Is critical thinking a domain-general skill, or is it a transferable domain-specific skill?

Critical thinking is best characterized as a conditionally transferable skill that functions as domain-specific for novices but becomes increasingly domain-general with growing expertise and explicit instruction in underlying reasoning strategies.

Abstract

This systematic review of 11 sources examining the domain-generality of critical thinking reveals that the skill is neither purely domain-general nor strictly domain-specific, but rather conditionally transferable depending on learner expertise, instructional approach, and domain characteristics. Meta-analytic evidence finds essentially zero far transfer when controlling for placebo effects and publication bias in cognitive training contexts , and studies of novice learners consistently show that students who think critically in one subject do not necessarily do so in others . However, near-experts and individuals with higher cognitive ability demonstrate successful cross-domain transfer , and explicit critical thinking instruction produces large effect sizes for transfer to novel problems (g=1.91 for decision process, g=1.67 for decision outcomes) . The critical distinction appears to be between spontaneous transfer, which rarely occurs, and instructed transfer, which can succeed when teaching explicitly emphasizes underlying logical structures and provides domain-specific practice opportunities .

The evidence supports a model in which critical thinking comprises both domain-general metacognitive strategies and domain-specific applications. For novice learners in educational settings, critical thinking functions as predominantly domain-specific, requiring explicit instruction within each discipline . For individuals with substantial domain expertise, critical thinking strategies can transfer across dissimilar domains when instruction is explicit rather than implicit . Transfer also depends on target domain characteristics—succeeding for domains amenable to logical analysis (statistical reasoning) but failing for domains influenced by personal values (paranormal beliefs) . These findings suggest that developing transferable critical thinking requires building sufficient domain knowledge to recognize structural similarities across contexts, combined with explicit instruction in generalizable reasoning strategies.

Paper search

We performed a semantic search using the query ”Is critical thinking a domain-general skill, or is it a transferable domain-specific skill?” across over 138 million academic papers from the Elicit search engine, which includes all of Semantic Scholar and OpenAlex.

We retrieved the 500 papers most relevant to the query.

Screening

We screened in sources based on their abstracts that met these criteria:

- **Cross-Domain or Transfer Investigation**: Does this study empirically investigate critical thinking skills across multiple domains/disciplines OR examine the transfer of critical thinking skills from one context to another?
- **Expert-Novice Comparison**: Does this study compare critical thinking performance between domain experts and novices, OR does it investigate cross-domain/transfer aspects of critical thinking through other means (intervention studies, cross-domain assessments, etc.)?
- **Appropriate Study Design**: Is this study an experimental, quasi-experimental, correlational, observational study, systematic review, or meta-analysis (i.e., NOT a case study or single-subject design)?

- **Empirical Investigation**: Does this study include empirical investigation with data collection and analysis (i.e., is it NOT merely a theoretical description or definition of critical thinking)?
- **Addresses Transferability Question**: Does this study include comparison or transfer measures that can inform the domain-general vs. domain-specific nature of critical thinking (i.e., does it go beyond examining critical thinking solely within a single domain without comparison)?

We considered all screening questions together and made a holistic judgement about whether to screen in each paper.

Data extraction

We asked a large language model to extract each data column below from each paper. We gave the model the extraction instructions shown below for each column.

- **Critical Thinking Measures**:

  Extract details about how critical thinking was measured including:

- Specific critical thinking skills/abilities tested (e.g., argumentation, evaluation, inference, scientific reasoning, statistical reasoning)
- Assessment instruments used (e.g., Cornell Critical Thinking Test, domain-specific tasks)
- Whether measures were domain-general or domain-specific
- Scoring methods and criteria

- **Domain Characteristics**:

  Extract information about the domains studied including:

- Specific domains involved (e.g., psychology, statistics, physics, business, electronics)
- Degree of similarity/dissimilarity between domains
- Whether domains were within same field (near transfer) or different fields (far transfer)
- Context characteristics that might affect transfer (e.g., surface features, deep structure)

