Peta International Journal of Social Science and Humanity
Peta Research Publication
www.PIJSSh.peta-research.com
Online ISSN 2830-540X

What Makes Learner-Centered Teaching Effective? Protocol for a Systematic Review and Meta-Analysis of Pedagogical Approaches, Design Characteristics, and Contextual Moderators

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Abstract

Learner-centered pedagogies are generally associated with favorable educational outcomes, but their effects vary substantially across instructional approaches, educational settings, outcomes, and implementation conditions. Existing meta-analyses have typically examined individual pedagogical traditions such as cooperative, problem-based, inquiry-based, project-based, or flipped learning using different eligibility criteria, outcome classifications, effect-size metrics, and analytical strategies. Consequently, the literature provides stronger evidence about whether particular approaches are effective on average than about the design characteristics and contextual conditions that may explain variation in their effectiveness. This protocol describes a systematic review and meta-analysis designed to address that gap. For the purposes of the review, learner-centered pedagogy is operationalized as instruction in which learners make substantive contributions to the learning process through active cognitive engagement, interaction, inquiry, application, reflection, or adaptation to learner needs, while teachers retain an intentional role in structuring and supporting learning. Eight pedagogical families will be examined: collaborative/cooperative learning, problem-based learning, inquiry-based learning, project-based learning, flipped learning, dialogic teaching, experiential/service learning, and personalized/adaptive learning. Rather than treating these labels as homogeneous interventions, the review will additionally code theoretically relevant design characteristics, including instructional guidance and scaffolding, interaction and group structure, intervention duration, teacher preparation, technological support, and implementation fidelity. The review will follow PRISMA-compatible procedures for systematic searching, independent screening, data extraction, risk-of-bias assessment, effect-size estimation, random-effects meta-analysis, treatment of statistically dependent effect sizes, moderator analysis, sensitivity analysis, and assessment of small-study and reporting biases. Academic achievement and learning performance will constitute the primary outcome domain, while cognitive, motivational, self-regulatory, social, and attitudinal outcomes will be analyzed as distinct secondary domains rather than combined into a single overall effect. Comparisons with conventional/business-as-usual instruction and comparisons with alternative learner-centered approaches will also be analyzed separately. No empirical results are reported because the systematic search and meta-analysis have not yet been completed. The intended contribution is to move beyond family-level judgments about whether learner-centered teaching "works" toward a theory-informed account of which design characteristics and contextual conditions are associated with stronger or weaker educational effects.

Keywords: learner-centered pedagogy; systematic review; meta-analysis; instructional guidance; cooperative learning; inquiry-based learning

Received on 30 May. 2026, Accepted on 30 Jun. 2026, Published on 12 Aug. 2026.

1. Introduction

Learner-centered pedagogy has become an influential orientation in contemporary education, encompassing instructional approaches that seek to increase learners' cognitive engagement, participation, interaction, inquiry, application, reflection, or responsibility for aspects of the learning process. A substantial body of research suggests that active, cooperative, problem-based, inquiry-based, project-based, and flipped approaches can produce favorable learning outcomes relative to conventional instruction (Dochy et al., 2003; Freeman et al., 2014; Lazonder & Harmsen, 2016; Strelan et al., 2020). However, the magnitude and consistency of reported effects vary considerably across studies, educational levels, subject areas, outcome measures, and implementation contexts.

This variability is theoretically important because learner-centered teaching is not a single intervention. Approaches commonly described as learner-centered differ in what learners are asked to do, how responsibility is distributed between teachers and learners, how interaction is organized, and how much instructional guidance is provided. Collaborative and cooperative learning, for example, depend on the structure of interdependence, accountability, and interaction; inquiry- and problem-based learning depend substantially on the nature and timing of guidance and scaffolding; dialogic teaching emphasizes the quality and structure of classroom discourse; and flipped or personalized approaches depend on the design of in-class activity, sequencing, adaptation, and, frequently, technological support. Research on minimally guided instruction further demonstrates that increasing learner activity or autonomy does not necessarily improve learning when adequate instructional support is absent (Kirschner et al., 2006; Mayer, 2004).

Accordingly, the present review does not define learner-centered pedagogy simply by the absence of teacher-directed instruction. For the purposes of eligibility and coding, a learner-centered intervention must provide learners with a substantive role in the learning process through one or more of the following features: active cognitive construction, structured interaction with others, inquiry or problem solving, application or experiential activity, reflective participation, or meaningful adaptation of instruction to learner needs. At the same time, learner-centeredness is not treated as synonymous with minimal guidance. Teacher explanation, modeling, feedback, scaffolding, and instructional structure may coexist with and potentially strengthen learner-centered activity.

