Assessing the impact of new curriculum on open and transparent practices

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The problem

Curriculum:

- There is a critical need to align the practices of **teaching research methods** in Psychology with the best practices of **conducting research** in Psychology.

Assessment:

- Does introducing undergraduates to these best research practices improve their conceptual understanding of research methods?

The context of methodological reforms

- In recent years, there has been a growing recognition that common **questionable research practices (QRPs)** are undermining the robustness of scientific knowledge

  - **Failures to replicate** "classic" or high-profile claims in Psychology

- In response to this "credibility crisis," scientists have pushed for methodological reforms to improve the robustness of scientific research by understanding and avoiding these QRPs.

Project Plan

- **Create new curriculum**

  - 3 video lectures

  - hands-on labs focusing on reproducing published results (open datasets and open-source statistical platform)

- **Develop assessment tool**

  - Open Science Concept Inventory

- **Implement curriculum and assessment in the classroom**

  - PSYC2103–Fall 2019

  - PSYC2103–Spring 2020

The Open Science Concept Inventory (OSCI)

- A concept inventory for Open Science that will assess knowledge in this domain

Developed in two phases:

- **Study 1:** Eliciting open ended responses to scenarios

- **Study 2:** Evaluating multiple choice version of responses to scenarios items

OSCI Study 1: Developing vignettes

- Identified a list of target concepts related to open science and QRPs

- Created 41 vignettes describing hypothetical scenarios faced by a researcher, science consumer, or other stakeholder

OSCI Study 1: Vignette Example

Target concept: Publication bias

David's research project is based on a well-known effect in the psychology literature. After attempting to replicate the effect in two experiments, David finds that he hasn't replicated the published findings despite using a very similar procedure and a large sample of participants. Concerned that he won't be able to publish nonsignificant results in a journal, he's considering abandoning the project.

Would you advise him to abandon the project or not? Why or why not?

OSCI Study 1: Developing vignettes

- Identified a list of target concepts related to open science and QRPs

- Created 41 vignettes describing hypothetical scenarios faced by a researcher, science consumer, or other stakeholder

- Piloted items with RAs and had discussions with Drs. Elise Demeter and Karen Singer-Freeman

  o Revised for clarity

  o Added definitions of key terms

- Divided items in two lists to shorten study duration

OSCI Study 1: Item lists

	ListA	Topic	ListB	Topic
1	item1	Publication bias/file drawer problem: researcher's perspect	item2	Publication bias/file drawer problem: editor's / reviewer's perspe
2	Item3	Preregistration (evaluating evidence)	item34	Preregistration (researcher's perspective; revising plan)
3	Item10-11	Participant bias	item4	Optional stopping
4	Item10-11	Participant bias (reporting)	item14-15	Misconduct/Fraud/Fabrication
5	item33	Data peeking with pilot studies	item14-15	Misconduct/Fraud/Fabrication (reporting)
6	Items5-6	Replication (Relation to Type I/II errors)	items7-8-9	Covariate inclusion
7	Items5-6	Outlier exclusion	items7-8-9	Dropping participants or observations
8	item17	Outcome switching	items7-8-9	HARKing
9	item18	Reproducibility	item16	Open data
10	item20	Selective reporting of conditions	item19	Selective reporting of outcomes
11	item22	Selective reporting; publication bias (editor's perspective)	item21	Selective reporting of conditions/experiments
12	item27	Open data (data owner's perspective)	item23	Open data (data requester's perspective): privacy issues
13	item28	Misconduct: Reusing own data without citation	item29	Citation / Misconduct: Not providing proper attribution for use of
14	item30	Costs of open science practices	item31	Preregistration; Costs of open science practices
15	item32	Incentive structures: Funders	item26	Publishing incentive structure (open access)
16	item36	Incentive structures (publish or perish)	item35	Salami-slicing
17	item37	Replication	item38	Replication
18	item24	Non-HARKing / Clear about exploratory post-hoc analyses	item25	Outlier removal based on plan
19	item41	Retraction	item40	Misconduct/fraud
20	item12-13	Reliability	item39	Power/sample
21	item12-13	Reliability (reporting)		

OSCI Study 1: Coding Procedure

N = 64 participants

Coding open-ended responses and generating MC responses

1. Generated our target response for each item.

2. Grouped participants' responses into consistent themes. Summarized each themes as a statement.

3. Excluded response themes that were broadly correct but not the target (e.g., "I would advise David to not abandon the project because additional replications are needed to establish if there is a true effect.").

4. Included response themes that are clearly incorrect (e.g., "David should not try to publish these results because replicating someone else's work is unethical").

5. If needed, generated additional distractor options.

OSCI Study 2 items

David's research project is based on a well-known effect in the psychology literature. After attempting to replicate the effect in two experiments, David finds that he hasn't replicated the published findings despite using the same procedure and a large sample of participants. Concerned that he won't be able to publish non-significant results in a journal, he's considering abandoning the project.

What should David do?

A. **David should still try to publish the results of his project because non-significant findings are informative.**

B. David should keep modifying the procedure until he obtains a significant effect that he can then publish.

C. David should not try to publish these results because replicating someone else's work is unethical.

D. David should not try to publish these results because non-significant results are not informative.

OSCI Study 2

- 40 items presented in randomized order

- Currently, we have $N = 108$; aiming for $N = 200$

- We will use Item Response Theory (IRT) analysis to select items that vary in difficulty and are high in discrimination

- We are currently preregistering our analysis plans for Studies 2-4

OSCI 3: Implementation & Assessment

Pre-test – Post-test design in two sections of PSYCH2103

- Pre-test administered in Week 7 of semester

- Curriculum is being integrated in the course

  o **Lecture 1a SLO:** Recognize problems caused by current incentives and norms in science

  o **Lecture 1b SLO:** Identify questionable research practices and recognize why they undermine the robustness of the scientific literature

  o **Lecture 2 SLO:** Identify open science solutions to address these problems and recognize why they help

- Post-test will be administered in Week 16 of semester

Anticipated impact on students

- Learning gains in students conceptual understanding of robust and reproducible research practices (OSCI)

- Increased self-efficacy to complete research activities and increased confidence in psychology as a field (Attitudes Toward Research Questionnaire, ATRQ)

- **Scalability**: Material and assessments will be made openly available (OSF and Canvas) and can be integrated in other research methods courses

Lessons learned

- Developing the assessment tool was time consuming

  - Vignettes required multiple rounds of revision

  - Generating 40+ vignettes was difficult

  - Generating definitively correct vs. incorrect options was challenging

- Developing new curriculum was also demanding

  - In parallel with the assessment development

    - In Study 4, pre-test and curriculum integration will come earlier

Acknowledgements

Some Questionable Research Practices (QRPs)

- *p*-hacking

  ○ Optional stopping

  ○ Dropping observations

  ○ Outcome switching

  ○ Covariate inclusion

- Selective reporting

- Hypothesizing After the Results are Known (HARKing)

OSCI Study 1: Vignette Example

Target concept: Optional stopping

Anna is researching how introverts and extroverts differ in their responses to stress. Based on the sample size of previous studies on this topic, she proposes collecting data from *N*=100 participants for her study. After 50 people participated, Anna performs a preliminary data analysis and finds a significant difference between the two groups. Since she found a significant effect, Anna is considering ending data collection in order to write up the results for publication.

Would you advise Anna to end data collection? Why or why not?