



Healing from Doubt or Hardening Beliefs? The Impact of Cartesian Method Pedagogy on Student Epistemic Beliefs and Academic Self-Efficacy

Stanley Tweyman

Department of Philosophy, York University

DOI: 10.26417/bggkqy20

Abstract

This study investigates the pedagogical impact of René Descartes' method of analysis on higher education students. The central inquiry is whether teaching this method fosters robust, self-reliant inquiry or inadvertently promotes epistemic rigidity. A quasi-experimental, pre-test/post-test design was employed with 180 undergraduate philosophy students across three groups: a Cartesian Method group, a Collaborative Inquiry group, and a Control group. Over an 8-week intervention, we measured changes in epistemic beliefs (certainty, source, justification) and academic self-efficacy using validated scales. Analysis of Covariance (ANCOVA) revealed that the Cartesian Method group showed significant gains in academic self-efficacy for logical argumentation. However, this group also developed stronger beliefs in knowledge certainty and individual intuition as a source of truth, alongside a diminished appreciation for knowledge derived from collaboration or empirical evidence. These findings suggest that while Cartesian pedagogy can bolster confidence in individual reasoning, it risks fostering absolutist epistemic stances, highlighting a critical trade-off for educators designing critical thinking curricula.

Keywords: Cartesian Method, Epistemic Beliefs, Academic Self-Efficacy, Philosophy Pedagogy, Critical Thinking, Descartes, Higher Education, Individualism, Collaborative Learning

1. Introduction

René Descartes' *Meditations on First Philosophy* is a foundational text in the Western intellectual tradition, chronicling a profound journey from the abyss of radical doubt to the bedrock of perceived certainty. This journey is not merely a philosophical exercise but can be interpreted as a process of psychological "healing." Descartes

confronts the "trauma" of realizing his foundational beliefs may be false and employs a rigorous, individualistic method—what he terms 'analysis'—to reconstruct knowledge upon the indubitable foundation of "clear and distinct" ideas (Descartes, 1967). This method, emphasizing solitary introspection, systematic doubt, intuition, and deduction, positions the individual rational mind as the ultimate arbiter of truth. As I have argued elsewhere, this process promises a transition from the paralysis of uncertainty to the security of indubitable, self-grounded knowledge (Tweyman, 2024).

While the philosophical implications of Descartes' project are endlessly debated, its potential as a pedagogical model for cultivating critical thinking and intellectual self-reliance has received surprisingly little empirical attention. In a contemporary educational landscape characterized by information overload, susceptibility to misinformation, and the erosion of reasoned discourse, the appeal of a method promising certainty through individual reason is potent. Could teaching students to apply the Cartesian method—to systematically doubt, dissect arguments, and seek intuitive clarity—provide a form of intellectual "healing," bolstering their confidence in their own cognitive abilities? Or does this intense focus on solitary intuition and the pursuit of absolute certainty risk fostering epistemic rigidity, hindering collaboration, and devaluing other valid ways of knowing? This study conceptualizes this tension as a "double-edged sword," where the same pedagogical tool can produce both desirable and undesirable cognitive outcomes (see Figure 1).

Figure 1: The Double-Edged Sword of Cartesian Pedagogy

Pedagogical Intervention: The Cartesian Method of Analysis	
The "Healing" Edge (Positive Outcomes) Fosters cognitive strengthening and intellectual self-reliance. - Increased Academic Self-Efficacy - Enhanced Analytical & Argumentative Skills - Confidence in Individual Reason - Systematic Approach to Problems	The "Hardening" Edge (Negative Outcomes) Promotes epistemic closure and cognitive rigidity. - Belief in Absolute Certainty - Over-Reliance on Individual Intuition - Devaluation of Collaborative Knowledge - Dismissal of Empirical Justification

Source: Conceptual model developed by the author.

This study moves beyond philosophical interpretation to empirically investigate this dichotomy. We explore how a pedagogy centered on the Cartesian method influences

university students' epistemic beliefs—their underlying assumptions about the nature, source, certainty, and justification of knowledge (Schommer, 1990; Hofer & Pintrich, 1997)—and their academic self-efficacy, particularly concerning tasks of logical reasoning and argumentation (Bandura, 1997). Epistemic beliefs are crucial developmental constructs, profoundly shaping how students approach learning, evaluate evidence, and engage with complex problems (Greene et al., 2018). Similarly, academic self-efficacy is a powerful motivator influencing effort, persistence, and ultimate achievement (Zimmerman, 2000; Mega et al., 2014).