Existing meta-analyses provide substantial evidence within individual pedagogical traditions, but direct interpretation across these traditions remains difficult. Previous syntheses frequently differ in their search periods, eligibility rules, comparator definitions, outcome classifications, effect-size metrics, and moderator analyses. Consequently, differences between reported pooled effects may reflect not only genuine differences between pedagogical approaches but also differences in review methodology, study populations, outcome selection, and implementation characteristics. The literature therefore provides clearer answers about the average effects of individual pedagogical approaches than about the mechanisms and conditions associated with stronger or weaker effects.

A further limitation is that pedagogical labels may conceal important variation within interventions. Two studies both described as "inquiry-based learning," for example, may differ markedly in the amount of teacher guidance, duration, group structure, teacher preparation, technological support, and implementation fidelity. Conversely, interventions carrying different pedagogical labels may share important design characteristics. Comparing pedagogical families alone may therefore be less theoretically informative than examining both family membership and the instructional characteristics that cut across families.

The present systematic review and meta-analysis addresses these limitations by applying a common taxonomy, outcome framework, and analytical strategy across eight major learner-centered pedagogical families while simultaneously coding theoretically relevant design and implementation characteristics. The central objective is therefore not to identify a universally superior teaching methodology. Rather, the review asks whether variation in educational effects can be explained by differences in pedagogical design, implementation, learners, outcomes, and educational context, and whether broad pedagogical-family labels retain explanatory value after these characteristics are considered.

2. Theoretical Background

Learner-centered pedagogy is best understood not as a single instructional theory but as an umbrella category encompassing approaches derived from several related but theoretically distinct traditions. A useful synthesis must therefore distinguish between pedagogical families, which describe recognizable instructional configurations, and underlying design characteristics or mechanisms, which may operate across several families.

Collaborative and cooperative learning are strongly informed by social interdependence theory, which proposes that learning in groups depends not merely on placing learners together but on structuring positive interdependence, individual accountability, and productive interaction (Johnson & Johnson, 2009; Roseth et al., 2008). From this perspective, the relevant explanatory mechanism is not "group work" itself but the quality and structure of interdependence and interaction.

Problem-based, inquiry-based, and project-based learning draw broadly on constructivist and guided-inquiry traditions, in which learners construct understanding through engagement with meaningful problems, questions, evidence, or extended tasks. However, these approaches vary substantially in the amount and form of instructional guidance they provide. Evidence concerning discovery and inquiry learning suggests that scaffolding, prompts, explanations, feedback, and other forms of guidance can substantially influence effectiveness (Alfieri et al., 2011; Furtak et al., 2012; Lazonder & Harmsen, 2016). Guidance should therefore be treated as a design characteristic that varies within pedagogical families rather than as the opposite of learner-centered teaching.

The ICAP framework provides a complementary cognitive account by distinguishing passive, active, constructive, and interactive modes of engagement (Chi & Wylie, 2014). Its relevance to the present review lies in the proposition that observable learner activity alone is insufficient: educational effects may depend on the cognitive processes elicited by that activity. Approaches carrying different pedagogical labels may therefore produce similar effects when they generate comparable levels and forms of constructive or interactive engagement.

Sociocultural and dialogic perspectives emphasize learning through discourse, questioning, explanation, argumentation, and collaborative meaning-making (Alexander, 2008; Howe & Abedin, 2013). Within these perspectives, the amount of classroom talk is less important than its quality: opportunities for learners to articulate reasoning, respond to others, develop ideas, and receive productive uptake may constitute mechanisms through which dialogic and collaborative forms of instruction influence learning.

Experiential learning theory emphasizes the relationship between experience, reflection, conceptualization, and subsequent application (Kolb, 1984). Experiential and service-learning interventions therefore cannot be characterized by activity or experience alone; the extent to which experience is structured, reflected upon, and connected to disciplinary concepts is theoretically important.

