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Conducting Inter-Institutional Collaborative Replication Studies as Student Projects

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Abstract

The replication crisis has had a profound effect on how we conduct research in psychology and relatedly, on how we train university students in research methods. In our teaching of psychological research methods, we may highlight to students that we, as a field, are striving to improve reproducibility and to reduce research waste. However, we often supervise these same students in conducting underpowered individual research projects. One solution is greater collaboration in student projects. In this reflective practice paper, we describe our experience in supervising an inter-institutional collaborative replication project. Eight Masters' students collaborated in replicating the famous "Lost in the mall" false memory study, with a much larger sample than the original experiment. Each student contributed to the overall replication while also writing up an individual element. Here we describe the processes we used to manage the project and the lessons learned. We encourage other third-level educators to adopt these supervision methods, where appropriate, and conclude with some practical tips and resources for conducting collaborative replications with students.

Keywords: major research project, replication, postgraduate research training, open science

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In recent years, psychology has experienced a "replication crisis" sparked by high-profile failures to replicate the findings of influential studies. In brief, many branches of psychology advance knowledge by empirically investigating hypotheses and using statistical analysis to assess whether any effects or relationships are statistically significant or are likely to be due to chance. The expectation is that significant findings can be repeated – e.g., by other experimenters with a new group of participants – but a series of investigations and failed replication studies demonstrated that the literature may include a great deal of influential findings that cannot be independently replicated (Shrout & Rogers, 2018). What followed was a period of profound self-reflection and an ensuing "credibility revolution", with calls for higher standards of evidence and greater focus on transparency (Vazire, 2018). This revolution has affected how we teach our third-level students and especially how we train them in research conduct. Both authors of this paper are lecturers in psychology in Irish universities. Here, we discuss a recent experience of conducting an inter-institutional replication project with our students, as a means of both generating more reliable research findings and providing a richer educational experience.

There is a contradiction at play between the message (theory) conveyed to psychology students and their experience (practice) of completing college research assignments. In psychology courses, students are told about the replication crisis, the dangers of underpowered studies and the importance of rigorous research methods, and yet, due to practical constraints on what can be achieved by a single student in a single academic year, they often conduct research projects with samples that are too small to draw meaningful conclusions (Quintana, 2021). These projects often go unread after the student completes their degree, representing a huge amount of research waste (Churchyard, 2020). The ethical issues raised by research waste have been discussed in neuroscience; for example, Button et al. (2013) draw attention to the sacrifice of animals as part of neuroscience studies that are severely underpowered and thus have low likelihood of detecting true effects. In psychology studies too, the waste of participant time and energy is an ethical issue. When an individual signs up to partake in a psychology study, they might reasonably assume they are contributing to science, and any effort, inconvenience, or even distress arising from their participation may be offset by this contribution to the greater good; they might be disconcerted to learn that the study is not in fact capable of producing such an outcome. For those of us who supervise research projects that are very unlikely to produce meaningful results, there can be a sense that we are failing in our ethical duties. Indeed, research shows psychology participants themselves disapprove of consigning research to the file drawer but are enthusiastic about replication and open science practices (Bottesini et al., 2022). One solution to underpowered studies is to place greater emphasis on collaborative projects. Large-scale international collaborations like the Psychological Science Accelerator (Moshontz et al., 2018), the Reproducibility Project (Open Science Collaboration, 2012) and the Many Labs projects (Klein et al., 2014) aim to move the field forward and provide more conclusive assessments of specific claims.

Beyond being informed of these projects, however, students rarely get any practical experience of engaging in collaborative replication projects. As we continue to strive for more credible and valid research practices (Vazire et al., 2022), it is becoming more important that students engage in research training that reflects these goals. There are emerging initiatives such as the Collaborative Replications and Education Project (Wagge et al., 2019), which provide structure and resources for undergraduate students to participate in high-quality direct replications.