The Cartesian method, with its emphasis on radical doubt followed by the attainment of certainty through individual intuition, presents a unique pedagogical intervention. On one hand, it could enhance students' confidence in their ability to analyze arguments, thus boosting academic self-efficacy—a form of "healing" from intellectual uncertainty. On the other hand, its focus on innate ideas and indubitable certainty might reinforce naive epistemic beliefs that knowledge is absolute and personally attainable without recourse to external evidence or collaborative validation, a view characteristic of earlier stages of epistemic development (Perry, 1970). This potential tension between fostering self-reliance and fostering epistemic absolutism is the central focus of our investigation.

Therefore, this study employs a quasi-experimental design comparing three pedagogical approaches within an undergraduate philosophy course: one emphasizing the Cartesian method of analysis, one emphasizing collaborative philosophical inquiry, and a control group focused on historical context. We hypothesize that the Cartesian method group will show greater gains in academic self-efficacy related to argumentation but will also exhibit a strengthening of epistemic beliefs favoring certainty and individual intuition, potentially at the expense of appreciating collaborative or empirical justification. By empirically examining these outcomes, we aim to provide nuanced insights into the cognitive consequences of adopting a Cartesian pedagogical framework, informing educators who seek to cultivate both critical thinking and epistemic maturity.

2. Literature Review and Hypothesis Development

2.1. Descartes' Method of Analysis: A Framework for Pedagogy

Descartes' *Meditations* begins with a profound sense of epistemic crisis. The meditator confronts the unsettling realization that beliefs acquired since youth may be fundamentally flawed. This state of radical doubt can be framed as a form of intellectual trauma—a shattering of one's perceived reality (Tweyman, 2024). The path to recovery, or "healing," lies in the systematic application of the method of analysis. This method, as Descartes (1967) explains, aims not merely to prove known truths but to discover foundational principles. It involves: 1) Radical Doubt: Withholding assent from anything not perceived with absolute certainty. 2) Reduction/Analysis: Breaking down complex problems into their simplest intuitive components. 3) Intuition: The direct, non-inferential grasp of "clear and distinct"

ideas by the attentive mind (e.g., the *Cogito*). 4) Deduction: Moving step-by-step from intuitively grasped truths to logically necessary conclusions. 5) Enumeration/Review: Ensuring completeness and coherence.

Translating this into a pedagogical approach involves training students to emulate the meditator's journey. Instruction would emphasize rigorous questioning of assumptions, breaking arguments into logical steps, prioritizing internal coherence and intuitive clarity, and building knowledge deductively from self-evident starting points. Such a pedagogy aligns with modern goals of critical thinking education, which emphasize analytical skills and reasoned judgment (Franco & Almeida, 2023). However, its intense individualism stands in contrast to more socio-constructivist approaches that are increasingly prevalent in higher education (Tirca & Stanciu, 2024).

2.2. The Role of Academic Self-Efficacy

Academic self-efficacy refers to students' beliefs in their capabilities to organize and execute the courses of action required to manage academic tasks (Bandura, 1997). It is a domain-specific construct; a student may have high self-efficacy for writing essays but low self-efficacy for statistical analysis. Bandura's social cognitive theory posits that self-efficacy beliefs are formed through four primary sources: mastery experiences, vicarious experiences, social persuasion, and physiological states. Of these, mastery experiences—direct, successful experiences with a task—are the most influential (Usher & Pajares, 2008). Successfully navigating the demanding process of Cartesian doubt and analysis could provide powerful mastery experiences. By identifying flaws in complex arguments, achieving moments of intuitive clarity (the "aha!" moment of the *Cogito*), and constructing deductive chains, students may develop greater confidence in their abilities related to argumentation, analysis, and independent problem-solving. This enhanced confidence can be seen as the pedagogical equivalent of Descartes' own "healing" from the paralysis of doubt.

H1: Students in the Cartesian Method pedagogy group will show significantly greater increases in academic self-efficacy related to logical argumentation compared to students in the Collaborative Inquiry and Control groups.