Flipped and personalized/adaptive learning are more heterogeneous and hybrid configurations. Flipped learning changes the temporal organization of instruction by relocating some forms of direct instruction outside scheduled class time and potentially creating additional opportunities for active application and interaction during class. Personalized or adaptive learning changes the relationship between instruction and learner characteristics by adjusting content, pace, sequence, support, or learning pathways. Neither configuration is necessarily learner-centered by virtue of technology or sequencing alone. Their inclusion therefore depends on whether the intervention provides substantive learner engagement or meaningful adaptation consistent with the operational criteria of the review.

Taken together, these theoretical traditions suggest a distinction between pedagogical labels and explanatory characteristics. Pedagogical families describe how interventions are conventionally organized, whereas characteristics such as instructional guidance, cognitive engagement, interaction structure, learner responsibility, teacher preparation, technological support, and implementation fidelity may more directly explain variation in effects. The review will therefore examine whether pedagogical-family differences remain after accounting, where the evidence permits, for theoretically relevant characteristics that operate within and across families.

3. Research Gap

Three related limitations motivate the proposed review.

First, the evidence base is fragmented across pedagogical families. Meta-analyses of cooperative, problem-based, inquiry-based, project-based, flipped, and other forms of learner-centered instruction have generally developed within separate research traditions. Because these syntheses differ in eligibility criteria, comparison conditions, outcome definitions, study periods, and statistical procedures, their pooled estimates cannot be interpreted straightforwardly as comparative evidence regarding the relative effectiveness of pedagogical families. A common review protocol is needed to place these approaches within a consistent analytical framework.

Second, pedagogical labels may obscure the sources of effect heterogeneity. Interventions within the same family can differ substantially in guidance and scaffolding, interaction structure, duration, teacher preparation, technological support, and implementation fidelity. At the same time, interventions assigned to different families may share these characteristics. Consequently, estimating a pooled effect for each pedagogical family may identify *whether* effects differ but provide limited explanation of *why* they differ. A theoretically informative synthesis should therefore examine both pedagogical-family membership and design characteristics that operate across families.

Third, statistical detectability is not equivalent to educational importance. A statistically distinguishable pooled effect may nevertheless be small relative to the intervention's demands, uncertainty, implementation costs, or the magnitude of effects typically observed for comparable educational outcomes. Conversely, modest standardized effects may be practically meaningful in particular educational contexts. Interpretation should therefore consider effect magnitude, uncertainty, heterogeneity, prediction intervals, outcome type, and context rather than relying on statistical significance or universal effect-size thresholds alone (Hill et al., 2008; Kraft, 2020).

The proposed review addresses these limitations by synthesizing multiple learner-centered pedagogical families under common eligibility, outcome, comparator, and analytical rules while coding theoretically motivated characteristics of instructional design and implementation. Its distinctive purpose is therefore not simply to generate another average estimate of learner-centered teaching effectiveness, but to test whether variation in effectiveness is more informatively explained by pedagogical-family labels, cross-cutting design characteristics, contextual conditions, or combinations of these factors.

4. Review Questions

The review addresses five research questions.

RQ1. Overall effectiveness:
What are the average effects of learner-centered pedagogical approaches relative to (a) conventional or business-as-usual instruction and (b) alternative learner-centered approaches? Effects will be estimated separately by prespecified outcome domain rather than combined across conceptually distinct outcomes.

RQ2. Pedagogical families and design characteristics:
How does effectiveness vary across learner-centered pedagogical families, and to what extent are observed family differences associated with cross-cutting design characteristics such as instructional guidance, scaffolding, interaction and group structure, duration, technological support, and implementation fidelity?

RQ3. Moderators:

Which prespecified intervention and contextual characteristics are associated with variation in effect sizes? Primary moderators will include instructional guidance and scaffolding, pedagogical family, educational level, implementation fidelity, and outcome type. Subject area, intervention duration, group structure, teacher preparation, technological support, geographic context, and other sufficiently reported characteristics will be examined as secondary moderators.

RQ4. Robustness:
How robust are the principal conclusions to study design, risk of bias, treatment of statistically dependent effect sizes, inclusion of grey literature, influential studies, and alternative defensible analytical specifications?

RQ5. Reporting and small-study bias:
When the available evidence is sufficient for meaningful assessment, what evidence exists for small-study effects or selective dissemination, and how sensitive are the principal conclusions to plausible forms of missing evidence?

Moderator analyses will be interpreted as observational associations across studies rather than as causal estimates of moderator effects unless the underlying study designs permit stronger inference.