The value of collaborative replication projects for the scientific community has received significant attention, but the benefits for individual students are equally important. Replication projects can give students training in open science practices such as preregistration and the sharing of data and materials (Quintana, 2021). A preregistration is where researchers publicly declare their hypotheses, methods and analyses in advance of collecting their data. This makes it less likely that they will be able to statistically torture their data until they get a significant result or claim that a surprise effect was what they had predicted all along. Through replication projects, students can also learn to engage deeply with previously published work, getting a sense of the "behind the scenes" practical problems that may not be obvious upon reading an influential published paper (Stojmenovska et al., 2019). Working collaboratively with an inter-institutional team can also help students to develop a more sophisticated understanding of the research process. Woodzicka and colleagues (2015) found that, relative to a traditional single-faculty project, students who undertook a multi-institutional collaborative project were more aware of the dynamic nature of research and how it can be affected by institutional resources, cultures, and practices. They also learned more practical skills such as sharing information and working in a truly collaborative way that included effective critique and complementary skills. Inspired by all of these benefits, we, the authors, initiated an inter-institutional replication project, described in detail below.

A Successful Cross-Institution Student Replication Project

We are based at University College Cork and University College Dublin, two large research-active universities in Ireland. The universities are approximately three hours' drive apart and the study described here was conducted in the academic year 2020-2021, while COVID-19 restrictions were still in place. Thus, for practical and public health reasons, the entire study was conducted online with no in-person meetings. We recruited eight students to contribute to this collaboration. The students were enrolled on a variety of Masters' programmes across the two universities, but, for all eight students, the research project and associated dissertation represented approximately one third of their overall grade. The project was initiated in late September 2020 and students submitted their dissertations in August/September 2021.

The paper we decided to replicate was "The formation of false memories" by Loftus & Pickrell (1995). This seminal paper, often referred to as the "Lost in the mall" study, was amongst the first to demonstrate that false memories for entirely fabricated childhood events – in this case, getting lost in a shopping centre at five years of age – can be planted via mere suggestion. The study has been criticised for its small sample size (n = 24) and lack of transparency and detail concerning how memories were coded (Blizard & Shaw, 2019). However, this paper remains enormously influential: It is featured in the majority of introductory psychology textbooks and is often referenced by expert witnesses in legal cases, as well as in popular media (Newberry, 2020; Thielman, 2018). The lack of a published replication of this study to date may be in part due to the demanding data collection process required. In the original study, participants signed up to complete a pen-and-paper survey, and an older relative of each participant was then asked to answer detailed questions regarding the participant's childhood. About a week later, the participant completed an in-person interview with the researcher where they discussed childhood events, three of which were true (provided by the parental informant) and one of which was fabricated by the research team. A week after that, participants completed another interview where they again discussed the four events, before being debriefed. We adapted these methods slightly, using technological solutions to adjust to COVID-19 restrictions (e.g., using online surveys, conducting interviews via Teams/Zoom).

Our final analysis included 123 participants recruited by the eight student researchers. We also extended the original study, adding additional measures and research questions alongside the direct replication. These additions were based on critiques of the original paper and were developed in consultation with the students. Overall, the findings of the original study were successfully replicated. The original study reported a false memory rate of 25%, and our preregistration specified that a rate of 15-35% would be considered to constitute successful replication. The final false memory rate in our study was 35%, supporting the central claim that participants can be guided to form false memories of fictitious events. The additional extension questions also provided further support to the original paper, demonstrating that both the participants themselves and external observers (mock jurors) were highly likely to believe these false memories. The replication paper was published in a peer-reviewed journal (Murphy, Dawson et al., 2023) and we have also written other papers relating to additional preregistered questions such as how participants felt about the deception used in the study (Murphy, Maher et al., 2023) and whether our debriefing methods were effective (Greene et al., 2023).

Our supervision and collaboration methods were based in part on a pilot inter-institutional project involving two students, conducted during the 2019-20 academic year. This earlier project was not a replication, but consisted of an experimental cognitive psychology project with multiple conditions. The pilot collaboration was a success; the students and supervisors enjoyed the process and the pre-registered

study was published in a high-impact journal, with students as co-authors (Greene et al., 2021).