2.3. The Development of Epistemic Beliefs

While potentially boosting confidence, the Cartesian method's core tenets might interact less favorably with the development of sophisticated epistemic beliefs. Epistemic beliefs are an individual's theories about knowledge and knowing. Early models, like Perry's (1970) scheme, proposed a developmental trajectory from dualism (knowledge is certain, absolute, and handed down by authority) through multiplicity and relativism, to a final stage of commitment within relativism (knowledge is contextual, constructed, and requires reasoned justification). More recent multi-dimensional models, such as those by Schommer (1990) and Hofer and

Pintrich (1997), view epistemic beliefs as a system of more-or-less independent beliefs about the certainty, simplicity, source, and justification of knowledge.

Research consistently shows that more sophisticated epistemic beliefs (i.e., viewing knowledge as complex, tentative, and justified by evidence) are linked to better learning strategies, deeper comprehension, and stronger critical thinking skills (Greene et al., 2018; Leden et al., 2022). Educational interventions are therefore increasingly designed to foster this epistemic development. The Cartesian emphasis on (a) **Certainty** (seeking indubitable foundations), (b) **Individual Intuition** (prioritizing the solitary mind's grasp of innate ideas), and (c) **Deduction over Empiricism** (favoring logical chains over sensory experience) could inadvertently reinforce or even cause regression towards more absolutist epistemic stances. A focus on certainty might hinder the appreciation of probabilistic reasoning or the provisional nature of scientific knowledge. A focus on individual intuition might devalue knowledge gained through collaboration, testimony, or empirical investigation (Elby & Hammer, 2010). This leads to our subsequent hypotheses.

H2: Students in the Cartesian Method pedagogy group will show significantly greater increases in epistemic beliefs favoring knowledge certainty compared to students in the Collaborative Inquiry and Control groups.

H3: Students in the Cartesian Method pedagogy group will show significantly greater increases in epistemic beliefs favoring individual intuition as the source of knowledge compared to students in the Collaborative Inquiry and Control groups.

H4: Students in the Cartesian Method pedagogy group will show significantly smaller increases (or even decreases) in epistemic beliefs favoring collaborative or empirical justification of knowledge compared to students in the Collaborative Inquiry and Control groups.

2.4. Collaborative Inquiry as a Pedagogical Counterpoint

In contrast to the individualistic Cartesian approach, collaborative inquiry emphasizes knowledge construction as a social process. Drawing on Vygotskian and constructivist learning theories, this pedagogy involves students working together to analyze problems, challenge assumptions, build arguments, and co-create understanding (Hmelo-Silver et al., 2007). In a philosophy context, this might involve Socratic dialogue, group analysis of texts, or peer critique of arguments. This approach implicitly models knowledge as socially negotiated and justified through shared reasoning and evidence. It is designed to foster epistemic beliefs that value multiple perspectives and social justification (Muis & Duffy, 2013). By including a collaborative inquiry group, we create a direct comparison between a pedagogy that models knowledge as an individual pursuit of certainty and one that models it as a social construction of reasoned agreement.

3. Methodology

3.1. Research Design and Participants

This study employed a quasi-experimental, pre-test/post-test design with three comparison groups. The study was conducted over an 8-week period within a multi-section undergraduate "Introduction to Philosophy" course at a large, multicultural Canadian university. Three course sections, taught by different instructors who received specific training and detailed protocols for their assigned condition, were designated as the three groups. This design was chosen for its ecological validity, as it reflects a realistic university setting. Students enrolled in these sections were invited to participate in the study; participation was voluntary and did not affect their course grades. Informed consent was obtained from all participants in accordance with the university's research ethics board guidelines.

The initial pool of participants was 212 students. The final sample consisted of N=180 students (60 per group) who completed both pre-test and post-test measures, resulting in a retention rate of 84.9%. Demographic information is presented in Table 1. The groups were comparable at baseline on key demographics and pre-test scores, with no statistically significant differences found, mitigating some concerns of the quasi-experimental design. The average age was 19.8 years (SD = 1.6), and the sample was 55.0% female. The majority of students (86.7%) had not taken a prior university-level philosophy course, making them a suitable population for studying the effects of a foundational pedagogical intervention.