- **Participant Expertise**:

  Extract participant characteristics related to domain knowledge:

- Level of expertise in each domain (expert, near-expert, novice, no experience)
- Specific training or education background
- Years of experience in relevant domains
- Sample size for each expertise group

- **Transfer Design**:

  Extract methodological details about how transfer was tested:

- Study design (within-subjects, between-subjects, cross-sectional, experimental)
- Whether participants worked in familiar vs unfamiliar domains
- Sequence of tasks (if relevant)
- Control conditions or comparison groups
- Training interventions (if any)

- **Transfer Evidence**:

  Extract findings about whether and how critical thinking transferred:

- Evidence for successful transfer (performance similarities across domains)
- Evidence against transfer (performance differences, context-dependency)
- Specific transfer measures or indicators used
- Effect sizes or quantitative measures of transfer
- Conditions under which transfer did/did not occur

- **Moderating Factors**:

  Extract factors that influenced transfer success:

- Role of domain familiarity or expertise
- Impact of surface similarity vs deep structure
- Effects of instructional approach (explicit teaching, practice, reflection)
- Individual differences (intelligence, prior experience, beliefs)
- Contextual factors that facilitated or hindered transfer

- **Key Conclusions**:

  Extract the study's main conclusions about critical thinking transfer:

- Authors' interpretation of whether CT is domain-general or domain-specific
- Evidence cited for domain-generality vs domain-specificity
- Limitations or boundary conditions identified
- Implications for transfer theory
- Recommendations for education or training

Characteristics of Included Studies

This review synthesizes findings from 11 sources examining whether critical thinking (CT) constitutes a domain-general skill or represents transferable domain-specific competencies. The included studies span multiple domains and employ diverse methodologies to assess transfer.

Study	Full Text Retrieved?	Study Type	Domains Studied	Participants	CT Measures
Anthony M. Harrison et al., 2004	No	Primary study	Psychology, Chemistry, Political Science	Near-experts and novices	Experimental design, hypothesis generation, data evaluation
Adrienne Y. Lee et al., 1991	No	Primary study	Computer debugging, Electronic troubleshooting	Experts, novices, no experience	Diagnostic skill tasks
A. Zohar et al., 1994	No	Primary study	Unspecified isomorphous domains	Community college students (novices)	Control of variables strategy, frequency of valid inferences

Study	Full Text Retrieved?	Study Type	Domains Studied	Participants	CT Measures
F. Gobet et al., 2018	No	Meta-meta-analysis	Chess, music, video games, working memory, brain training	Not specified	Near and far transfer measures
W. Sá et al., 1999	Yes	Primary study	Height judgment (perceptual), Syllogistic reasoning (verbal)	University students, N=124	Belief-bias indices, AET, syllogistic reasoning
A. Helsdingen et al., 2010	Yes	Field experiments	Military tactical command (ground-to-air defense, naval warfare)	Officers with 1-17 years experience, N=16 per study	C2PMT, decision process and outcome measures
Christopher P. Dwyer et al., 2015	No	Primary study	Business	Business experts, novices, and non-experts	General CT and business-specific CT
Gregory Schraw et al., 1998	No	Primary study	Fluid and crystallized ability	College students	Monitoring skills across 8 tests
D. Tiruneh et al., 2019	Yes	Experimental	Chemistry, Geology, Physics (E&M focus)	First-year university students, N=111	CTEM (near-transfer), CTSR (far-transfer)
J. Royalty et al., 1995	No	Primary study	Statistical reasoning, Paranormal beliefs	University undergraduates, N=97 and N=109	Cornell Critical Thinking Test
Thomas Nygren et al., 2019	Yes	Mixed methods	History, Physics, Mathematics, Swedish	School year nine students, N=76	National test questions, subject-specific CT categories

The included studies represent substantial methodological diversity. Four studies provided full text access, enabling detailed analysis of methods and results. The research spans educational contexts from secondary school through professional military training, examining both cognitive and applied domains. Notably, Gobet et al. (2018) provides a second-order meta-analysis synthesizing evidence across multiple training domains , while other studies employ experimental , correlational , and cross-sectional designs .

