Experience Report: Running and Participating in a Multi-Institutional Research in Practice Project Activity (RIPPA)

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ABSTRACT

In this paper we report on our experiences of being involved in the first Research in Practice Project Activity (RIPPA) which was established at UKICER 2021. The purpose of the RIPPA was to bring practitioners and researchers together from multiple institutions to collaboratively perform a practical research task at their own institutions over several months. The intended RIPPA outcomes were to strengthen the knowledge and skills of participants, expand their network of collaborators and to produce high quality research. As the first RIPPA draws to a close, we highlight the main successes, failures and other learning moments of the RIPPA to provide guidance for aspiring RIPPA leaders and participants. We hope that in sharing our experiences, we can encourage and support the launch and success of other RIPPA projects across the field of CER.

CCS CONCEPTS

• **Social and professional topics → Computing education**.

KEYWORDS

experience report, multi-institutional, spatial skills, RIPPA

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1 INTRODUCTION

A Research in Practice Project Activity (RIPPA) is a new long term, multi-institutional project initiative designed to onboard new researchers into Computing Education Research (CER), to grow a community of CER practice and to produce rich, broadly applicable publications [4]. The first RIPPA, based on spatial skills in introductory computing, was launched at UKICER 2021 and is scheduled to conclude in 2022. This paper is written by the members of the first RIPPA to share our process and experiences to encourage and guide future RIPPA participants and others considering similar initiatives.

This is a *research practice* paper. It is of relevance to those who want to grow an education research community – that is, it is about the practice of research and development among novice researchers. This is highly important in the CER community because in some countries, CER infrastructure is barely, or not at all, in place.

Our experiences and reflections apply to *research* because they describe a large, multi-institutional study and the challenges encountered in such an endeavour. They apply specifically to *education research* because they relate to the issues arising when working with students, like working to student timetables and relying upon student voluntary participation. They also apply specifically to *computing education research* because such projects make rich research contributions and build the CER community and research infrastructure, vital qualities in a discipline still coming of age [7].

2 BACKGROUND

2.1 MIMNs in CS Education

Fincher & Petre express a need for CS Education (CSEd) researchers to perform multi-institutional, multi-national (MIMN) research [7]. CSEd researchers should collaborate on a multi-institutional level to provide much-needed critique and scrutinise practices in order to form nuanced conclusions which are derived from multiple contexts. These practices make research richer and applicable to a broader audience than if studies were to be conducted in isolated contexts, particularly when the research is multi-national. These kinds of goals are achieved by research initiatives like Working Groups (WGs) associated with the Innovation and Technology in Computer Science Education (ITiCSE) conference, where the conference provides a structure to allow researchers from around the world to collaborate over several months, both at distance and in-person, resulting in large quantities of data and multiple perspectives.

However, this requires the formation of collaborative networks in the first place: without connections in the same research space, researchers are unable to find the collaborative colleagues they need to start MIMN studies. In fact, in some instances the partners they need may not *exist*, particularly if there is no local CER infrastructure. This can be addressed by community building and

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research training initiatives which work to create communities capable of research in computing education through explicit training and physical meetings. Some projects which have achieved this are *Bootstrapping* [9], *Scaffolding* [8] and BRACE [5]. An experiment kit was created for each project: a resource including all materials, protocols and other details required for individuals to successfully and independently run the project at their own institutions. This led to easy engagement for participants who were given a set of tools and activities with detailed instructions on how to use them.

2.2 RIPPA – A New MIMN Study Form for CS

The RIPPA was envisioned as a similar kind of activity to other MIMNs in CER. It was designed as a multi-institutional study with a low barrier to entry, consisting of practical tasks which can be completed with limited experience in the RIPPA's subject area, following guiding principles set out by Fincher *et al.* [6]. It is an amalgam of other MIMN projects (*Bootstrapping*, *Scaffolding* and BRACE) combining their training and community building aspects while doing this regularly (e.g., annually) like the ITiCSE WG model. Crucially, like WGs, it is unfunded, using the enticement of publications and professional development to help participants to encourage their institutions to support and possibly fund the research.

The RIPPA comes at a crucial time in the UK CER journey. CS education is burgeoning: computing is a mainstream school subject across the UK; Computing at School[1] was a phenomenon; and there is government funding for programmer and teacher training initiatives – e.g., the Institute of Coding[2] and the National Centre for Computing Education. Yet there is little infrastructure to support research on all this activity. There are few experienced researchers or PhD students, and limited funding streams for CER. Education is highly contextualised, so a strong local research base is necessary.