Table 1: Descriptive Statistics of Respondent Demographics (N=180)				
Variable	Group Cartesian (n=60)	Group Collaborative (n=60)	Group Control (n=60)	Total (N=180)
Gender				
Female	33 (55.0%)	31 (51.7%)	35 (58.3%)	99 (55.0%)
Male	27 (45.0%)	29 (48.3%)	25 (41.7%)	81 (45.0%)
Age (Years)	Mean (SD)	19.6 (1.5)	19.9 (1.7)	19.8 (1.6)
Year of Study				
1st Year	38 (63.3%)	41 (68.3%)	40 (66.7%)	119 (66.1%)

Table 1: Descriptive Statistics of Respondent Demographics (N=180)

Variable	Group 1: Cartesian (n=60)	Group 2: Collaborative (n=60)	Group 3: Control (n=60)	Total (N=180)
2nd Year	18 (30.0%)	15 (25.0%)	16 (26.7%)	49 (27.2%)
3rd+ Year	4 (6.7%)	4 (6.7%)	4 (6.7%)	12 (6.7%)
Prior Philosophy Courses				
None	51 (85.0%)	53 (88.3%)	52 (86.7%)	156 (86.7%)
One or more	9 (15.0%)	7 (11.7%)	8 (13.3%)	24 (13.3%)

3.2. Interventions (Pedagogical Conditions)

All three groups covered similar core philosophical topics (e.g., epistemology, skepticism, the nature of self, the existence of God) over the 8-week intervention period but used distinct pedagogical approaches. To ensure fidelity, instructors were provided with detailed weekly lesson plans, activity guides, and standardized slide decks.

Group 1 (Cartesian Method Focus): Instruction centered on explicitly teaching and applying Descartes' method of analysis. Readings focused heavily on the *Meditations* and *Discourse on Method*. Weekly activities were designed to mirror the meditator's journey. These included: (a) "Doubt Journals," where students systematically recorded and challenged their own foundational beliefs; (b) "Argument Deconstruction," where students broke down philosophical arguments into premises and conclusions to check for logical validity; and (c) "Clear and Distinct Idea" exercises, where students practiced identifying intuitive starting points for arguments. The emphasis was on individual analytical practice and written reflection, mirroring the solitary journey described by Descartes.

Group 2 (Collaborative Inquiry Focus): Instruction emphasized group discussion, Socratic dialogue, and peer critique. While some Cartesian texts were read, the focus was on collaboratively analyzing arguments and constructing shared understandings. Weekly activities included: (a) Structured Academic Controversies, where student teams debated different philosophical positions; (b) Group Problem-Solving, where

students worked together to analyze complex ethical dilemmas; and (c) Peer Review Workshops, where students provided structured feedback on each other's written arguments. The instructor acted as a facilitator of discussion rather than a primary source of knowledge.

Group 3 (Control - Historical Context): Instruction focused on presenting philosophical ideas (including Descartes') within their historical and biographical context. The approach was primarily lecture-based, supplemented with instructor-led Q&A sessions. The goal was to provide foundational knowledge typical of a standard survey course, without emphasizing a specific analytical method (like Group 1) or a specific interactional model (like Group 2). This group served as a baseline to control for the effects of general university-level philosophy instruction.

3.3. Measures

Validated psychometric scales were administered online via the university's learning management system at the beginning (Week 1, pre-test) and end (Week 9, post-test) of the 8-week intervention. All items used a 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree).

Epistemic Beliefs Inventory (EBI): This 16-item inventory was adapted from established instruments (e.g., Hofer, 2000; Greene et al., 2018) to fit the context of philosophical inquiry. It included four subscales:

- *Certainty of Knowledge:* (4 items, e.g., "If you work hard enough, you can find the right answer to most philosophical problems"; "Truth is unchanging in philosophy" - reverse coded). Higher scores indicate a stronger belief in certain, absolute knowledge. Reliability was strong (Pre-test $\alpha = .78$; Post-test $\alpha = .80$).
- *Source of Knowledge (Individual):* (4 items, e.g., "The most important insights come from individual reflection"; "I trust my own intuition to know what is true"). Higher scores indicate a belief in the individual mind as the primary source of knowledge. Reliability was strong (Pre-test $\alpha = .81$; Post-test $\alpha = .84$).
- *Justification of Knowledge (Collaborative):* (4 items, e.g., "Discussing ideas with others is the best way to test their validity"; "Knowledge is built through social agreement and debate"). Higher scores indicate a belief in collaborative justification. Reliability was strong (Pre-test $\alpha = .80$; Post-test $\alpha = .82$).
- *Justification of Knowledge (Empirical):* (4 items, e.g., "Scientific evidence is the best basis for belief"; "Philosophical claims must be backed up by observable facts"). Higher scores indicate a belief in empirical justification. Reliability was strong (Pre-test $\alpha = .83$; Post-test $\alpha = .85$).