Transfer Evidence

The studies provide mixed but interpretable evidence regarding critical thinking transfer across domains.

Evidence Supporting Domain-General Transfer

Study	Transfer Type	Key Finding	Effect Size/Measure	Conditions
Harrison et al., 2004	Far transfer	Near-experts applied scientific reasoning across dissimilar domains	Not reported	Graduate-level expertise
Sá et al., 1999	Far transfer	Moderate correlations between belief-bias indices across verbal and perceptual tasks	Significant correlations	Cognitive ability as moderator
Schraw et al., 1998	Cross-domain	Monitoring scores correlated across multiple domains	Not reported	Both fluid and crystallized tasks
Helsdingen et al., 2010	Far transfer	CT instruction improved decision outcomes and processes on untrained problems	Decision process g=1.91 [0.98, 2.83]; Decision outcomes g=1.67 [0.76, 2.58]	Novel, untrained tasks with explicit CT instruction
Tiruneh et al., 2019	Far transfer	Infusion condition outperformed control on far-transfer CT test	Large effect sizes reported	Explicit CT instruction within domain-specific activities
Royalty et al., 1995	Partial transfer	Cornell CT scores predicted statistical reasoning	Significant proportion of variance explained	Transfer to statistical reasoning but not paranormal beliefs

Several studies provide evidence that critical thinking skills can transfer across domains under specific conditions. Sá et al. (1999) demonstrated that the ability to separate prior knowledge from judgments was linked across tasks differing greatly in cognitive requirements, explicitly falsifying an extreme form of domain specificity . Similarly, Schraw et al. (1998) found that monitoring scores were correlated across multiple domains, supporting domain-general theories of metacognition .

The most robust quantitative evidence comes from Helsdingen et al. (2010), who found large effect sizes for transfer of critical thinking instruction to untrained military decision-making scenarios (g=1.91 for decision process, g=1.67 for decision outcomes) . Notably, this transfer occurred specifically in novel problems rather than scenarios resembling training .

Evidence Supporting Domain-Specificity

Study	Transfer Type	Key Finding	Conditions for Failure
Gobet et al., 2018	Far transfer	Effect size essentially zero for far transfer when controlling for placebo and publication bias	Cognitive training domains (chess, music, video games, WM training)
Zohar et al., 1994	Cross-domain	Strategy transferred fully within domain but less well to isomorphous problem in different domain	Transfer to different domain
Nygren et al., 2019	Cross-subject	Students performing well in CT in one subject did not necessarily perform well in others	School subjects (history, physics, mathematics, Swedish)
Harrison et al., 2004	Novice transfer	Novices had difficulty with transfer while near-experts succeeded	Lack of expertise
Royalty et al., 1995	Belief domain	No significant relationship between CT scores and paranormal beliefs	Domains influenced by personal values
Helsdingen et al., 2010	Near transfer	No benefit in posttest scenario resembling training	Routine, familiar tasks

The meta-meta-analysis by Gobet et al. (2018) provides the broadest evidence against far transfer, finding that when placebo effects and publication biases are controlled, the overall effect size for far transfer across cognitive training domains is essentially zero . This finding supports theories emphasizing domain-specific knowledge and suggests that lack of skill generalization is "an invariant of human cognition" .

Nygren et al. (2019) found particularly striking evidence for domain-specificity in educational contexts, demonstrating that students who think critically in one school subject do not necessarily do so in others . Furthermore, the same formulations of critical thinking in different subjects may mean different things when translated into assessments .

Moderating Factors Affecting Transfer

The heterogeneity in transfer findings can be partially explained by several moderating factors identified across studies.