RIPPAs are an early step in the development of this local research base, developing CER infrastructure with three main goals:

- Give participants an opportunity to **develop their skills in research and practice** by engaging with CER methods, tools and practices through collecting data from tests/surveys, performing interventions, applying CER tools, engaging with CER data analysis methods, writing for CER venues, etc. RIPPAs should give participants the appropriate scaffolding and guidance to engage with valuable, common practices in CER.
- Participants should **build a network of collaborators**. By participating in group tasks, meetings and communications, participants should get the opportunity to meet and engage with their peers, creating a network of future collaborators.
- Feedback to the community by **generating high-quality publications**. While developing skills and connections, RIPPAs are still MIMNs capable of producing rich and valuable data from many varied institutions, making them vehicles for producing high-quality research. Feeding this back into the CER community strengthens knowledge and understanding across CER, furthering the field in a meaningful way.

Process of each RIPPA may vary but should broadly follow the following stages, whose sequence and period can be seen in Figure 1:

(1) Established researcher decides on a topic of broad value
(2) Preparation of an experiment kit
(3) Call for participants prior to UKICER
(4) Preliminary meetings
(5) Meet at UKICER
(6) Spend a year conducting research
(7) Write up for publication at a future UKICER

These stages lend themselves to the three goals of the RIPPA in different ways. Developing skills and research practice is primarily achieved in stages 6 and 7 of the RIPPA when participants engage with research tools at their own institutions and then come back together to analyse data and write for publication. Building a network of collaborators is achieved through the initial networking in stages 2–5, and throughout the project via check-ins and collaboration on the final stages of the project. Generating a publication is technically achieved in stage 7 when the project is written up, and the data for publication is collected throughout stage 6 as well.

2.3 The First RIPPA: Spatial Skills in CS Education

Spatial skills appear to expose a set of abstract cognitive skills associated with success in many STEM domains, demonstrated by multiple correlational studies in many contexts. Spatial skills training appears to be valuable, particularly in engineering education [19, 21] but across several STEM domains – that is, deliberately improving spatial skills through intervention leads to positive STEM outcomes [18, 20]. The relationship also appears to be bi-directional: Pallrand & Seeber demonstrated that physics instruction can improve spatial skills in a way that liberal arts learning does not [14].

In CSEd specifically we have seen a recent increase of evidence for this relationship. Several studies have shown correlations with particular factors of success in CS [1, 11, 12, 17] there are examples of spatial skills training appearing to improve CS outcomes [2, 3, 16].

However, spatial skills in CER is still fledgling with limited exploration of different contexts. We have not yet determined if the relationship is bi-directional, which has implications for our understanding of the core relationship. We also have limited understanding of the impact of demographic factors, like gender and socio-economic status (SES), with only a few studies discussing this in detail [13, 15]. Therefore, the specific goals of this RIPPA are:

- To determine if the relationship is bi-directional by seeing if spatial skills improve over a period of CS instruction
- To explore the effect of demographic factors on the relationship between CS and spatial skills
- To contribute to the existing corpus of spatial skills and CS research by determining if the correlation between spatial skills and CS module grades holds

Note that this RIPPA is designed to understand a learning process, not to improve practice. A related RIPPA could have been for all the participants to apply spatial skills training in their own institutions as educational practice. This choice of research or practice focused projects may impact participation, just as in WGs. Also, while this study's spatial skills findings may be interesting, they do not have much bearing on the RIPPA process. We give details of the project to provide important context, but the main purpose of this paper is to describe more generally the RIPPA for future RIPPA hopefuls, so our description of the spatial skills component is light and we focus

[1] https://www.computingatschool.org.uk/
[2] https://instituteofcoding.org/

on the specifics of running the RIPPA. We plan to publish details on the spatial skills work specifically in the future.

3 PROCESS AND EXPERIENCES

Here we step through each stage of the RIPPA and describe the method followed for our specific context, the experiences of the participants and key leanings from our approach. Our learnings here will probably be of use to many future RIPPAs, but in some cases may be specific to our own RIPPA. We give a more general set of recommendations based on these learnings in Section 4.2.