Academic Self-Efficacy (ASE) - Argumentation Subscale: Adapted from the Motivated Strategies for Learning Questionnaire (Pintrich & De Groot, 1990), this 5-

item scale was tailored to assess confidence in tasks central to philosophical argumentation (e.g., "I am confident I can analyze complex philosophical arguments effectively"; "I believe I can construct logically sound arguments on my own"; "I am good at identifying flaws in reasoning"). This scale demonstrated high internal consistency (Pre-test $\alpha = .88$; Post-test $\alpha = .91$).

3.4. Data Analysis Strategy

To test the hypotheses, a series of one-way Analyses of Covariance (ANCOVA) were conducted for each of the five post-test dependent variables (the four EBI subscales and the ASE scale). The independent variable was the pedagogical group (Cartesian, Collaborative, Control). The corresponding pre-test score for each dependent variable was included as a covariate. This statistical technique is ideal for pre-test/post-test designs as it controls for baseline differences between the groups, thereby increasing the statistical power to detect intervention effects. Assumptions for ANCOVA (normality, homogeneity of variances, homogeneity of regression slopes) were checked and met. Significant main effects of the group variable were followed up with pairwise comparisons using Bonferroni adjustments to control the family-wise error rate. Effect sizes (partial eta-squared, η^2) were calculated to assess the practical significance of the findings, with .01, .06, and .14 representing small, medium, and large effects, respectively.

4. Results

4.1. Descriptive Statistics

Table 2 presents the means and standard deviations for all dependent variables at pre-test and post-test for each pedagogical group. The raw change scores provide a preliminary view of the intervention effects. The Cartesian group shows the largest positive change in Academic Self-Efficacy (+0.90), Certainty (+0.60), and Individual Source (+0.68), while also showing a negative change in Collaborative Justification (-0.18). The Collaborative group shows the largest positive change in Collaborative Justification (+0.40). The Control group shows minimal change across all measures.

Table 2: Descriptive Statistics (Means and SDs) for Dependent Variables by Group (Pre-Test and Post-Test)

Dependent Variable (Scale 1-7)	Group	Pre-Test Mean (SD)	Post-Test Mean (SD)	Change
EBI: Certainty	1. Cartesian	3.85 (1.10)	4.45 (1.05)	+0.60
	2. Collaborative	3.91 (1.15)	3.98 (1.12)	+0.07
	3. Control	3.88 (1.08)	3.90 (1.06)	+0.02

Table 2: Descriptive Statistics (Means and SDs) for Dependent Variables by Group (Pre-Test and Post-Test)

Dependent Variable (Scale 1-7)	Group	Pre-Test Mean (SD)	Post-Test Mean (SD)	Change
EBI: Source (Individual)	1. Cartesian	4.10 (1.21)	4.78 (1.18)	+0.68
	2. Collaborative	4.05 (1.25)	4.15 (1.20)	+0.10
	3. Control	4.12 (1.19)	4.18 (1.17)	+0.06
EBI: Justification (Collab.)	1. Cartesian	4.88 (1.08)	4.70 (1.15)	-0.18
	2. Collaborative	4.95 (1.05)	5.35 (1.00)	+0.40
	3. Control	4.90 (1.10)	4.94 (1.08)	+0.04
EBI: Justification (Empirical)	1. Cartesian	5.15 (1.02)	5.05 (1.10)	-0.10
	2. Collaborative	5.10 (1.05)	5.25 (1.01)	+0.15
	3. Control	5.18 (1.00)	5.20 (0.98)	+0.02
ASE: Argumentation	1. Cartesian	4.25 (1.30)	5.15 (1.25)	+0.90
	2. Collaborative	4.30 (1.28)	4.45 (1.22)	+0.15
	3. Control	4.22 (1.35)	4.30 (1.30)	+0.08

4.2. Hypothesis Testing (ANCOVA)

The results of the five ANCOVA tests are summarized in Table 3. After controlling for pre-test scores, there were significant differences between the pedagogical groups on all five post-test measures, confirming the efficacy of the interventions.

