What do earlier reviews leave to add?

Prior-review comparison table I Companion to Worksheet A, handout p. 9

Case study: Eeamtak et al., *Green Chemistry* (2026), 10.1039/d6gc03171d

A retrospective teaching reconstruction of a published review: how its review gap and novelty can be articulated. This is not a proposal to publish the same review again.

Prior review	Window	Organising logic	What it does not do*	What we add
Harper et al. 2019, *Nature* [2]	Published 2019; search cutoff not stated in the material inspected.	EV lithium-ion battery reuse and recycling: assessment, disassembly, processing and design for recycling.	Does not organise the comparison using the combined reset-depth, repair-window and reversibility-ledger tools of this case study.	Link loss of structure at different scales to routes that preserve value for subsequent manufacturing.
Baum et al. 2022, *ACS Energy Lett.* [3]	Trend analysis: 2010-2021; not a cutoff for every claim.	Techniques, publication and patent trends, facilities, and economic and environmental issues.	A route overview does not itself supply a mechanistic rule matching differently degraded feedstocks to repair capability.	Explain why similar metal yields may leave different amounts of reusable structure and different rebuilding burdens.
Li et al. 2024, *Chem. Soc. Rev.* [4]	Published 2024; search window and cutoff not verified from the abstract.	Recycling fundamentals: classification, testing, pretreatment, electrolyte recovery and direct regeneration.	The inspected scope does not establish whether the same three-part decision tool is present. Audit the full text before claiming absence.	Connect knowledge across stages: feedstock state → reset depth → repairability → resource burden.

Example review-gap statement

Relative to these selected reviews, there is room to synthesise **how the functional structure retained in a feedstock determines suitable recycling routes**, using descriptors that connect pack-level features to interphase chemistry and identify conditions under which direct regeneration remains selective.

*The limitation column is a teaching interpretation of accessible material and the positioning in [1], not an exhaustive audit of all prior reviews. Earlier work already discusses material preservation and quality; do not claim that nobody previously considered structure.

Takeaway: Publication year ≠ literature-search window. “What we add” should identify additional understanding or decision support, rather than simply more references.

A completed one-page review proposal

One-page proposal I Companion to Worksheet B, handout p. 9

Status: The title, concept and venue come from the published paper [1]. The year range, workflow, roles and schedule below are an **illustrative teaching plan**, not a record of the authors' actual process.

1. Working title

Beyond metal recovery in lithium-ion battery recycling: order retention as a sustainability framework from pack disassembly to interphase chemistry

2. Thesis - one sentence

A suitable recycling route depends on matching **the order retained in the feedstock** to the process's selective repair capability; metal recovery yield alone is therefore insufficient for route selection.

3. Review type and target venue

Critical review / conceptual synthesis; Green Chemistry. The case study is already published as a Critical Review. For a new submission, check current journal requirements and overlap with existing reviews; do not invent unverified word or reference limits.

4. Scope - Population, Concept, Context

P: Spent LIBs, focusing on LFP and layered-oxide cathodes; SIBs serve as a boundary comparison, without assuming identical behaviour. **C:** Order retention, reset depth and repairability. **C:** Recycling from pack disassembly to interphase chemistry. **Illustrative search years:** 2010-2026. Exclude lead-acid and primary batteries, and second-life operation unrelated to recycling-route selection. The actual paper does not report a systematic-review search window.

5. Why now, and why us

Why now: Direct regeneration and varied feedstock states make it necessary to explain the value of retained structure and the burden of destroying and rebuilding it. **Why us:** The case-study team combines electrochemistry, materials and chemical engineering expertise, as described in [1]. Do not add unverified field-wide publication counts or a three-year publication record.

6. Section outline - the organising framework

Order-retention framework: (1) Problem and prior-review gap → (2) Feedstock order descriptors → (3) Routes classified by reset depth → (4) Match disorder to repair windows through a reversibility ledger → (5) Reagent, energy, water and emissions implications → (6) Limitations and validation priorities.
Give each section a distinct role: material state / process / matching / impacts. Cross-reference evidence instead of retelling it.