3.1 Stage 1: Inception

3.1.1 Method. Anyone considering running a RIPPA should consider a research or practice project that: requires multiple participants to produce some strong evidence; is likely to capture the imagination, to ensure good buy-in; involves data collection activities that can be undertaken by the participants relatively simply and mechanically. Such a study captures all the goals of the RIPPA: easy to implement for a group of potentially relatively inexperienced researchers to produce a large dataset leading to publication.

3.1.2 Experiences. The spatial skills project ticked all these boxes. The RIPPA leader established gaps in the known relationship between spatial skills and CS, as well as areas requiring further replication, and shaped research questions around these explorable areas. In particular, the RIPPA leader needed institutions involved which weren't already running any kind of spatial skills intervention, which would obfuscate spatial skills development as a result of CS instruction, and large numbers of students as the effect sizes were likely to be small. The leader was also looking to minimise data collection required and maximise cross-use of instruments so as to reduce the workload of RIPPA participants and increase buy-in.

The research questions the RIPPA sets out to answer are heavily research-inspired, to further a conceptual understanding of a phenomena rather than directly affect practice. This will inevitably will have had an impact on interested participants: those more interested in conceptual research will have more intrinsic motivation to take part in the project over those with a practice focus. This is not necessarily a bad thing, as building the knowledge and connectivity of the community at large is still valuable, however the specifically envisioned target demographics of model RIPPA participants were experienced practitioners interested in getting involved in CER.

One of the research questions, about the correlation between spatial skills and grades, does tap into practice and could lead to roll-outs of spatial skills training in participating institutions or at least future buy-in, so the RIPPA satisfies this demographic in part.

3.1.3 Learning.

- The RIPPA topic of choice – and its focus on either research or practice – will likely impact the demographics of participants applying to take part.
- Buy-in for future work may be a participation factor.

3.2 Stage 2: Experiment Kit

3.2.1 Method. Prior to launching the RIPPA, an experiment kit was developed utilising the principles proposed by Fincher *et al.* in their advice on designing MIMN studies [6]. The experiment kit described the project overview, study design, methodology and protocol, and included copies of instruments required. The main instruments for this study were a spatial skills test (the revised PSVT:R [22]) and an SES survey (compiled from the PISA SES survey[3] and the Family Affluence Survey [10]).

The RIPPA leader also entered an ethics application at their institution to approve the handling of the data, pending the participants' own institutional approval to collect and share the data. The documents submitted and the approval letter were added to the kit.

Although the initial kit was sent out as a static archive, as more updates were made (e.g., adding ethics documents to the kit for reference) the participants pushed to move the kit to a shared online storage space where we could all see live updates. This was done initially as a result of some minor text-surface errors identified in one of the instruments, and the kit was kept online in case any other inaccuracies were noticed or additions were requested.

3.2.2 Experiences. From the perspective of the RIPPA leader, developing the kit was trivial, with three main perspectives to consider: the project description, the context, and a clear, concise protocol. This led to the kit's three root documents: a handbook covering the general expectations of the project, the timeline and the research questions; an instrument instructions document which focused explicitly on the logistics and specifics of delivering the instruments being used; and a context overview document which explained the background relationship in more detail. The purpose of splitting out the reading was to allow participants to find what they needed at any point in the project quickly without being overwhelmed with a single, impenetrable document. Not only was this valuable to participants, but it also allowed the RIPPA leader to be more explicit in specific documents regarding their subject matter.

Everyone valued the experiment kit: it was a useful resource which explained the whole project and had everything needed to participate. Moving the kit online was also useful because it gave us confidence that content was up to date and could be updated if it needed to be. Fincher suggests trialling the experiment kit in a few institutions before releasing it to the wider group [6]. There was not time for this in the current RIPPA, but in this case the benefits would probably not have been notable since this particular RIPPA mostly used tried and tested instruments which had already been through several rounds of rigorous examination and applied in many contexts. In a context where new materials are being created for the RIPPA, a pre-release stage would be valuable.

3.2.3 Learning.

- An up-to-date and accurate experiment kit is seen as a valuable resource.
- Well established or at least pre-made materials are less likely to have errors or difficulties in delivery when distributed, making RIPPAs more accessible and less demanding.