Hypothesis 1 (ASE: Argumentation): There was a significant effect of the pedagogical group on post-test academic self-efficacy, $F(2, 176) = 15.68, p < .001$, with a large effect size ($\eta^2 = .151$). Post-hoc Bonferroni tests revealed that the Cartesian group (Adjusted Mean = 5.12) scored significantly higher than both the Collaborative group (Adj. M = 4.48, $p < .001$) and the Control group (Adj. M = 4.32, $p < .001$). The

Collaborative and Control groups did not differ significantly from each other. H1 was strongly supported.

Hypothesis 2 (EBI: Certainty): A significant group effect was found for beliefs in knowledge certainty, $F(2, 176) = 7.84$, $p < .001$, with a medium effect size ($\eta^2 = .082$). The Cartesian group (Adj. M = 4.43) scored significantly higher than both the Collaborative group (Adj. M = 3.96, $p = .003$) and the Control group (Adj. M = 3.92, $p = .001$). H2 was supported.

Hypothesis 3 (EBI: Source - Individual): A significant group effect was found for beliefs in individual intuition as a source of knowledge, $F(2, 176) = 9.15$, $p < .001$, with a medium effect size ($\eta^2 = .094$). The Cartesian group (Adj. M = 4.75) scored significantly higher than both the Collaborative group (Adj. M = 4.17, $p < .001$) and the Control group (Adj. M = 4.20, $p < .001$). H3 was supported.

Hypothesis 4 (EBI: Justification - Collaborative & Empirical): H4 was tested with two separate ANCOVAs. For collaborative justification, there was a significant group effect, $F(2, 176) = 6.44$, $p = .002$, with a medium effect size ($\eta^2 = .068$). The Collaborative group (Adj. M = 5.33) scored significantly higher than the Cartesian group (Adj. M = 4.72, $p = .001$). Notably, the Cartesian group scored significantly lower than even the Control group (Adj. M = 4.95, $p = .025$). For empirical justification, there was also a significant group effect, $F(2, 176) = 4.18$, $p = .017$, with a small-to-medium effect size ($\eta^2 = .045$). The Cartesian group (Adj. M = 5.03) scored significantly lower than both the Collaborative (Adj. M = 5.27, $p = .038$) and Control groups (Adj. M = 5.22, $p = .045$). Thus, H4 was fully supported.

Table 3: Analysis of Covariance (ANCOVA) for Post-Test Dependent Variables

Dependent Variable	Source	Sum of Squares	df	Mean Square	F	p-value	Partial η^2
ASE: Argumentation	Pre-Test Score (Cov)	88.5	1	88.5	75.1	< .001	.299
	Group	37.0	2	18.5	15.68	< .001	.151
	Error	207.3	176	1.18			
EBI: Certainty	Pre-Test Score (Cov)	65.2	1	65.2	68.9	< .001	.281
	Group	14.8	2	7.4	7.84	< .001	.082
	Error	166.4	176	0.95			

Table 3: Analysis of Covariance (ANCOVA) for Post-Test Dependent Variables

Dependent Variable	Source	Sum of Squares	df	Mean Square	F	p-value	Partial η^2
EBI: Source (Indiv.)	Pre-Test Score (Cov)	71.3	1	71.3	70.1	< .001	.285
	Group	18.6	2	9.3	9.15	< .001	.094
	Error	179.0	176	1.02			
EBI: Justif. (Collab.)	Pre-Test Score (Cov)	55.9	1	55.9	60.3	< .001	.255
	Group	11.9	2	6.0	6.44	.002	.068
	Error	163.2	176	0.93			
EBI: Justif. (Empirical)	Pre-Test Score (Cov)	60.1	1	60.1	67.8	< .001	.278
	Group	7.4	2	3.7	4.18	.017	.045
	Error	156.1	176	0.89			

5. Discussion

5.1. The Double-Edged Sword: Interpreting the Findings

This study aimed to empirically assess the cognitive consequences of teaching the Cartesian method of analysis. Our findings paint a complex, double-edged picture, strongly supporting the conceptual model presented in Figure 1. On one hand, the results confirm that focusing on the Cartesian method can provide a form of cognitive "healing" or strengthening, specifically in terms of academic self-efficacy (H1 supported). Students rigorously trained in this individualistic, analytical method reported significantly greater confidence in their ability to dissect arguments, reason logically, and identify flaws. This large effect size ($\eta^2 = .151$) suggests that the method's emphasis on systematic doubt and deductive construction provides potent mastery experiences that bolster students' belief in their own rational capacities, a key goal of critical thinking education (Franco & Almeida, 2023).