Table 1: Operational Taxonomy of Learner-Centered Pedagogical Families

Pedagogical family	Operational definition	Principal theoretical basis	Key cross-cutting characteristics to code
Collaborative/cooperative learning	Structured learning in which students work interdependently toward learning goals and individual participation or accountability is incorporated into the activity	Social interdependence theory	Interdependence; individual accountability; group size; interaction structure; teacher guidance
Problem-based learning	Learning organized around complex or authentic problems through which students identify learning needs, investigate relevant knowledge, and develop solutions with facilitative instructional support	Constructivism; cognitive apprenticeship; guided inquiry	Guidance/scaffolding; problem authenticity; collaboration; facilitation; duration
Inquiry-based learning	Learning in which students investigate questions or phenomena through evidence gathering,	Constructivism; scientific inquiry	Level and form of guidance; learner autonomy; evidence use; teacher prompts/feedback

Pedagogical family	Operational definition	Principal theoretical basis	Key cross-cutting characteristics to code
	analysis, reasoning, explanation, or knowledge construction, with varying degrees of instructional guidance		
Project-based learning	Extended learning organized around a complex question, problem, or challenge that results in the development of a substantive product, performance, or other artifact	Constructivist and experiential learning	Duration; learner responsibility; collaboration; scaffolding; authenticity; feedback
Flipped learning	Instruction in which some direct content delivery occurs before scheduled class activity and class time is intentionally used for active application, interaction, problem solving, or other learner-engaged activity	Active learning; cognitive engagement	Quality of pre-class instruction; in-class activity; accountability; technology; guidance
Dialogic teaching	Instruction structured around sustained questioning, explanation, reasoning, discussion, and uptake of learners' contributions to develop understanding collectively	Sociocultural and dialogic theory	Quality of dialogue; student contribution; questioning; uptake; interaction structure
Experiential/service learning	Learning organized around structured experience or community engagement that is intentionally connected to academic learning through reflection,	Experiential learning theory	Authenticity of experience; reflection; conceptual integration; duration; guidance

Pedagogical family	Operational definition	Principal theoretical basis	Key cross-cutting characteristics to code
	conceptualization, or application		
Personalized/adaptive learning	Instruction systematically adjusted to learner needs, prior performance, pace, interests, or learning progress, with substantive opportunities for learner engagement or individualized learning pathways	Mastery learning; adaptive learning	Basis of adaptation; learner agency; feedback; technology; pacing; teacher involvement

Taxonomy rule.

Pedagogical-family labels will not by themselves determine eligibility. An intervention must satisfy the operational definition of the relevant family and the review's overarching definition of learner-centered instruction. Hybrid interventions will be coded as hybrid where appropriate, and their component characteristics will be extracted separately rather than automatically forcing them into a single mutually exclusive category. Cross-cutting characteristics will therefore be available for analysis independently of pedagogical-family membership.

5. Methods

5.1 Search Strategy

The review will search major education, psychology, and multidisciplinary databases, including ERIC, Education Research Complete, PsycINFO, Scopus, Web of Science Core Collection, and ProQuest Dissertations & Theses Global. Backward reference searching of included studies and relevant systematic reviews will be supplemented by forward citation tracking.

The search will cover studies published from 2000 to the final search date. This period is intended to capture contemporary implementations of learner-centered pedagogies while limiting substantial historical variation in educational technologies, assessment practices, and instructional contexts. The implications of this temporal restriction will be acknowledged as a limitation.

Search strategies will combine four concept blocks: pedagogical approach, educational population, outcomes, and eligible intervention design. Terms for the eight pedagogical families will be supplemented by synonyms and related terminology identified during preliminary scoping. Search syntax will be adapted to the indexing conventions of each database. A complete executable search strategy for at least one database, together with all database-specific adaptations and search dates, will be provided in the supplementary materials.

The primary review will include English-language reports. Non-English studies will be included only where reliable screening, translation, and data extraction can be completed using qualified language support. Language eligibility will be established before formal screening and applied consistently throughout the review. The protocol and primary analytical decisions will be preregistered before screening and effect-size analysis.

5.2 Eligibility Criteria

Eligibility will follow the PICOS framework.

Participants.

Studies must involve learners enrolled in formal primary, secondary, post-secondary, or higher-education settings.

Interventions.

Eligible interventions must satisfy the review's overarching operational definition of learner-centered instruction and meet the prespecified definition of at least one pedagogical family: collaborative/cooperative, problem-based, inquiry-based, project-based, flipped, dialogic, experiential/service, or personalized/adaptive learning. Pedagogical labels alone will not establish eligibility.

