paced research environment where new developments are constantly being reported. However, recent controversies —such as the retraction of a 2018 Nature article claiming to find evidence of the elusive Majorana fermion¹— have made me reflect on the research practices of my field and my own practice.

Discourse in the field online and in journals calls for openness and accountability to combat the reproducibility issues encountered in this type of research. Despite this, few research groups appear to be actively pursuing open research practices beyond publishing papers open-access.

IS OPEN RESEARCH ACCESSIBLE AND ENCOURAGED IN QUANTUM TECHNOLOGIES?

I wanted to consider...

WHAT OPEN RESEARCH PRACTICES CAN I IMPLEMENT IN MY OWN RESEARCH?

WHY CARE ABOUT OPEN RESEARCH?

Transparency of data collection and experimental methodology combats reproducibility concerns

Enables new research questions to be formulated and stimulates interdisciplinary research

Encourages collaboration between more researchers, leading to better science!

OPEN RESEARCH PRACTICES

PUBLISHING OPEN ACCESS

Publishing under an open licence allows research to be accessed by anyone for free.

Gold OA

Following a growing interest in open science and completing the Open Research Training Module, I explored a variety of different open research practices that could be incorporated into my research workflow.

DATA AND CODE REPOSITORIES

Depositing data and code in open repositories online enables anyone to access these research items.

GitHub

OSF

Zenodo

OPEN LAB NOTEBOOKS

In open lab notebooks, researchers publicly share updates on their research in real-time, including detailed protocols, negative and positive results, raw and processed data. With date stamping, open lab notebooks can help prove the temporal priority of data and ideas.²

REGISTERED REPORTS

A method of publishing where a study proposal is reviewed and published before the research is undertaken³. Once the study is complete, it is guaranteed to be published, combating publication bias.

CONSIDERATIONS FOR OPEN PRACTICES IN QUANTUM TECHNOLOGIES RESEARCH

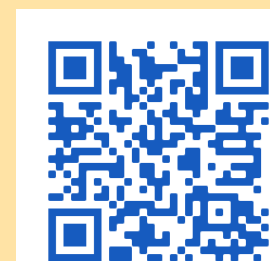
A reflection on current research practices and aims for the future

Daisy K. Shearer

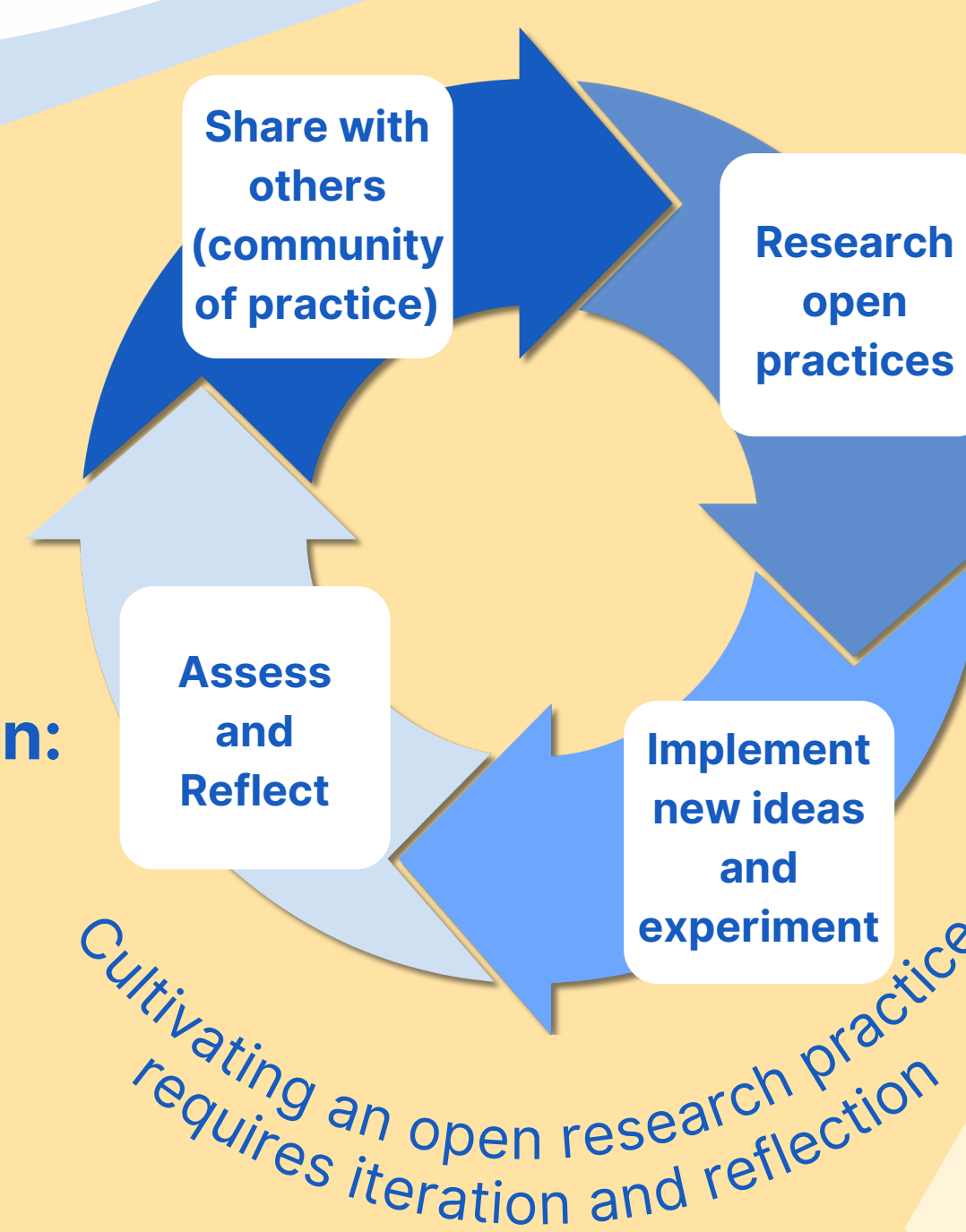
Advanced Technology Institute,
Department of Physics, University of Surrey