3.3 Stages 3–5: Call for Participation, Initial Meetings and RIPPA Launch Session

3.3.1 Method. Email advertisements for the RIPPA went out to the SIGCSE and SICSA[4] mailing lists in August 2021, and a drop-in

[3] https://www.oecd.org/pisa/test/
[4] The Scottish Informatics and Computer Science Alliance

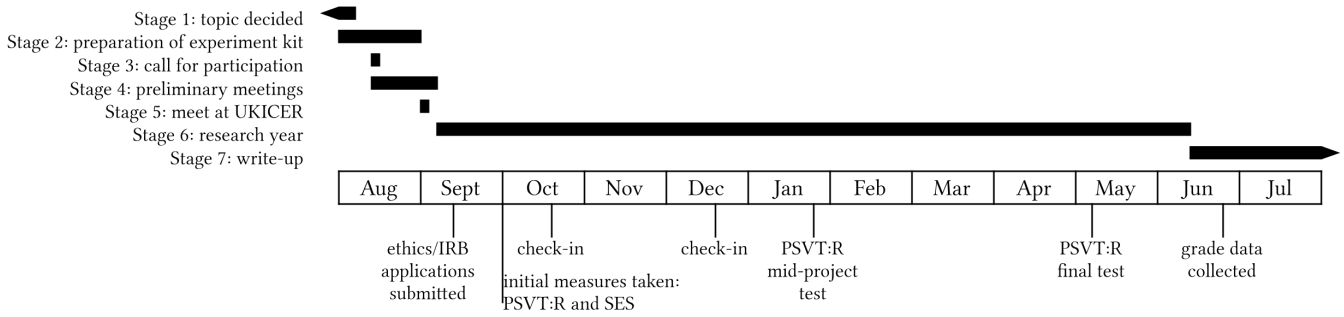

Figure 1: RIPPA process with a gantt chart indicating the period of each RIPPA stage over the year above the months, and the spatial skills RIPPA specific tasks taking place displayed below the months.

session was held at ICER at the end of the month. The RIPPA was also advertised on the UKICER website with a sign-up form.

After several informal, individual online Q&A meetings for interested but uncommitted parties, a launch session was held at UKICER in September 2021. The launch session consisted of information dissemination through a presentation by the RIPPA leader on the project context, expected participation requirements and project outcomes, followed by a discussion session. Those in attendance (or unable to attend but had explicitly indicated that they wished to participate) formed the initial group of 10 RIPPA participants.

3.3.2 Experiences. The multiple calls for participation garnered roughly 15 expressions of interest from various parties. Most respondents fell into three broad categories: teaching practitioners with limited CER experience, experienced computing researchers but outwith the sphere of CER, and researchers/practitioners with existing CER experience. The first group is who the RIPPA was originally designed to capture, however the other categories are valuable to include: bringing researchers with different backgrounds into CER will enrich the project and the community with alternative research perspectives, and having more experienced researchers involved in the RIPPA may be of limited benefit to them individually but it would be valuable for less experienced RIPPA members to meet and collaborate with these experienced partners. Nevertheless, clearly the means of reaching the target groups weren't exclusively capturing the participants the RIPPA was designed for.

It was also impossible to tell form the sign-up form where the prospective participants had heard about the RIPPA from. This would have helped us to know which mailing lists or venues to target with future advertisements and generally would have helped us categorise these various forms of contact for future RIPPAs.

The individual Q&A discussions were valuable in helping those who had seen the brief but still had questions. In instances where participants ended up joining the RIPPA, these discussions helped us feel more confident in the requirements, specifically as they pertained to our own individual institutions and processes. They were a good opportunity to talk through private concerns or issues from individual contexts. Five of these individual meetings were held prior to the launch. Each of the five parties ended up attending the UKICER launch session. One of the meetings did require some effort to arrange due to timezone issues, but the other four were either in local time or during a dedicated social session at the ICER conference, so were not challenging to arrange.

This approach of garnering participants does depend almost exclusively on the individual's intrinsic motivation to take part. Given the extreme workload of typical candidates (those interested in education, hence very probably with high teaching workloads) it is likely that many may have been put off from stepping forward at all. Indeed, the target audience – local UK academics – did not step up in the numbers we had hoped: only half of all interested parties were at UK-based institutions. This indicates that RIPPAs may need a wider national publicity campaign with heads of school to encourage potential participants to take this up and reward them for doing so by reducing their workload in some way to make room for participation. This would fit with the model of a UK teaching fellow typically undertaking scholarship/education research.