Comparators.

Eligible studies must include one of two comparison types:

1. conventional or business-as-usual instruction; or
2. an alternative active or learner-centered instructional approach.

These comparator types will be analyzed separately because they represent substantively different estimands.Outcomes. Academic achievement and learning performance will constitute the primary outcome domain. Secondary outcomes will be grouped into conceptually distinct domains, including:

- higher-order thinking and transfer;
- engagement and motivation;
- self-regulated learning;
- collaborative or social learning outcomes; and
- satisfaction or related attitudinal outcomes.

Conceptually distinct outcome domains will not be pooled into a single global effect.
Study designs. Eligible designs will include individually randomized trials, cluster-randomized trials, and quasi-experimental studies with a comparison group and a defensible strategy for addressing baseline group differences.

Studies will be excluded if they are qualitative only, use uncontrolled single-group pre–post designs, lack student-level outcomes, provide insufficient information for effect-size estimation, duplicate previously reported samples, or cannot be classified reliably within the review taxonomy.

Where multiple publications report the same underlying sample, reports will be linked and treated as a single study to avoid double counting.

5.3 Screening, Classification, and Data Extraction

Screening will proceed in two stages: title/abstract screening followed by full-text eligibility assessment. Two reviewers will independently screen records using a piloted eligibility form. Disagreements will be resolved through discussion and, when necessary, adjudication by a third reviewer. Reasons for full-text exclusion will be recorded and reported in the PRISMA flow diagram.

A standardized extraction form will capture:

- study and publication characteristics;
- participant characteristics;
- educational level and subject area;
- study design and unit of assignment;
- comparator type;
- pedagogical family;
- intervention duration and intensity;
- instructional guidance and scaffolding;
- interaction and group structure;
- teacher preparation;
- technological support;
- implementation fidelity;
- outcome domain, measure, and timing; and
- statistical information required for effect-size estimation.

Pedagogical families will be coded using the prespecified operational taxonomy. Hybrid interventions will not automatically be forced into one exclusive category. Where appropriate, studies will be coded as hybrid, while their component design characteristics are extracted separately. Cross-cutting characteristics such as guidance, group structure, technology, and implementation fidelity will therefore be coded independently of pedagogical-family membership. Moderator variables will be organized into two levels. Primary moderators will be instructional guidance and scaffolding, pedagogical family, educational level, implementation fidelity, and outcome type. Secondary moderators will include subject area, intervention duration, group structure, teacher preparation, technological support, geographic context, and other characteristics with sufficient reporting and variation. Teacher preparation will be coded as present, absent, or unclear/not reported, rather than treating lack of reporting as evidence that preparation did not occur. Implementation fidelity will similarly distinguish observed fidelity from missing or unreported information.

5.4 Risk of Bias

Risk of bias will be assessed independently by two reviewers using design-appropriate tools. Randomized and cluster-randomized trials will be evaluated using the Cochrane Risk of Bias 2 (RoB 2) framework, including the appropriate extension for cluster-randomized designs where applicable. Non-randomized intervention studies will be evaluated using ROBINS-I, with the version used fixed at preregistration. Risk-of-bias judgments will be reported by domain rather than converted into a single numerical quality score. Disagreements will be resolved through consensus or third-reviewer adjudication. Risk of bias will inform interpretation and sensitivity analyses. Studies will not automatically be excluded because they receive an unfavorable overall judgment unless such an exclusion rule is specified prospectively.

5.5 Statistical Analysis

The principal continuous-outcome effect-size metric will be the standardized mean difference corrected for small-sample bias (Hedges' g). Where appropriate, effect sizes will be reconstructed from means and standard deviations, change scores, test statistics, or other compatible summary data using established procedures.

Effect sizes will be oriented so that positive values consistently indicate outcomes favoring the learner-centered intervention. Analyses will be conducted separately by outcome domain and comparator type. A random-effects framework will be used because true intervention effects are expected to vary across pedagogical designs, populations, and educational settings. Between-study heterogeneity will be summarized using the estimated between-study variance, I^2, and prediction intervals where appropriate. Because studies are expected to contribute multiple statistically dependent effect sizes, the primary dependency model will use a three-level meta-analytic structure, with effect sizes nested within studies. Robust variance estimation will be used as a sensitivity analysis where appropriate.