Practicalities

The collaborative research project was conducted primarily using Microsoft Teams. This software allows for the sharing of materials and hosting of meetings between team members. We had frequent all-team meetings throughout the project. Some of these were discussion-based (e.g., early meetings establishing the goals of the project) and some were longer practical exercises (e.g., training students on how to conduct the interviews, including peer-to-peer training where students moved to breakout rooms to work in pairs). For data collection, the two institutions had licences for different meeting software, so one group used Teams for conducting interviews while the other used Zoom, but the transcribed data and materials were always shared with the wider group via Teams.

With so many researchers gathering data, consistency was an important consideration. A study protocol was developed by the supervisors to guide the student researchers in the data collection phase and a detailed interview schedule was provided to keep the interviews relatively consistent between researchers. Considerable time was spent on training the students to follow the interview schedule and develop rapport with participants. This included workshops via Teams where students practised interviewing one another and conducted pilot interviews with friends, recordings of which were shared with the supervisors and students for discussion and critique.

Student Roles

While we worked together to replicate the original study, each student developed their own unique research question within the bounds of the replication and extension. For example, one student focused on the ethics of the "Lost in the mall" experiment and how participants felt about the deception employed, while another assessed the effectiveness of the debriefing procedures and whether any residual false memories remained after the study. Several of these questions featured in the peer-reviewed publications referred to above (Murphy, Maher et al., 2023; Greene et al., 2023). Importantly, each student had to contribute to the overall project, including recruitment and data collection. It was only at the conclusion of all data collection and coding that students took the data relevant to their own research and worked independently to run their analysis and write their own individual dissertation. In effect, this meant that the students worked on two projects simultaneously – the overall replication and their own independent offshoot study.

Prior to data collection, students were grouped in pairs. These pairs would work together to recruit participants and run interviews. We wanted to ensure the students were not interviewing their own friends and family; so for example, a student in Cork

was paired with a student in Dublin for the duration of the project. The Cork student would recruit someone to take part in the study, then pass their details to the Dublin student (via a secure channel on Microsoft Teams). The Dublin student would then take that participant through the study in its entirety. In this way, we protected the integrity of the data we collected as well as teaching students about collaborative recruitment and responsibility. Later in the process, these pairs swapped their interview transcripts with another pair to check for accuracy (against the interview video file) and anonymity (carefully reading the transcript and removing any names or personal details that the participant may have mentioned during the interview). We also used this swapping process for coding the data. This ensured that students were not coding their own interviews, or those of their friends or family.

Reflections on Collaborative Research Training

As supervisors, we have enjoyed this project immensely. The supervision workload was intense and perhaps more loaded towards the beginning of the academic year, as substantial effort was required to get the project up and running. However, the workload compares fairly with what would have been required to supervise each student individually on separate projects. From our perspective, we feel our students have learned much more about the intricacies, trade-offs and innumerable decisions that are part of a large research project such as this. We all experienced the common frustrations of a collaborative project (and what felt like a never-ending stream of emails and meetings at times) but we also feel very proud of the completed project and the contribution it may make to the literature.

We had some concerns early on that, due to the nature of the project and the requirement for each individual to complete their work to a deadline, we sometimes found ourselves assisting students more than we might have expected to. For instance, though all students contributed to the project planning and had to develop a draft of the preregistration document together, it was necessary for us as supervisors to then make substantial changes to that document to ensure it was detailed and rigorous enough for publication. There simply wasn't time to go more than a few rounds of feedback with students to get that document to where it needed to be, so we felt we needed to make the necessary changes to allow the group to move on. In a project, where publication is not a priority and the preregistration might be attempted as a pedagogical exercise, there wouldn't be the same need to intervene. We often reflected on how much we were directing the project and whether we were doing too much work on behalf of the students. However, as the project progressed and students took ownership of their own data for analysis and write-up, we found we could afford them more freedom and time and encourage them to work things out without so much direct input from their supervisor. While everyone contributed to the overall project fairly equally, the individual write-ups meant that each student's strengths and weaknesses could be clearly seen. The marks awarded had a wide range

(though all students achieved at least a passing grade) and as we would expect in any assessment, students differed in how well they could write up the report, demonstrate their understanding and critical insight, and draw appropriate conclusions. The projects were assessed according to the marking procedures used at each of the two institutions. The requirements differed slightly between programmes, but all were independently marked by the supervisor and a second marker (not involved in the project), according to a rubric. The marks were awarded based on the written report (i.e., critical analysis, original thinking, appropriate analyses, etc.) and not on the basis of effort or hours put in across the project. If any substantial differences in grades had been found between the two markers, the project would have been sent to an independent third marker, but no such incidence occurred. Overall, we felt there was more than sufficient scope for students to engage in self-directed learning and demonstrate their independence as researchers.