That said, most of the participants lasting to the end of the project indicated that the work initially felt doable, even on top of existing time constraints, and that this was not explicitly a deterrent from participating. Although some issues did arise later in practice, the project was pitched at the right level to capture *some* teaching academics who saw it as easy to fit around their teaching.

Engagement during the launch meeting's post-presentation discussion session was high. We discussed several points on the technicalities of the various measures being used and on the background research. Each of these points was covered by the experiment kit which was only released after the meeting, so there was some duplication of effort but it was good to address concerns directly.

3.3.3 Learning.

- Capturing where participants heard about the RIPPA from would have allowed us to review if particular avenues of communication were better suited to targeting specific demographics of participants.
- Individual Q&A meetings may require some effort to set up and involve duplicated information sharing, but are valuable in encouraging participation.
- Participation could be encouraged by reaching out to senior CS faculty at various institutions, ideally with a promise of local support for taking part in RIPPAs.

3.4 Stage 6: Individual Institutional Research

3.4.1 Method. After the initial meetings and the release of the experiment kit, we conducted the research activity in our own institutions. The work required fell into three broad steps.

The first step was to prepare for the study. Since student data was involved, each participant had to gain ethical approval through their own institutional channels with applications confirming that the students' data would be safe and identities protected through to dissemination in stage 7. The RIPPA leader submitted an ethics application to their institution prior to the project to permit data handling and to provide a template for other institutions to follow.

The next step was to recruit students, achieved by: encouraging participation in the tests/measures during or immediately after a scheduled lecture, advertising separate testing sessions, and putting the materials online to be completed in their' own time.

Finally, the data was collected. In all instances, online versions of the instruments were used (at the time of delivery, restrictions on in-person teaching were in place at all participating institutions). Spatial skills were measured at three points across the academic year (start of first semester, end of first/start of second semester and at the end of teaching), SES and consent responses were collected only at the start of the semester and grade data is to be collected once assessments have been ratified at the end of the academic year. The timings of the various activities can be found in Figure 1.

3.4.2 Experiences. Ethical approval/IRB proved to be a major early challenge to most participants: each institution had different protocols and requirements and none met third-party approval standards, making shared documentation impossible to produce and raising different challenges for each participant. Most of the challenges were manageable, usually just requiring more details than were provided in the leader's submission, but the back-and-forth took time and effort. The project also started too late, with several participants having to scramble to get their applications submitted in time for the start of teaching. However, having the leader submit an overall application was valuable, as it gave participants an idea of the language to use and detail to provide in our own submissions.

The RIPPA leader's ethics application was useful; it gave everyone else an idea of the language and detail expectations for our own submissions. It also gave the RIPPA leader a better idea of the work required for for a project of this scale. The RIPPA leader must be aware of the challenges participants are facing when participating, since there may well be unforeseen difficulties not captured in documentation. This does not necessarily mean that they should perform every step of the project: this would give them a real participant perspective, allow them to preempt difficulties as they go and provide another dataset for the project, but coordinating the project and supporting the other participants is a substantial job. Leaders should be wary of overworking themselves at the expense of the RIPPA outcomes, even with good intent.

Student recruitment was a major challenge. Although the repeated measure was only a 20-minute exercise, there was a steep attrition observed between testing periods. Frustratingly, a number of students also took part in the tests but refused to consent to their data being used in research, forcing us to remove their datapoints from the analysis pool – this mostly seemed to occur in institutions where the consent form had been delivered separately from the other instruments, suggesting that while the students had the motivation or opportunity to complete the exercises, they did not follow through and complete the consent form at a later date.

Another recruitment challenge was *faculty* recruitment: in some cases it was necessary to bring other faculty into the project to assist, either to promote the project to their classes, to assist in the data collection or to act as a third party to handle data in cases where the perception of coercion needed to be avoided. Despite some time being spent on discussions with other faculty at one institution, it did not ultimately bear fruit and the project delivery had to be pushed back by a semester. Although assistance was secured for the second semester, we would have benefited from having an action plan for bringing other faculty on board and liaising with other members of local CER networks who may have been able to assist.