Cluster-randomized studies will be adjusted for clustering when the original analysis has not already accounted adequately for the clustered design.

Moderator analyses will proceed hierarchically. Primary meta-regressions will examine:

- instructional guidance and scaffolding;
- pedagogical family;
- educational level;
- implementation fidelity; and
- outcome type.

Secondary moderators will be examined only when the number and distribution of available studies provide adequate information for meaningful estimation. Multivariable meta-regression will be used cautiously because pedagogical characteristics may be correlated and moderator analyses are observational at the study level.

Where possible, the analysis will examine whether cross-cutting design characteristics explain variation that would otherwise be attributed to pedagogical-family membership. Meta-regression coefficients will therefore be interpreted as associations rather than causal effects.

Sensitivity analyses will examine:

- restriction to randomized studies;
- exclusion of studies at high risk of bias;
- influential or extreme effect sizes;
- inclusion versus exclusion of grey literature;
- alternative approaches to statistically dependent effects; and
- alternative defensible effect-size assumptions.

Small-study effects and possible selective dissemination will be examined only where the number of contributing studies is sufficient for meaningful assessment. Funnel plots and regression-based asymmetry tests will be selected according to the effect-size metric and interpreted cautiously because asymmetry may arise from mechanisms other than publication bias. Where appropriate, additional sensitivity analyses for missing evidence will be conducted rather than relying on a single statistical correction. Statistical significance will not be treated as synonymous with educational importance. Interpretation will consider effect magnitude, confidence intervals, prediction intervals, heterogeneity, outcome type, comparison condition, and educational context.

6. Planned Results and Reporting

No systematic search has yet been completed, and no empirical effect sizes are reported in this protocol.

The completed review will first report study identification and selection using a PRISMA flow diagram, followed by descriptive characteristics of the included studies, pedagogical families, outcomes, comparator types, educational settings, and risk-of-bias judgments. Primary meta-analytic results will be reported separately for:

1. learner-centered approaches versus conventional/business-as-usual instruction; and
2. learner-centered approaches versus alternative active or learner-centered instruction.

Within each comparison type, pooled effects will be reported separately by prespecified outcome domain. Each estimate will include the number of contributing studies and effect sizes, pooled effect size, confidence interval, heterogeneity estimates, and, where appropriate, prediction interval. Moderator analyses will first examine the prespecified primary moderators and then secondary moderators where the evidence base permits reliable estimation. Particular attention will be given to whether differences attributed to pedagogical families persist after accounting for cross-cutting design characteristics such as guidance, implementation fidelity, and instructional structure. Sensitivity analyses will report the robustness of principal conclusions to study design, risk of bias, effect-size dependency, grey-literature inclusion, influential studies, and alternative analytical assumptions. Assessment of small-study effects and possible missing evidence will be reported only when the number and characteristics of available studies permit meaningful interpretation. Confirmatory analyses specified in the preregistered protocol will be clearly distinguished from exploratory analyses developed after inspection of the evidence base. Unexpected or null moderator findings will be reported rather than selectively omitted. The central interpretive objective will be to determine whether variation in learner-centered teaching effectiveness is better explained by broad pedagogical-family labels, by cross-cutting instructional design and implementation characteristics, or by interactions between pedagogy and educational context.

