Geosci. Commun. Discuss.,
https://doi.org/10.5194/gc-2020-35-AC4, 2020

Geoscience Communication Discussions
Open Access
EGU

Interactive comment on "Transforming school students' aspirations into destinations through extended interaction with cutting-edge research: "Physics Research in School Environments"" *by* Martin O. Archer et al.

Martin O. Archer et al.

m.archer10@imperial.ac.uk

Received and published: 2 December 2020

General comments

This paper makes a valuable contribution to the available literature on undertaking projects that involve school students in research. It is generally well-constructed and well written, leading the reader through the premise, structure and success of the programme. The detailed exposition of the workings of PRiSE is especially welcome as it facilitates the successful replication of such a pro-

gramme without a duplication of the evidently extensive effort and multiple trials that have been required to bring the programme to its current level.

There are some points in the paper (as will be addressed in the specific comments below) that would benefit from further consideration; however, these comments are mostly fairly minor, and are noted in a spirit of bringing the level of every part of the paper to the high standard it exhibits overall.

We thank the reviewer for their time and comments on our manuscript. We have carefully considered all the reviewer's suggested improvements.

The authors give a thorough depiction of the landscape in which this work sits, taking care to give details of other similar projects distinct from PRiSE. Nevertheless, as noted below, these other projects are not always considered in a positive light. It might be wise not to be over-critical at the risk of sounding petty rather than constructive. However, proper credit is given where appropriate, both to work outside this project and to the researchers and other staff involved in PRiSE, which was heartening to see.

We will adjust the tone slightly in places when discussing other projects to mitigate any perceived negativity. The points raised summarise the information available about these projects, highlighting the need for more publications detailing the provision within this area, and also to be able to compare/contrast to the considerations made in developing PRiSE's approach.

The title seems fair, although there is an emphasis on 'destinations' that is less apparent within the body of the paper. Although this is mentioned within the section on the Theory of Change, there seems to be little further discussion or evidence of the destinations of students that take part in PRiSE. Nevertheless, the abstract provides a concise, complete and clear summary of the contents of the paper.

Upon reflection, we feel that the title perhaps does not best encapsulate the content of the manuscript. So we will change it to "Developing a framework to bolster school students' aspirations through extended interaction with cutting-edge research: 'Physics Research in School Environments'". Assessing whether PRiSE has actually affected the degree destinations of students is covered in the companion paper on impact (Archer and DeWitt, 2020). However, we will add more references back to this aim of the programme throughout the manuscript.

Archer, M. O. and DeWitt, J.: "Thanks for helping me find my enthusiasm for physics!" The lasting impacts research in schools projects can have on students, teachers, and schools, Geosci. Commun. Discuss., https://doi.org/10.5194/gc-2020-36, in review, 2020.

The language is largely fluent and precise. On occasion, some of the sentence structures are a little hard to follow on a first reading. In particular, there is substantial use of possessive apostrophes that on occasion impede initial comprehension. It may be worth reconsidering some of these to aid the flow of the text (as opposed to the text's flow).

Upon revision we will attempt to improve the language throughout.

The paper is well-referenced throughout, with many recent publications cited, demonstrating a laudable grasp of current best practice and educational research. This is to be highly commended.

We thank the reviewer for this comment.

Specific comments

The specific comments are given with line references relating to the pre-print (pdf) of the paper.

- Line 9: 'with all elements appearing equally important.' – it would be useful (perhaps later in the article) to have a simple list of all the elements that are

being encompassed by this phrase.

We will add a list to make these elements clearer.

- Line 66 on: The discussions of other similar projects, while not obviously straying from factual, nevertheless read as ungenerous. E.g. line 73: 'other memberships are seemingly justified to ensure that schools make a commitment to working with the university'; line 88: 'While some researchers/academics have designed or consulted on some IRIS projects, they appear in general to have little involvement supporting students or teachers'. This could perhaps be construed as criticism of the other projects (with the aim of elevating PRiSE) which may or may not be considered constructive at this juncture.

As mentioned earlier, we will adjust the tone of these statements. For example removing the phrase "seemingly justified" with regards to HiSPARC (line 73) and adding that IRIS itself acts as the main point of contact for schools rather than researchers (line 88). These points are important to include in order to contrast the different approaches currently used and in explaining the considerations made in developing PRiSE's approach later in the manuscript.

- I understand that the Theory of Change as presented here is discussed in more detail in another publication. Nevertheless, I would query a couple of aspects that are here presented without substantial examination (though I recognise this review comment may not be the best home for this remark and the authors may feel that no response or alteration is merited.) ** Figure 1: The implication that 'Know other people interested in physics' leads to 'See themselves as equals in physics to those from different backgrounds'. I don't know that this follows. I think you can quite easily know other people interested in physics and *not* see yourself as "equal in physics" to those other people. ** Line 163: 'By interacting first-hand with "real physics" through the projects and working with active researchers, students (especially those from underrepresented groups) should

feel included'. I think it is perfectly possible to do physics research and yet feel excluded. I am not convinced that under-represented students will automatically feel included, simply by virtue of doing "real physics", especially if they do not recognise themselves in the active researchers they are connected with or are a minority in the group taking on a project in their school.

We appreciate the reviewer's point that by no means are all the causal links presented in the Theory of Change guaranteed to occur. Indeed only through identifying assumptions and potential barriers to these links can a successful programme be formulated which might go on to enact the theorised outcomes and impacts. We will add this point to the manuscript to make this clearer. Furthermore, we will add more references back to the Theory of Change when discussing the considerations made in developing PRiSE. As the reviewer mentions, whether PRiSE has been successful in these aspects is assessed in another publication as is stated at the end of this section (lines 188-189).