7. Deliverables and schedule - illustrative eight-week plan

Targets: About 80-100 references, four figures and three key tables: prior-review comparison / evidence matrix / descriptor-to-route map, with a search log and inclusion rules.
Roles: Person 1 searches and extracts; person 2 checks numerical claims and primary sources; person 3 challenges mechanisms and conclusions. **Schedule:** W1-2 search/scope; W3-4 extract/appraise; W5-6 synthesise/draft; W7-8 verify/prepare submission. A 9 September 2026 start gives a target of 4 November 2026.

> **PRISMA:** This critical-review example does not imply that the original paper used PRISMA. If a new project is designed as a scoping or systematic review, select the appropriate reporting guideline and record actual screening counts.

Read the evidence before writing the gap

Worked evidence matrix I Five selected condition rows from Table 3 of [1]

Evidence boundary: These entries were extracted through Table 3 of [1], PDF p. 16, using its primary-reference numbers. This is a teaching extraction through a review. Check the primary papers and their test details before using the data in a research synthesis.

ID	Feedstock / disorder	Route	Result reported in Table 3	Supported inference
E1 [5] ref. 43	Degraded LFP: lithium loss, Fe(III)-rich surface and conductivity loss.	Direct regeneration with a multifunctional organic lithium salt.	Capacity increases from 102 to 157 mAh g^{-1} at 0.1 C; 88% retention after 400 cycles.	Performance can recover without a complete structural reset in this case.
E2 [6] ref. 57	Spent LFP slurry: lithium deficiency, with host framework retained.	Electrochemical relithiation; 25 °C, 2 h.	151.5 mAh g^{-1} at 0.1 C; 96.6% retention after 400 cycles.	Some feedstock states permit restoration under mild conditions.
E3 [7] ref. 59	LFP already dissolved into ionic species.	Acid leaching + hydrothermal synthesis.	136 mAh g^{-1} at 0.1 C; 98.6% retention after 300 cycles at 1 C.	A functional product after deep reset does not imply preservation of the original structure.
E4 [8] ref. 51	NMC622 with ionic Cu; best reported case at 0.34 at% Cu ion.	Reuse/regeneration of recovered cathode material.	Initial charge/discharge = 211.8/186.0 mAh g^{-1} at 0.05 C.	Impurity chemistry matters; this value is not a universal Cu threshold.
E5 [8] ref. 51	NMC622 with metallic Cu.	Reuse/regeneration tested in the same study as E4.	Table 3 reports that metallic Cu impurities can readily cause cell short circuits; this row gives no numerical threshold.	Total Cu alone cannot distinguish ionic from metallic impurity effects.

Evidence pattern

E1-E3: Post-recycling capacity alone does not reveal reset depth.
E4-E5: Impurity identity and chemical form affect reuse outcomes.

How appraisal limits the claim

E4 and E5 come from one study, not two independent studies. Different C-rates, feedstocks and protocols prevent direct route ranking by capacity or retention.

Count correctly: This excerpt has five condition rows from four primary studies. The full Table 3 has ten case/condition rows from eight references, not ten independent studies. Check replicates and controls in the originals; omission from this summary does not establish their absence.

From evidence patterns to gaps and novelty

Completed answers A-D I Companion to Worksheet C, handout p. 13

A. Define the boundary

Question: How do structural state and impurities in spent LFP/NMC cathodes help determine when direct repair is suitable and when a deeper reset is needed?

Type: Critical synthesis in case study [1]. Evidence for this example: E1-E5, Fig. 4 and §4.5.6. Document inspection date: 9 September 2026. No new comprehensive database search was performed; this date is not a "last systematic search date", and conclusions must remain within the selected evidence.

B. Name the evidence pattern

E1-E3 show that routes with different reset depths can each deliver usable performance under their own test conditions. E4-E5 show why Cu impurity forms must be distinguished. Section 4.5.6 describes numerical repair boundaries as working hypotheses drawn from heterogeneous sources and chemistries.

Still to check: Comparisons using the same feedstock lot, pre-recycling disorder measurements, and comparable outcomes and controls. Reporting quality limits the strength of threshold claims.