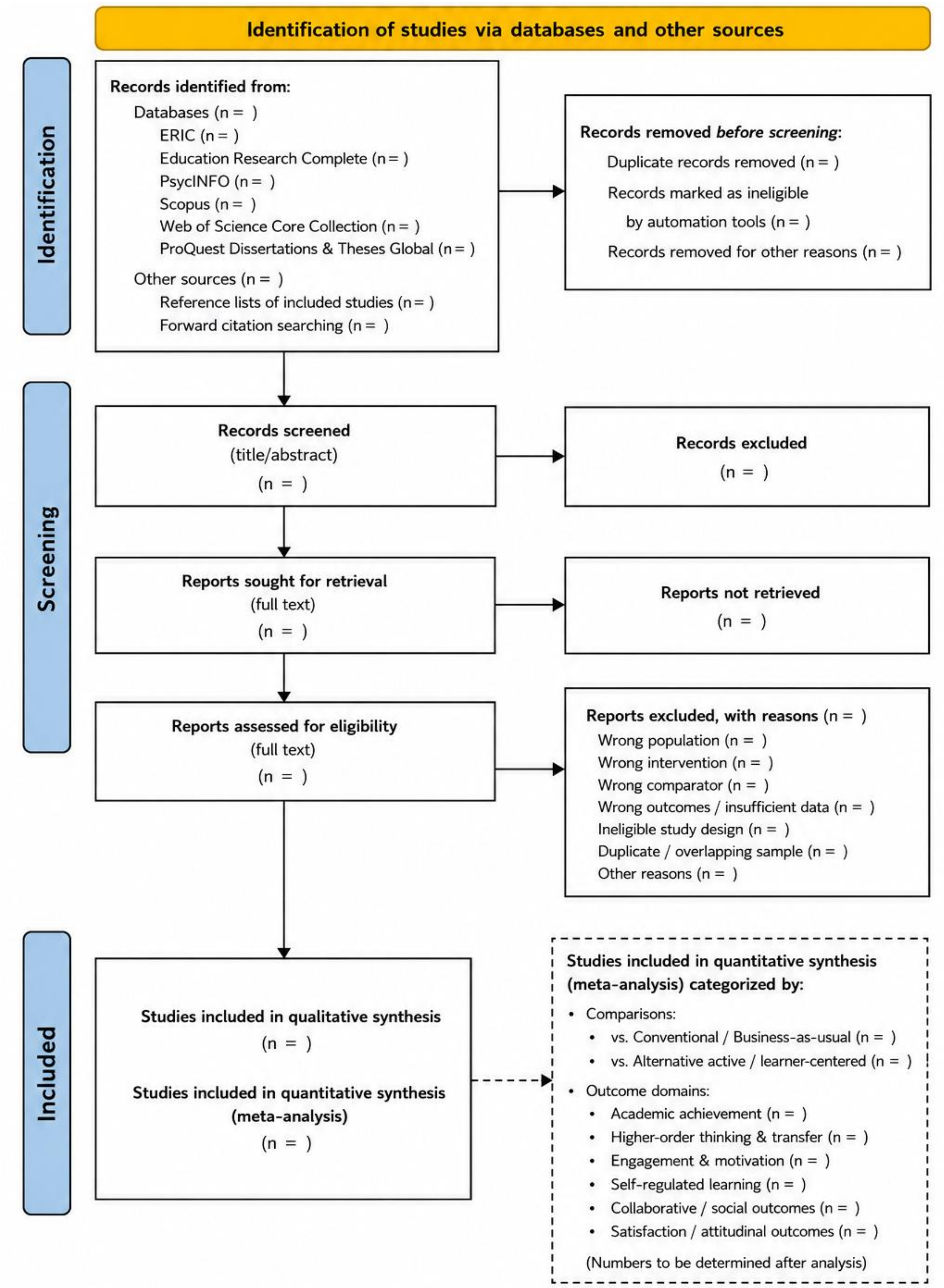

Figure 1. Planned PRISMA flow diagram for study identification, screening, eligibility, and inclusion.

7. Discussion

Because this paper presents a protocol, the discussion specifies the interpretive framework that will guide the completed review rather than reporting conclusions in advance. The central question will be whether variation in learner-centered teaching effects can be explained by theoretically meaningful differences in instructional design, implementation, and educational context. Particular attention will be given to guidance and scaffolding, interaction structure, implementation fidelity, educational level, subject area, and outcome type. These characteristics will be interpreted in relation to mechanisms such as cognitive engagement, positive interdependence, guided inquiry, and dialogic participation (Chi & Wylie, 2014; Johnson & Johnson, 2009; Lazonder & Harmsen, 2016).

Three principles will guide interpretation. First, statistical significance will be distinguished from educational importance. Pooled effects will therefore be interpreted alongside confidence intervals, prediction intervals, heterogeneity, outcome type, and comparison condition. Second, comparator choice will be treated as substantively important. Effects relative to conventional or business-as-usual instruction will be distinguished from effects relative to alternative active or learner-centered approaches because these contrasts answer different questions about effectiveness. Third, heterogeneity will be treated as theoretically informative rather than merely statistical noise. Where moderator relationships are supported, they may identify design and contextual characteristics associated with stronger or weaker effects. Where moderator effects are weak, inconsistent, or imprecise, this will also be informative and may indicate that broad pedagogical categories or currently reported study characteristics are insufficient to explain variation in effectiveness. Findings will be interpreted cautiously across educational levels, disciplines, and geographic settings, particularly where evidence is sparse. The discussion will therefore emphasize both the general patterns identified by the synthesis and the limits of their transferability.