In reflecting on this process, we were also keen to obtain the students' views. All eight students were invited to complete an anonymous online survey in which they described the pros and cons of their experience of taking part in a collaborative project. The students were mostly very positive about the experience, especially the collaborative nature of the project. One student noted:

> *I really like the collaborative aspect of being able to contribute to changes in a shared space. I enjoyed the Teams calls as we all got to know one another and voice concerns or successes. Having people excited and invested in the research who can share trials and tribulations is a big positive of inter-institutional collaboration.*

Another reflected that:

> *I felt one of the greatest benefits was being able to bounce ideas around each other to refine the scope of the project, as well as our individual projects. I also felt that working in a group better prepared me for future projects.*

Interestingly, some students felt the group project provided reassurance and was less isolating:

> *Being part of a larger project was reassuring. It was easy to bounce ideas off people, and it was reassuring to know that decisions we were making about the project were correct as eight people agreed with it. It was also reassuring to know we were all in it together – I knew seven other people were at the same milestone of their projects as me – we were all recruiting/starting our write up. I couldn't fall behind.*

Students also noted the challenges of this project, however, and commented that having to rely on other team members – or having other team members rely on them – was occasionally a source of stress:

> *I think the project was more complicated than if I had done a thesis myself. I think working with other people does take up more time. Sometimes working with other students can be stressful, especially coming up to deadlines.*

Some acknowledged the learning that came from those struggles:

> *I found that I was driven and relentless when it came to recruiting the sample we had agreed. When others struggled with recruitment that was hard for me. I wanted the replication to be as successful as it could be and when others were recruiting lower numbers it worried me. However, I know that everyone is different and definitely the group tried their best to recruit as much as they could. Letting go of things that you can't control is something that comes with teamwork.*

On balance, the students generally reported that the advantages of being part of a team that completed a publishable study to a high standard outweighed any disadvantages.

Tips and Resources on Managing Student Collaboration

We have made the materials from our project available on the Open Science Framework (OSF; https://osf.io/2utvg/?view_only=c6baf9870c734122b4bc4977da115938). OSF is a free-to-use platform where researchers can share materials, data, preregistrations and more, acting as an open science hub for a particular project. As transparency was important in this project, we have shared all our materials (including surveys, interview schedules, and coding manuals) as well as our preregistration and all anonymised data (including interview transcripts from each participant).

Authorship

In embarking on a large-scale project like this, we wanted to establish a shared understanding with our students about authorship and ownership of data. We developed an Authorship Agreement (available on OSF) in consultation with the students where we outlined the potential papers that might arise from the project, who would contribute to each project, and who would be guaranteed to be invited to co-author each paper. We stressed to students that, in order to earn authorship, they would need to make an intellectual contribution to any papers resulting from the project. We discussed scenarios where one individual might finish their programme and cease to respond to emails. In this case, they could not be a named author as they did not contribute to the final paper, nor could their absence hold up the publication process for others in the group. In both our discussions and the written agreement, it was stressed that no elements of authorship were set in stone, and

that open communication and discussion were essential as the project evolved and progressed. We would recommend a frank and honest discussion of authorship and data ownership early in these kinds of projects, so that students do not expect access or ownership of the data for publication purposes.