However, this gain in confidence came at a clear cost to epistemic development. As hypothesized, the Cartesian group showed significant increases in beliefs favoring

knowledge certainty (H2 supported) and knowledge derived from individual intuition (H3 supported). This suggests that the method's focus on indubitable foundations and the solitary mind's "clear and distinct" perceptions may inadvertently reinforce more absolutist and individualistic epistemic stances, consistent with less mature stages of epistemic development (Perry, 1970; Hofer & Pintrich, 1997). Students appear to internalize the idea that reliable knowledge is primarily certain and discoverable through solitary reflection.

Critically, this shift came alongside a significant decrease in the appreciation for collaborative and empirical justification (H4 supported). The Cartesian group finished the intervention placing less value on discussion, peer review, and scientific evidence than they did at the start, and significantly less than both other groups. This is perhaps the most concerning finding. The "healing" from doubt seems to be achieved by retreating into the perceived safety of one's own mind, fostering an epistemic stance that is less open to external input, dialogue, or evidence that challenges one's own "clear and distinct" conclusions. This aligns with concerns raised by Elby & Hammer (2010) about the potential pitfalls of emphasizing purely internal coherence over external validation.

5.2. Theoretical Implications for Epistemic Cognition

This study provides empirical grounding for the long-standing debate about the pedagogical value and risks of Cartesian rationalism. It suggests that while Descartes' method is a powerful tool for developing analytical skills, it carries a tangible risk of fostering epistemic viewpoints that are less sophisticated according to contemporary developmental models (Greene et al., 2018). The "trauma" of doubt might be "healed" by finding certainty, but this certainty may come at the price of epistemic openness and humility.

Furthermore, the study contributes to the literature on epistemic cognition by demonstrating how specific, content-based pedagogical practices can directly and differentially influence students' beliefs about knowledge (Leden et al., 2022). It highlights that *how* we teach critical thinking matters just as much as *what* we teach. A method focused solely on individual logical rigor may produce students who are confident in their reasoning but are paradoxically less equipped to engage productively in collaborative knowledge building or to appreciate the provisional, evidence-based nature of empirical knowledge—both of which are crucial skills in contemporary academic and professional life (Tirca & Stanciu, 2024).

5.3. Broader Implications for Higher Education in the Digital Age

The findings have significant implications beyond the philosophy classroom. In the current digital ecosystem, individuals are constantly bombarded with information and misinformation. The ability to navigate this landscape requires more than just logical rigor; it requires epistemic virtues like intellectual humility, openness to new

evidence, and the ability to critically evaluate sources and engage in constructive dialogue.

A pedagogy that inadvertently promotes an over-reliance on "individual intuition" could be counterproductive in this context. It might encourage students to trust their "gut feeling" or internal sense of clarity when evaluating online content, making them more vulnerable to confirmation bias and algorithm-driven filter bubbles. An epistemic stance that devalues collaborative justification may also hinder the development of skills needed for civic engagement and democratic discourse, which rely on the ability to understand, respect, and integrate differing viewpoints. Fostering inclusive classroom environments also requires moving beyond a singular focus on individualistic rationalism to value diverse ways of knowing and collaborating (Salazar et al., 2010).

5.4. Practical Implications for Educators

The findings offer several practical considerations for educators in philosophy, critical thinking, and related disciplines:

1. **Use the Cartesian Method Mindfully:** Teaching Descartes' method remains valuable for developing analytical rigor. However, educators must be explicitly aware of its potential side effects on epistemic beliefs. It should be taught as one powerful tool among many, not as the sole path to knowledge.
2. **Explicitly Counterbalance with Epistemology:** When teaching the Cartesian method, it should be paired with explicit instruction about epistemology. Discuss the limitations of pure rationalism, the value of empirical evidence, the social construction of knowledge, and the importance of epistemic humility. Frame the *Meditations* not as a universal guide, but as one specific, historically situated epistemological project with its own strengths and weaknesses.
3. **Integrate Collaborative and Empirical Elements:** To mitigate the risk of fostering epistemic individualism, instructors should intentionally integrate collaborative activities. For example, after students individually apply the method of doubt, they could engage in group discussions to compare their "clear and distinct" ideas, thereby modeling the social negotiation of knowledge. Connecting philosophical arguments to relevant empirical studies can also reinforce the value of evidence.
4. **Assess Epistemic Beliefs:** Educators should consider assessing students' epistemic beliefs alongside critical thinking skills. Understanding students' underlying assumptions about knowledge can help tailor instruction more effectively to promote epistemic development.