Open practices explored and implemented so far:

- **Online Open Lab Notebook set-up**
- **Zenodo & GitHub repository created**
- **Research Philosophy Statement v1 written:** a living document sharing my ideas, reflections and intentions for research



Scan to visit my open research links



CONCLUSION

Despite the challenges that currently accompany open research practices in quantum technologies, it is possible to implement several alongside my in-progress research as well as plan for future studies. These include:

Publishing under and open licence and on arXiv

Sharing raw and processed datasets and code on Zenodo & GitHub

Creating and upkeeping an Open Lab Notebook for future studies

Producing a Registered Report for future studies

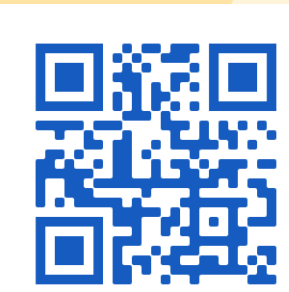
Engaging with other researcher's raw datasets to contribute to a more collaborative research culture

How successful are these open research ideas in other fields?

Let me know!

Email: d.shearer@surrey.ac.uk
ORCID: 0000-0001-8259-4444
Website: www.daisyshearer.com
Twitter: @QuantumDaisy

Scan to connect with me



CHALLENGES FOR OPEN RESEARCH

There are relatively few options for publishing Registered Reports within quantum technologies and physical sciences as a whole, with just **5 out of 281** journals listed on the Center for Open Science's list of journals that have adopted Registered Reports.³

Publishing 'gold open access' continues to involve expensive article processing charges.⁴

Practices such as creating an Open Lab Notebook may be considered time-consuming and not worth pursuing without incentives.

Sharing full raw datasets is not yet normalised and the competitive research culture works against this practice.⁵

Journals that publish registered reports in quantum technologies-related fields

- Scientific Reports
- Royal Society Open Science
- PeerJ Materials Science
- Nature Communications
- Discover Materials

References

- [1] Frolov, S., 2021. Quantum computing's reproducibility crisis: Majorana fermions. Nature, 592(7854), pp.350-352.
- [2] Schapira, M. and Harding, R., 2019. Open laboratory notebooks: good for science, good for society, good for scientists. F1000Research, 8, p.87.
- [3] Center for Open Science. n.d. Registered Reports: Peer review before results are known to align scientific values and practices. [online] Available at: <https://www.cos.io/initiatives/registered-reports> [Accessed 26 March 2022].
- [4] Eglen, S. and Gatti, R., 2022. UKRI's support for green open access is the right way forward. [online] Available at: <https://www.timeshighereducation.com/blog/ukris-support-green-open-access-right-way-forward> [Accessed 26 March 2022].
- [5] Womack, R., 2015. Research Data in Core Journals in Biology, Chemistry, Mathematics, and Physics. PLOS ONE, 10(12), p.e0143460.