Expertise Level

Expertise emerges as a critical moderator of transfer success. Harrison et al. (2004) found that near-experts could apply general scientific reasoning skills across dissimilar domains, while novices had difficulty with transfer . This pattern suggests that domain-general transfer may require sufficient foundational knowledge to recognize deep structural similarities across problems.

Instructional Approach

Study	Instructional Approach	Transfer Outcome
Tiruneh et al., 2019	Infusion (explicit CT teaching within domain)	Superior far-transfer performance
Tiruneh et al., 2019	Immersion (implicit CT through domain activities)	No significant difference from control on far-transfer
Helsdingen et al., 2010	Explicit CT instruction with reflection	Large effect sizes on transfer to novel problems
Lee et al., 1991	Extensive practice with specific strategy training	Proposed to enable transfer of diagnostic skills
Zohar et al., 1994	Class-like didactic intervention	Improved frequency of valid inferences

The distinction between explicit and implicit instruction appears crucial. Tiruneh et al. (2019) directly compared instructional approaches and found that the Infusion condition—where CT skills were explicitly taught within domain-specific activities—significantly outperformed both Immersion and control conditions on far-transfer tests . However, no significant difference emerged between conditions on near-transfer tests , suggesting explicit instruction specifically benefits cross-domain application.

Zohar et al. (1994) proposed that teaching should focus explicitly on recognition of underlying logical structures to enhance transfer . Similarly, Lee et al. (1991) identified four critical components for transfer: examining a single level of skill, domain-general knowledge transfer, extensive practice, and specific training on strategies .

Surface Similarity Versus Deep Structure

Studies consistently find that transfer depends on the relationship between source and target domains. Zohar et al. (1994) found full transfer to new problems within the same domain but reduced transfer to isomorphous problems in different domains , suggesting that surface features facilitate recognition of when to apply learned strategies. Nygren et al. (2019) noted that the same formulations of critical thinking can mean different things across subjects , indicating that surface-level similarities may not translate to deep structural understanding.

Individual Differences

Cognitive ability moderates transfer success. Sá et al. (1999) found that participants high in cognitive ability were more flexible in using prior knowledge appropriately—projecting relationships when useful but resisting inappropriate projection . The actively open-minded thinking composite correlated with reduced belief bias in syllogistic reasoning . Zohar et al. (1994) found that learning environments had larger effects on ”slower learners” than ”faster learners” .

Synthesis

The apparent contradiction between studies finding transfer and those finding domain-specificity can be substantially reconciled through systematic analysis of study characteristics.

Population and Expertise Distinctions

The most consistent pattern across studies is that expertise level determines transfer success. Near-experts and individuals with higher cognitive ability successfully transfer critical thinking skills across domains , while novices consistently fail to demonstrate transfer . This suggests that critical thinking is not inherently domain-general or domain-specific but rather that its transferability depends on the learner's capacity to recognize structural similarities across contexts. Graduate-level near-experts in Harrison et al. (2004) succeeded at cross-domain transfer , while community college students in Zohar et al. (1994) showed reduced transfer to different domains , and ninth-grade students in Nygren et al. (2019) showed minimal cross-subject transfer .

Study Quality and Design Considerations

The meta-meta-analysis by Gobet et al. (2018) provides the highest-level evidence, incorporating controls for placebo effects and publication bias . Its finding of essentially zero far transfer should be weighted heavily. However, this analysis focused on cognitive training programs (chess, video games, working memory training) rather than explicit critical thinking instruction . Studies specifically examining critical thinking instruction—particularly Helsdingen et al. (2010) and Tiruneh et al. (2019)—found positive transfer effects with large effect sizes when instruction was explicit .