8. Implications for Teaching

The review is intended to provide design-level guidance rather than rankings of teaching methodologies. If supported by the evidence, the findings may suggest that effective learner-centered teaching depends on how pedagogical approaches are designed and implemented rather than on the adoption of a particular label. Inquiry-, problem-, and project-based approaches, for example, may benefit from appropriately calibrated guidance and scaffolding rather than minimal instructional support. Collaborative learning may depend on structured interdependence, individual accountability, and meaningful interaction rather than group work alone. The review may also show that different pedagogical approaches are better suited to different educational outcomes. An approach that supports transfer, reasoning, or collaboration may not necessarily produce the strongest immediate achievement gains. Pedagogical effectiveness should therefore be evaluated in relation to the intended learning objective rather than through a single universal criterion. Implementation conditions including teacher preparation, intervention duration, technological support, and fidelity will also be considered part of the explanatory structure of effectiveness. The practical implication is that adoption of learner-centered teaching should focus not only on *what* methodology is selected but on *how* it is designed, supported, and adapted to learners and educational contexts.

9. Limitations

Several limitations should be acknowledged in advance; first, this manuscript is a systematic-review and meta-analysis protocol, and no conclusions about learner-centered teaching effectiveness can be drawn until the search, screening, extraction, and analyses are completed. Second, the proposed taxonomy necessarily simplifies a heterogeneous literature. Pedagogical families frequently overlap, and hybrid interventions may combine several design characteristics. Although component-level coding will reduce the risk of misclassification, some conceptual ambiguity will remain. Third, variation in outcome measures, intervention duration, implementation intensity, study design, and educational context may limit the comparability of effect sizes even when standardized metrics are used. Fourth, non-randomized studies may remain vulnerable to residual confounding despite structured risk-of-bias assessment and sensitivity analyses. Fifth, moderator analyses may have limited statistical power, particularly for characteristics such as implementation fidelity, teacher preparation, geographic context, or technological support that are inconsistently reported. Sixth, reporting of important intervention characteristics may itself be selective. An absence of information about guidance, teacher preparation, or fidelity cannot necessarily be interpreted as absence of the characteristic. Finally, language restrictions and incomplete retrieval of unpublished or inaccessible evidence may contribute to dissemination bias. These limitations will be incorporated explicitly into the interpretation of findings rather than treated as problems that statistical adjustment can eliminate completely.

10. Research Agenda

The completed review should provide a basis for a more mechanism-focused research agenda. A first priority is experimental research on instructional mechanisms. If characteristics such as guidance, interaction structure, or dialogue quality are consistently associated with stronger outcomes, future studies should manipulate these characteristics directly rather than relying primarily on comparisons between broad pedagogical labels. A second priority is stronger implementation research. Primary studies should report teacher preparation, intervention fidelity, duration, adaptation, and contextual conditions more systematically so that their contribution to educational effects can be examined reliably. A third priority is greater attention to learner-level heterogeneity. Individual-participant-data meta-analysis could help investigate whether effects differ according to prior achievement, age, motivation, educational disadvantage, or other learner characteristics that cannot be examined adequately through study-level meta-regression. Future synthesis may also use network meta-analysis where the evidence forms a sufficiently connected and comparable network of interventions. In rapidly developing areas such as personalized, adaptive, and technology-supported learning, living systematic reviews may provide a useful mechanism for updating conclusions as the evidence base changes.

11. Conclusion

A substantial literature has examined whether learner-centered teaching improves educational outcomes, but pooled average effects alone offer limited guidance for educational decision-making. This protocol proposes a systematic and theory-informed synthesis of major learner-centered pedagogical approaches while giving particular attention to differences in instructional design, implementation quality, comparison conditions, educational settings, and outcome domains. Its central contribution is to shift the analytical focus from pedagogical labels to pedagogical conditions. Rather than seeking a universally superior teaching methodology, the review will examine whether variation in effectiveness is associated with characteristics such as instructional guidance, interaction structure, implementation fidelity, teacher preparation, and educational context. By distinguishing pedagogical families from the mechanisms and conditions that operate within and across them, the completed review has the potential to provide a more useful basis for research, teaching, and teacher education. The central question is therefore not simply whether learner-centered pedagogy works, but when, for whom, for which outcomes, and under what instructional conditions it is most likely to be effective.

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