What can be do to improve reproducibility?
A teaching perspective

Nicole Janz, University of Cambridge

Royal Society
May 5, 2015

One of the main questions for today's discussion is: What can be done to improve reproducibility?

I will give you a teaching perspective. I will argue that university teaching is the key to improved research transparency.

Let me start by sharing a few emails with you, which were a great source of frustration for me in the last few years.

I occasionally write to authors who work on foreign direct investment and human rights – which is my substantive research topic - and ask for their replication materials. Here are a few answers I received:

> Hi Nicole,
>
> I only have some of my electronic files with me during this trip, and the material from the article is not, unfortunately, among them. I would be happy to collect these for you once I have access to the files. All the best, …
>
> *(I never got those data even after following up several times)*

> Nicole,
>
> I will definitely send the data file when I can clean it up a bit. Let me see what I can dig up.
>
> *(The author never wrote to me again)*

> Nicole,
>
> I would be more than happy to share my data with you, but I am currently swamped and have not had time to clean up the dataset that you requested.
>
> *(You can probably guess by now that I never got those data.)*

Such emails reflect the state of irreproducibility in the social sciences.

A recent study found that only 18 of 120 political science journals have a replication policy that requires authors to upload their data.

That means that authors have no incentives to create replication files. It takes time, and we're all busy with publishing and teaching.

But if data are not made available, no one will cross-check published work.

A second problem is: Even if all research was transparent, there would be little incentive to conduct replications.

A common criterion in the peer review process is the presentation of new, original research.

So there is little motivation for scholars to conduct a replication study when the prospect of publication is low.

Much of the knowledge we trust today remains unchecked.

I argue that the twin challenges of

- irreproducibility and
- the scarcity of researchers willing to be replicators

can be tackled through a change in university teaching.

By teaching transparency tools and by encouraging students to replicate existing work, the gold standard for scientific research can be implemented more efficiently than before.

When students conduct replication studies as part of their methods training, they will not only understand statistics better.

But they will also learn first hand, by trying to re-analyse published work, when an analysis is really reproducible and when it is not.

Let me give you a practical example of a course that integrates replications in university teaching.

The Cambridge Replication Workshop

I run a an interdisciplinary Replication Workshop at Cambridge for graduate students.

The students replicate a chosen paper in their field over the course of eight weeks.

In the first four sessions we focus on picking a suitable paper, downloading the data, and reproducing the results.

During the second half of the course, students add value to the replication by changing the models and adding new measurements, and write a paper draft.

At the end of the course, all students have to upload their paper, analysis, code and data to our class dataverse.

In the last three years, students were confronted with the following challenges:

1. The data were nowhere to be found and the original sources of the variables were not clear
2. the original author did not respond to emails asking for data
3. the author did not remember where they had stored their files
4. the steps in the analyses were not well described
5. it was not clear how the variables were transformed before entering the analysis
6. the statistical models remained opaque

This irreproducibility across all social science fields led to massive frustration among students and demonstrated the consequences of a lack of transparency.

The students and I share a dropbox with all the files. One of my students, Nico, a Criminologist, named his R files for the replication nightmare1.R, nightmare2.R and so on.

So why do student still sign up for such a course? Let me give you three main benefits:

Benefits

First:

Replication is a better way to learn statistics than using textbook data.

Students use real-life data with all bugs and complications included.

By going through the data and codes of the original study, students realize what kinds of decisions the author made, for example, about variable transformations, missing observations, or model specifications.

Second:

Students get published early. Several of my students have now published a revised version of their replication study as a journal article.

Third, and most importantly for the discussion today:

Students create a reproducibility routine and workflow.

At some point during the course, students exchange their code and data to cross-check each others' work. This means that they have to learn how to comment their code well enough so that their partner can understand what they did and give good feedback.

In addition, the frustration during the course is an effective, if painful, way to learn first hand when published results are really reproducible and when they are not.

This will help students to improve transparency in their own work.

Many of my students felt empowered that they can do better, and work in a more transparent way, in their own masters project or PhD thesis.

They understand the value of keeping logs and uploading their own data.

Hopefully this leads to a cohort of future researchers who develop a reproducibility routine which feels automatic and natural to them.

Conclusion

Therefore, to conclude, universities should encourage instructors to assign replications to students in order to establish a culture of replication and reproducibility during early career stages.

I want to end with two questions for you:

Do you think such a course would be a suitable way to uphold the gold standard of reproducible research in your field?

Or is this creating a culture of error hunting, where amateur student researchers take on big names?

Sources:

Political Science Replication Blog
http://politicalsciencereplication.wordpress.com

Cambridge Replication Workshop
http://schreiberin.de/teaching/replication.html

JANZ, NICOLE. (2015) "Bringing the Gold Standard Into the Class Room: Replication in University Teaching" (International Studies Perspectives). Open Access: http://onlinelibrary.wiley.com/doi/10.1111/insp.12104/abstract

GHERGHINA, SERGIU, AND ALEXIA KATSANIDOU. (2013) Data Availability in Political Science Journals. European Political Science 12 (3): 333–349. http://www.palgrave-journals.com/eps/journal/v12/n3/abs/eps20138a.html