At the October check-in, several people dropped out saying that they did not have time to continue the project. This may also have been compounded by discouragement through poor student uptake. Those who decided not to continue with the RIPPA had unanimously struggled to collect responses in the first data collection, though this was not a large problem (the data could still be used and there was an opportunity to collect more data over a second semester). Generally, applying the instruments and data collection was not challenging. We each had some initial work to prepare the instruments for our own institutional platforms but the kit protocol made the process clear. This stage was an opportunity to develop skills and knowledge in CER and was easy to engage with.

Participants who collected many datapoints in the early stages of the project remained involved up to the final data collection, even though there were long periods of inactivity after a major data collection. We expect that this is due to the high input required during the initial stages of the project, meaning that those of us who had already completed the initial stages felt that it was worth continuing. This may not be the case for projects with easier initial steps (e.g. for whatever reason, ethical approval was not required early on). This could be addressed through more frequent contact and communication, even throughout quiet periods of the project.

With respect to more frequent communication, much of this stage o the project was conducted on a very individual basis. One participant indicates that while they did not feel at this point that they had formed a good "team environemnt". However, aside from possibly an additional "getting to know each other" session early in the project, we do not feel that these sessions would necessarily have been valuable as frequent activities, particularly as the workload in both the project and our own institutions increased.

3.4.3 Learning.

- Start RIPPAs much earlier than the start of the academic year to allow the required discussion and assistance on ethics/IRB to happen, allowing for internal institutional application turn-around. The launch should happen during the summer and UKICER should be a check-in prior to data collection.
- Having the RIPPA leader participate is valuable for them to give advice to participants and provide template activities/documentation, but should be balanced with support.
- Garner institutional support for student participation (in line with internal ethicals), such as offering credit for participation, getting senior academics to promote studies, etc.

- Materials should be incorporated into standard learning activities as much as possible, for higher student participation.
- Keeping instruments easy to deliver and engage with leads to less stress and overhead work among RIPPA participants.
- Collect feedback on experiences – to better manage the project and to report back to the community – frequently to reduce the requirement for a single major reflection period.

3.5 Stage 7: Publication Plans

This stage of the RIPPA has not yet been completed. We cannot speculate on experiences or learnings, so we describe only the method. We have collected data on several hundred students across the project, with student grade data incoming. The next steps will be for each participant to obscure their data by replacing student IDs with unique identifiers. This data will be sent to the RIPPA leader who will collate all the data into a single repository with identifiers again replaced with a uniform standard for every student.

We plan a collective data analysis strategy. The RIPPA leader will identify some key analyses to run on the data and will bring the group together online to run them together. Through this process, participants should see exemplar analyses being run and will be able to query the steps and suggest either amendments, alternative analyses or additional checks which the leader has missed.

Finally, we will begin the write-up process. The RIPPA leader will create a publication template and discuss what each section will involve. Participants will then request responsibility for different sections for them to write, with the RIPPA leader providing supervision over all the sections. For participants who feel too inexperienced or are not sure where to start, the RIPPA leader will pair up with them and assist in the writing directly, allowing everyone the opportunity to learn and experience the writing process.

4 SUMMARY AND RECOMMENDATIONS

4.1 Meeting General RIPPA Outcomes

Looking back over the RIPPA so far, the main question to answer is whether the general RIPPA outcomes have been met. The first outcome, **strengthened knowledge and skills in research and practice**, appears to have been met. Through joining the RIPPA, participants have improved their research skills by thoughtful deployment and monitoring of the data collection instruments. Our knowledge and skills have been developed by engagement with common research methodologies and coming up against typical challenges faced in education research like submitting IRB applications and working to students' timetables. We intend to develop these skills further in the analysis and write-up stages of the project, where we will engage with data analysis and writing for CER.

The second outcome, **strengthened and expanded network of collaborators**, has been partially met: more could have been done in this respect. The leader had a tendency to contact participants individually, siloing progress and limiting connectivity with other participants to get work done quickly. While this may have maximised RIPPA progress, it wasn't conducive to building a strong community of collaborators. Still, we have had opportunities to discuss and share along the way, and there will be extra efforts made to provide more collaboration opportunities during analysis/write-up.

The third outcome, **publication**, is ongoing. This paper partially achieves this, to feedback to the UKICER community and to give us an opportunity to collaborate on a publication before working on the larger-scale data analysis and dissemination, which we intend to publish within the next year.