C. Research-gap statement - what the evidence cannot yet resolve

Within the LFP/NMC evidence selected here, **transferable repair-window boundaries cannot yet be specified with confidence**. Starting material states, impurity forms and test protocols are not on a common basis, and the review's numerical boundaries remain hypotheses requiring validation. This uncertainty affects the choice between direct regeneration and deeper-reset routes.

Research that would reduce the gap: Split a single feedstock lot between direct regeneration and leaching/resynthesis; measure Cu speciation, structure and particle-size distribution before processing. Compare product purity, long-term cell performance, and energy/reagent burdens using the same functional unit and system boundary, with a justified number of replicates.

D. Review-novelty statement - the understanding the review adds

Relative to the selected reviews in Worksheet A, [1] adds **a mechanistic framework connecting order retention, reset depth, repair windows and a reversibility ledger**. Synthesising degradation states with recycling outcomes reframes route selection as matching feedstock condition to repair capability, making visible value that metal yield alone does not explain.

This is the published review's conceptual contribution. It does not establish that every threshold has been validated or that direct regeneration is superior under all conditions.

Reading Fig. 4: The three blank cells in its 3 × 3 matrix indicate no worked feedstock examples in the map presented. They do not establish physical impossibility or prove that no relevant study exists anywhere in the literature.

How to discuss the completed example

Start with the purpose of the review, then identify the research still needed

A · What prior reviews leave unclear	→ B · What we will synthesise	→ C · What the evidence supports

> "These two uses of 'gap' refer to different things. A review gap is something previous reviews have not adequately synthesised. A research gap is a question the research evidence cannot yet answer adequately. This paper adds an order-retention framework for thinking about recycling-route selection, but it does not turn every proposed threshold into a validated fact. That distinction explains both the review's novelty and the starting point for further research."

Ask participants

If a recycled cathode achieves high capacity, can we conclude that its recycling route is the most sustainable?

Expected response

Not yet. Compare feedstock, durability and resource burdens on a common basis.

Writing prompt

Choose one E1-E5 pattern. Write a one-sentence gap and specify a comparator and outcome that would reduce the uncertainty.

References and scope of checking

1. **Eeamtak et al. (2026).** *Beyond metal recovery in lithium-ion battery recycling: order retention as a sustainability framework from pack disassembly to interphase chemistry.* Green Chemistry. 10.1039/d6gc03171d
Main source: the speaker-supplied PDF; Introduction, Fig. 1, Fig. 4, §4.5.6, Table 3 and Conclusion.
2. **Harper et al. (2019).** *Recycling lithium-ion batteries from electric vehicles.* Nature 575, 75-86. 10.1038/s41586-019-1682-5 · Publisher-page text inspected.
3. **Baum et al. (2022).** *Lithium-Ion Battery Recycling: Overview of Techniques and Trends.* ACS Energy Letters 7, 712-719. 10.1021/acsenergylett.1c02602 · Publisher page and CAS description checked for the 2010-2021 trend-analysis window.
4. **Li et al. (2024).** *Fundamentals of the Recycling of Spent Lithium-Ion Batteries.* Chemical Society Reviews 53, 11967-12013. 10.1039/D4CS00362D · Abstract and bibliography inspected; not a full-text audit.
5. **Ji et al. (2023).** Nature Communications 14, 584. 10.1038/s41467-023-36197-6 · E1 / ref. 43 in [1].
6. **Chen et al. (2024).** Inorganic Chemistry 63, 17166-17175. 10.1021/acs.inorgchem.4c02844 · E2 / ref. 57 in [1].
7. **Song et al. (2021).** Green Chemistry 23, 3963-3971. 10.1039/D1GC00483B · E3 / ref. 59 in [1].
8. **Zhang et al. (2020).** Nano Energy 78, 105214. 10.1016/j.nanoen.2020.105214 · E4-E5 / ref. 51 in [1].

[5]-[8] provide routes back to the primary sources. Numerical results here were extracted through Table 3 of [1]; no complete re-audit of all primary papers is claimed. No experimental results or search counts have been invented.