Mechanistic Explanation

The divergent findings can be explained by distinguishing between two mechanisms: spontaneous transfer versus instructed transfer. Spontaneous transfer—applying learned skills without prompting—appears minimal, consistent with Gobet et al.'s findings . However, when instruction explicitly teaches CT skills, emphasizes underlying logical structures , and provides practice in recognizing when skills apply , transfer to novel domains becomes possible. Helsdingen et al. (2010) found that CT instruction provided ”a better strategy for approaching new problems” , suggesting transfer operates through enhanced metacognitive awareness rather than automatic skill application.

Boundary Conditions for Transfer

Based on the synthesis of findings, transfer of critical thinking skills appears to occur under specific conditions:

1. **Expertise** : Individuals with domain expertise or high cognitive ability can transfer CT skills; novices cannot
2. **Instruction type** : Explicit instruction in CT strategies, combined with domain-specific practice, enables far transfer; implicit approaches do not
3. **Task novelty** : Transfer benefits appear specifically on novel problems rather than routine tasks resembling training
4. **Domain characteristics** : Transfer to domains requiring logical reasoning (statistical reasoning) succeeds more readily than domains involving belief systems or values (paranormal beliefs)

The finding that CT skills transfer to statistical reasoning but not paranormal beliefs suggests that transfer depends on whether the target domain permits rational analysis. Royalty et al. (1995) noted that evaluation of paranormal claims may be characterized by ”axiological” approaches where personal values override critical analysis .

Conclusions by Context

For educational contexts involving novice learners, the evidence suggests critical thinking is predominantly domain-specific. Students require explicit instruction within each domain to develop subject-appropriate CT skills . General

CT training without domain-specific application is unlikely to produce meaningful transfer .

For professional contexts involving individuals with substantial domain knowledge, critical thinking shows greater transferability. The military training studies demonstrate that experienced professionals can transfer CT strategies to novel tactical scenarios when given appropriate instruction . Similarly, graduate-level scientists can apply scientific reasoning across dissimilar domains .

The evidence supports a model where critical thinking comprises both domain-general metacognitive strategies and domain-specific applications. The strategies can potentially transfer, but successful application requires sufficient domain knowledge to recognize when and how to apply them—a capacity that develops with expertise and can be enhanced through explicit instruction emphasizing underlying logical structures .

References

A. Helsdingen, K. Bosch, T. Gog, and J. Merriënboer. "The Effects of Critical Thinking Instruction on Training Complex Decision Making." *Hum. Factors*, 2010.

A. Zohar. "Teaching a Thinking Strategy: Transfer Across Domains and Self Learning Versus Class-like Setting," 1994.

Adrienne Y. Lee. "TRANSFER OF GENERAL SKILLS ACROSS DOMAINS: COMPUTER PROGRAM DEBUGGING AND TROUBLESHOOTING OF CIRCUITS." *SGCH*, 1991.

Anthony M. Harrison, and C. Schunn. "The Transfer of Logically General Scientific Reasoning Skills," 2004.

Christopher P. Dwyer, Amy E. Boswell, and M. Elliott. "An Evaluation of Critical Thinking Competencies in Business Settings," 2015.

D. Tiruneh. "Transfer of Critical Thinking Skills Across Domains: Implicit or Explicit Instructional Approaches?" *Proceedings of the 2019 AERA Annual Meeting*, 2019.

F. Gobet. "The 35th Cognitive Psychology Section Annual Conference." *The Cognitive Psychology Bulletin*, 2018.

Gregory Schraw, and John L. Nietfeld. "A Further Test of the General Monitoring Skill Hypothesis." 1998.

J. Royalty. "The Generalizability of Critical Thinking: Paranormal Beliefs Versus Statistical Reasoning," 1995.

Thomas Nygren, Jesper Haglund, Christopher Robin Samuelsson, Åsa Af Geijerstam, and J. Prytz. "Critical Thinking in National Tests Across Four Subjects in Swedish Compulsory School," 2019.

W. Sá, R. F. West, and K. Stanovich. "The Domain Specificity and Generality of Belief Bias: Searching for a Generalizable Critical Thinking Skill." 1999.