4.2 Recommendations

Our RIPPA had a specific pre- and post-test structure with generally well established instruments. Any other RIPPA with a different structure will of course have different requirements and considerations to make, so our learnings may not be valuable to every future RIPPA leader or participants. However, we consider the following recommendations, based on our own experiences and reflections, to be general and widely applicable for future RIPPAs:

- **Start early.** The launch meeting should start well in advance of September, with a session at UKICER to check-in and lay out final plans for engagement with the individual activities.[5]
- **Meet frequently.** This is important to develop the community of practice among participants (a major RIPPA outcome), collect experiences from participants to provide insight and record feedback points, allow the leader to ensure activities are on track and improve collegiality among participants
- **Continually check for skills development opportunities.** Leaders should provide these. Participants should seek them out, especially if they want to develop specific skills.
- **Formalise the participant list early.** Ensuring even a low level of commitment is likely to reduce long term drop-out among participants. It may turn some away who are not ready to commit to the RIPPA, but those remaining will benefit from a clearer relationship with an established group.
- **Reiterate and discuss the project outcomes and goals frequently** to keep participants motivated and make their work feel "worth it" when there are valuable final outcomes.

5 CONCLUSION

The first RIPPA is still ongoing, so it is hard to say exactly what the outcomes will be. However, we have collected a large quantity of data on students in multiple institutions around the world and expect to be able to perform complex, valuable analyses with respect to our original research questions. We see this as a success in and of itself, but we have also detailed how we feel that the RIPPA's more general outcomes have been achieved. While they are not without challenges, which we should overcome as a community, RIPPAs appear to be valuable activities in CER with positive implications for skills and knowledge development, community building and high-quality research. We encourage anyone interested in leading or participating in a RIPPA in the future to do so.

REFERENCES

[1] Ryan Bockmon, Stephen Cooper, Jonathan Gratch, Jian Zhang, and Mohsen Dorodchi. 2020. Can Students' Spatial Skills Predict Their Programming Abilities?. In *Proceedings of the 2020 ACM Conference on Innovation and Technology in*

[5] This, of course, assumes that a RIPPA will need to work around student timetables as we did: requiring measures at different points in their academic pathway. This may not be the case for other RIPPAs, so may not be as important, however we urge participants not to underestimate the amount of time required to complete the initial setup of the project.

Computer Science Education. ACM, Trondheim Norway, 446–451. https://doi.org/10.1145/3341525.3387380

[2] Ryan Bockmon, Stephen Cooper, William Koperski, Jonathan Gratch, Sheryl Sorby, and Mohsen Dorodchi. 2020. A CS1 Spatial Skills Intervention and the Impact on Introductory Programming Abilities. In *Proceedings of the 51st ACM Technical Symposium on Computer Science Education*. ACM, Portland OR USA, 766–772. https://doi.org/10.1145/3328778.3366829

[3] Stephen Cooper, Karen Wang, Maya Israni, and Sheryl Sorby. 2015. Spatial Skills Training in Introductory Computing. In *Proceedings of the eleventh annual International Conference on International Computing Education Research*. ACM, Omaha Nebraska USA, 13–20. https://doi.org/10.1145/2787622.2787728

[4] Quintin Cutts, Joseph Maguire, Sally Fincher, and Jack Parkinson. 2021. Forming Community in Computing Science Education with Research in Practice Project Activities. In *United Kingdom and Ireland Computing Education Research conference*. ACM, Glasgow United Kingdom, 1–3. https://doi.org/10.1145/3481282.3481285

[5] Sally Fincher, Bob Baker, Ilona Box, Quintin Cutts, Michael de Raadt, Patricia Haden, John Hamer, Margaret Hamilton, Raymond Lister, and Marian Petre. 2005. *Programmed to succeed?: A multi-national, multi-institutional study of introductory programming courses.* Technical Report. University of Kent.

[6] Sally Fincher, Raymond Lister, Tony Clear, Anthony Robins, Josh Tenenberg, and Marian Petre. 2005. Multi-institutional, multi-national studies in CSEd Research: some design considerations and trade-offs. In *Proceedings of the 2005 international workshop on Computing education research - ICER '05*. ACM Press, Seattle, WA, USA, 111–121. https://doi.org/10.1145/1089786.1089797

[7] Sally Fincher and Marian Petre (Eds.). 2004. *Computer science education research*. Taylor & Francis, London ; New York.