- Line 201 -205. How do the other IRIS physics projects compare here? As it stands, it reads like a cherry-picked list of worst performers, highlighted to make PRiSE look good. If further data on the numbers of researchers / schools is not available for other IRIS projects, then this is worth noting here to avoid this impression.

The reviewer is correct in that we simply do not have any concrete information on the other IRIS projects and so will make a note of this here as suggested.

- Line 196: It becomes apparent here that some schools have taken part but then dropped out. It might be worth pointing this out explicitly, and possibly signposting the later short discussion of this (e.g. around line 806)

We thank the reviewer for this suggestion which we will explicitly highlight here.

- Line 240 – 242: teachers decide who to offer the PRiSE projects to. Do you have

any thoughts on how successful teachers are at selecting students who excel on the projects?

Unfortunately, we don't have any specific information on how teachers go about selecting students, which we will raise in the manuscript. However, we can also note that the average number of students per school each year is around 12, which compared to the national average class size in A-Level physics of 16 (RAE et al., 2015) indicates teachers involve a significant majority (or in many cases the entirety) of their cohorts in PRiSE.

RAE, IOP, and Gatsby Foundation: School sixth forms with no entries for A-level physics, Tech. rep., Institute of Physics, https://www.iop.org/about/publications/school-sixth-forms-no-entries-level-physics, accessed: Aug 2020, 2015.

- Line 248: 'We allow teachers to determine how best to integrate the projects within their school, though provide advice on this.' From the perspective of an outreach practitioner hoping to replicate the success of PRiSE, it would be interesting and useful to see this advice – perhaps included in an appendix?

So far this has been done through informal discussions between the outreach officer and teachers during the kick-off meeting, which we will note as:

> The outreach officer will also have an informal chat with (particularly new) teachers concerning how to go about undertaking and supervising the project, answering any questions or concerns they may have with either the science, activities, or project management.

We had hoped to additionally formalise this aspect into the planned 'how to' guides for teachers, but as noted on lines 416-419 we have not had time to co-create these yet so they cannot be included as an appendix.

- Line 286 on: How much drop-off do you typically see between teachers applying

for projects and then not taking up an offer come the new academic year?

There is a 33±5% drop out between application/assignment and the initial kick-off meeting in the new academic year. Retention within the programme is explored fully in one of the companion papers submitted (M.O. Archer, 2020) which we will highlight.

Archer, M. O.: School students from all backgrounds can do physics research: On the accessibility and equity of the PRiSE approach to independent research projects, Geosci. Commun. Discuss., https://doi.org/10.5194/gc-2020-37, in review, 2020.

- Line 309: 'though this latter approach often proves unsuccessful' – thank you for including this kind of helpful detail

We thank the reviewer for this comment.

- Line 463: What is 'the UK coding agenda'? This phrase needs further explication and / or a reference

We will add a short note and reference (e.g. https://www.gov.uk/government/news/schools-minister-announces-boost-to-computer-science-teaching) to highlight the UK government's desire for more young people to develop computer programming skills.

- Line 534: Feedback from the university sector. This is a bit confusing – it's a little unclear what the university sector is being asked or why, and how that connects with the previous discussion of participant feedback. Although there will be further detail given later, it might be worth clarifying some of it at this stage. Maybe it's simply the mention of "the workshop" (line 535) without context that is disconcerting.

We thank the reviewer for highlighting the need for a brief discussion of the content of the workshop, which we will add.

- Line 589: I enjoyed the inclusion of the negative words in the word cloud, and

appreciated that they were highlighted here.

It is important that the entirety of the collected data are presented and discussed in a balanced and appropriate way, which we have aimed to do throughout.

- Line 791: 'The ethos behind PRiSE is to transform current scientific research methods' This could be read as though you are trying to alter the way the scientists undertake their research. Perhaps consider re-phrasing this, if that is not your intention.

We will rephrase this to "The ethos behind developing PRiSE projects is to transform current scientific research methods, finding ways to make these methods accessible and pertinent to a diverse range of school students so that students can experience, explore, and undertake open-ended scientific research themselves."

Technical corrections

- Line 143: 'with standard one-off (or even short-series of) intervention(s)' – this doesn't quite read right to me

We will alter this to "with standard one-off interventions, or even short-series, showing no real changes"

- Line 169: 'Experience from physics outreach officers . . . have shown' – grammar error. Should either be 'Experiences . . . have shown' or 'Experience . . . has shown'

We will make this correction.

- Line 174: 'the impacts of PRiSE can be felt much wider' – grammar. Suggest 'can be felt much more widely'.

We will make this correction.

- Line 183: 'another major influence on young people's aspirations are family' –

grammar error. Should be 'another major influence . . . is family'.

We will make this correction.

- Line 213: 'One might think it is feasible that students' work on PRiSE projects contribute to novel research.' - Grammar: contributes - This sentence is generally hard to follow – consider revising

We will change this to "One might think that students' work on PRiSE projects can contribute to novel research".

- Line 423: 'organic semiconducters' – typo: semiconductors

We will make this correction.

- Line 502: 'and responsibilities have remained largely been falling to only a few people per PRiSE project' – grammar. Remove 'remained'?

We will make this correction.

- Line 803: 'and have relished the challenge of working differently to in their regular school experience' – grammar. Remove 'in'?

We will make this correction.

Interactive comment on Geosci. Commun. Discuss., https://doi.org/10.5194/gc-2020-35, 2020.