Rewarding Students' Work

We gave students a target for participant recruitment, but they differed in their ability to achieve that, some through no fault of their own, as their recruiting partner was unable to source enough participants. We suggest counteracting this in two ways. Firstly, where possible, find ways to balance the workload across the project. In our study, we matched those who had recruited a high number of participants with those who had recruited a low number of participants for the coding stage. This meant that those who had expended more hours on participant recruitment had to code fewer transcripts and vice-versa. It was important to introduce this correction as otherwise the incentives for recruiting more participants could have been skewed, with students potentially seeing more effective recruitment as simply creating more work for themselves. Secondly, ensure that, in the dissertation write-up process, students can report each individual element of their individual contribution. For example, rather than just reporting the overall number of participants, students can be encouraged to give a breakdown: "*I recruited 17 participants for my study partner; I collected data from 21 participants in total; and I coded the data from 52 participants recruited by others*". By recording their personal contribution, students who excel in certain areas have an opportunity to make sure their work is at least visible to assessors.

Data Policing

Having so many students collect such rich and detailed data from so many participants meant that data checks were essential. This would have been an overwhelming task for us as supervisors, so we employed two methods to help us ensure data quality. The first was to establish systems where students checked each other's data. Working both within and between recruitment pairs, students reviewed raw data, checked transcripts for errors, and double-coded responses to check for accuracy. This was a useful learning experience for students and gave us reassurance about data quality. The second method we employed was to bring in an external data champion to check the students' record keeping. We provided a student intern who took up this role with a data checking spreadsheet (available on OSF) and gave her access to the Teams channel. This enabled her to check off every file for each participant, noting any missing elements or researcher deviation (e.g., if a student completed an interview late, beyond the timeline outlined in the study protocol). We empowered the student intern to contact students for any missing elements and encouraged her to bring any consistent or concerning errors to us directly. We would recommend an exercise like

this, if possible, as students were so busy with the project, and their other coursework, that they would sometimes forget to upload materials. While it was easy to remind them and receive the file while the project was still ongoing, if more time had passed and students had moved on from their studies, this may have been more difficult to implement. Employing a data champion during a study is therefore likely to be a time-saving effort for everyone involved.

Ethical Considerations

A practical consideration is how to handle the ethical approval process for students. In our institutions (as in many others), students must submit an ethics application and receive approval before proceeding to collect data for their dissertation. In cases where the collaboration is between two universities, we would suggest that, where possible, the research team should send a detailed application to one university on behalf of all the students based there and, on receipt of approval, apply for a waiver from the ethics committees of the other institution(s). This approach reduces the chances of receiving conflicting requests for amendments from different ethics boards, which may delay your project as you wait for sequential decisions from the relevant institutions. This issue must be considered in planning the project timeline. Furthermore, for data protection reasons, it is critical that consent documents ask participants to agree to their data being shared within the broader research team (for coding, transcription, etc.). Generic consent forms might only mention the student and their supervisor and may not reflect the inter-institutional nature of a project such as this. Special consideration should be given to data protection if the collaboration crosses national borders, and researchers should familiarise themselves with the requirements of each jurisdiction in which they are working. We have made our ethics approval application available on our OSF page, including details of data sharing across institutions.

Conclusion

In summary, we would recommend this project model to fellow supervisors across any discipline. We observed our students engage in active learning; by getting into the "nitty-gritty" of a specific research paper, they gained an appreciation for transparent reporting and open data – important elements of the credibility revolution (Vazire, 2018). The replication element also allowed students to critically engage with an influential paper and see that such standards were not beyond them, thus encouraging them in their own research careers. The collaborative element was rewarding for us as supervisors and for students who learned to work with a wide team of people, understand different styles of supervision, and experience what it is like to contribute to a broader team effort, including the responsibilities in meeting deadlines and hitting targets. As has been argued by Ellemers (2021), collaboration is central to knowledge generation and many of our biggest contemporary challenges –

such as the COVID-19 pandemic and the climate emergency – require the pooling of collective expertise. Academic research culture can often encourage competition over collaboration, and this is evident from undergraduate level all the way up to faculty research projects (Altenmüller & Gollwitzer, 2022; Ellemers, 2021). We propose that embedding collaborative replication projects into students' coursework can foster an appreciation for open science and develop the prosocial collaborative skills necessary to conduct paradigm-shifting research into the future. In short, our students graduated with multiple rigorous papers under review for publication and a greater understanding of the research process.

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