[8] Sally Fincher, Marian Petre, Josh Tenenberg, Ken Blaha, and Dennis Bouvier. 2004. *Cause for alarm?: A multi-national, multi-institutional study of student-generated software designs.* Technical Report. University of Kent.

[9] Sally Fincher and Josh Tenenberg. 2006. Using Theory to Inform Capacity-Building: Bootstrapping Communities of Practice in Computer Science Education Research. *Journal of Engineering Education* 95, 4 (Oct. 2006), 265–277. https://doi.org/10.1002/j.2168-9830.2006.tb00902.x

[10] Jane E. K. Hartley, Kate Levin, and Candace Currie. 2016. A new version of the HBSC Family Affluence Scale - FAS III: Scottish Qualitative Findings from the International FAS Development Study. *Child Indicators Research* 9, 1 (March 2016), 233–245. https://doi.org/10.1007/s12187-015-9325-3

[11] Sue Jones and Gary Burnett. 2008. Spatial Ability And Learning To Program. *Human Technology: An Interdisciplinary Journal on Humans in ICT Environments* 4, 1 (2008), 47–61. https://doi.org/10.17011/ht/urn.200804151352

[12] Sue Jane Jones and Gary E. Burnett. 2007. Spatial skills and navigation of source code. *ACM SIGCSE Bulletin* 39, 3 (June 2007), 231–235. https://doi.org/10.1145/1269900.1268852

[13] Anna Ly, Jack Parkinson, Quintin Cutts, Michael Liut, and Andrew Petersen. 2021. Spatial Skills and Demographic Factors in CS1. In *21st Koli Calling International Conference on Computing Education Research*. ACM, Joensuu Finland, 1–10. https://doi.org/10.1145/3488042.3488049

[14] George J. Pallrand and Fred Seeber. 1984. Spatial ability and achievement in introductory physics. *Journal of Research in Science Teaching* 21, 5 (May 1984), 507–516. https://doi.org/10.1002/tea.3660210508

[15] Miranda C. Parker, Amber Solomon, Brianna Pritchett, David A. Illingworth, Lauren E. Marguilieux, and Mark Guzdial. 2018. Socioeconomic Status and Computer Science Achievement: Spatial Ability as a Mediating Variable in a Novel Model of Understanding. In *Proceedings of the 2018 ACM Conference on International Computing Education Research*. ACM, Espoo Finland, 97–105. https://doi.org/10.1145/3230977.3230987

[16] Jack Parkinson and Quintin Cutts. 2020. The Effect of a Spatial Skills Training Course in Introductory Computing. In *Proceedings of the 2020 ACM Conference on Innovation and Technology in Computer Science Education*. ACM, Trondheim Norway, 439–445. https://doi.org/10.1145/3341525.3387413

[17] Jack Parkinson, Quintin Cutts, and Steve Draper. 2020. Relating Spatial Skills and Expression Evaluation. In *United Kingdom & Ireland Computing Education Research conference*. ACM, Glasgow United Kingdom, 17–23. https://doi.org/10.1145/3416465.3416473

[18] Sheryl Sorby, Norma Veurink, and Scott Streiner. 2018. Does spatial skills instruction improve STEM outcomes? The answer is 'yes'. *Learning and Individual Differences* 67 (Oct. 2018), 209–222. https://doi.org/10.1016/j.lindif.2018.09.001

[19] Sheryl A. Sorby. 2009. Educational Research in Developing 3-D Spatial Skills for Engineering Students. *International Journal of Science Education* 31, 3 (Feb. 2009), 459–480. https://doi.org/10.1080/09500690802595839

[20] Norma Veurink and Sheryl Sorby. 2011. Raising the Bar? Longitudinal Study to Determine which Students Would Benefit Most from Spatial Training. In *2011 ASEE Annual Conference & Exposition Proceedings*. ASEE Conferences, Vancouver, BC, 22.1210.1–22.1210.13. https://doi.org/10.18260/1-2--18592

[21] Norma L. Veurink and Sheryl A. Sorby. 2019. Longitudinal study of the impact of requiring training for students with initially weak spatial skills. *European Journal of Engineering Education* 44, 1-2 (March 2019), 153–163. https://doi.org/10.1080/03043797.2017.1390547

[22] So Yoon Yoon. 2011. *Psychometric properties of the Revised Purdue Spatial Visualization Tests: Visualization of Rotations (the Revised PSVT:R).* Ph. D. Dissertation. Purdue University.