

Replication & Cumulative Science

Companion to the Week 12 episode. One study is a brick, not a building.

1. The one idea

Knowledge is **cumulative**: replication filters flukes and reveals what's real; meta-analysis combines many studies. Your study's job isn't the final word — it's an **honest, checkable, combinable brick** in a shared building.

2. Direct vs conceptual replication

Direct / close	Conceptual
Repeat as faithfully as possible, new participants → "is the effect real, or a fluke?" (sharper for reality)	Same hypothesis, different methods/population → "does it generalise?"

A *failed conceptual* replication is ambiguous (effect false, or method didn't capture it); a *failed direct* points more cleanly at fragility. A healthy field needs both — ours has done few.

3. Checking the field — the replication projects

~1/3—1/2 replicated Reproducibility Project: Psychology (OSC, <i>Science</i>, 2015; 100 studies)	~1/4 robustly replicated Sport & exercise science (Murphy, Caldwell, Mesquida et al., <i>Sports Medicine</i>, 2025)
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A **diagnosis to act on, not a scandal to hide**. The immune system working — checking makes a field *more* trustworthy, not less. Every tool in this course aims to *raise* that number.

4. Meta-analysis — and its catch

Pools many studies → one more precise estimate (ten underpowered studies → power of one large one); best with **individual participant data**.

Garbage in, authoritative garbage out: a meta-analysis is only as trustworthy as its inputs. A biased literature (publication bias, selective reporting, p-hacking, winner's curse) → a *precise estimate of a biased number*, laundered into a tight CI. This is **why** preregistration / honest

reporting / transparency / power matter — they keep the *literature* clean. Real fix is prospective (Registered Reports, multi-site).

5. Research waste (Chalmers & Glasziou, 2009)

~85% of research investment is wasted — poor questions, avoidable flaws, underpowered studies, unpublished results, unusable reports. Every stage of this course maps onto *avoiding* a form of waste. Hopeful: waste is largely *avoidable*, so simple reforms yield big returns.

6. Make yours count — this week's task

Join the cumulative effort

- 1. Value & do replications** — for your next study, ask whether replicating an important-but-shaky finding beats another novel one-off (student research is ideal; cf. the SSRIC).
- 2. Share de-identified data** so it can be pooled into future meta-analyses — a permanent brick.
- 3. Engage with a multi-site / replication network** — your modest contribution + many others = power a small-sample field can't get alone.

References

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- Chalmers, I., & Glasziou, P. (2009). Avoidable waste in the production and reporting of research evidence. *The Lancet*, 374(9683), 86–89.
- Mesquida, C., Murphy, J., Lakens, D., & Warne, J. (2022). Replication concerns in sports and exercise science. *Royal Society Open Science*, 9(12), 220946.