6. Conclusion

6.1. Principal Contribution

Drawing inspiration from an interpretation of Descartes' *Meditations* as a journey of cognitive healing (Tweyman, 2024), this study empirically investigated the impact of a Cartesian method pedagogy on students' epistemic beliefs and academic self-efficacy. The principal contribution is the finding of a significant trade-off: while this pedagogy effectively enhances students' confidence in their analytical and argumentative abilities (H1), it simultaneously fosters less sophisticated epistemic beliefs favoring certainty (H2) and individual intuition (H3), while diminishing appreciation for collaborative and empirical justification (H4). This research provides the first quantitative evidence suggesting that the very method Descartes used to escape the "trauma" of doubt might, when translated into pedagogy, inadvertently lead students towards a different kind of cognitive confinement—an overly confident reliance on individual reason at the expense of epistemic openness.

6.2. Limitations and Future Research

This study has limitations inherent in its quasi-experimental design, including the use of intact class sections and potential instructor effects despite training and protocol adherence. The sample consisted of undergraduate students in a single discipline at one university, and findings might differ for other populations. The intervention duration was limited to 8 weeks; the long-term effects remain unknown.

Future research should aim to replicate these findings using true experimental designs with random assignment of individuals to conditions. Longitudinal studies tracking students over their entire university careers could assess the lasting impact of different pedagogical approaches on epistemic development and academic trajectories. Mixed-methods research, combining quantitative scales with qualitative interviews or analyses of student journals, could provide deeper insights into the subjective experience of learning via the Cartesian method. Finally, future studies should explore the effectiveness of "hybrid" pedagogies that intentionally attempt to integrate the analytical rigor of the Cartesian method with the dialogic and evidence-based practices of collaborative and empirical inquiry, potentially achieving the benefits of the "healing" edge while mitigating the risks of the "hardening" one.

References

- [1] Bandura, A. (1997). *Self-efficacy: The exercise of control*. W. H. Freeman.
- [2] Descartes, R. (1967). *The Philosophical Works of Descartes* (Vols. 1 & 2). (E. S. Haldane & G. R. T. Ross, Trans.). Cambridge University Press.
- [3] Elby, A., & Hammer, D. (2010). Epistemological resources and framing: A cognitive framework for helping teachers interpret and respond to their students' epistemologies. In L. D. Bendixen & F. C. Feucht (Eds.), *Personal epistemology in the classroom: Theory, research, and implications for practice* (pp. 409-434). Cambridge University Press.

- [4] Franco, A., & Almeida, L. S. (2023). Promoting Critical Thinking in Higher Education: Issues, Challenges, and Opportunities. *European Journal of Investigation in Health, Psychology and Education*, 13(1), 150-165. <https://doi.org/10.3390/ejihpe13010012>
- [5] Greene, J. A., Sandoval, W. A., & Bråten, I. (Eds.). (2018). *Handbook of epistemic cognition*. Routledge.
- [6] Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. A. (2007). Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Sweller, and Clark (2006). *Educational Psychologist*, 42(2), 99-107. <https://doi.org/10.1080/00461520701263368>
- [7] Hofer, B. K. (2000). Dimensionality and disciplinary differences in personal epistemology. *Contemporary Educational Psychology*, 25(4), 378-405. <https://doi.org/10.1006/ceps.1999.1026>
- [8] Hofer, B. K., & Pintrich, P. R. (1997). The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning. *Review of Educational Research*, 67(1), 88-140. <https://doi.org/10.3102/00346543067001088>
- [9] Leden, L., Hansson, L., & Ideland, M. (2022). Epistemic cognition in science education: navigating uncertainty and fostering critical evaluation. *Cultural Studies of Science Education*, 17(2), 345-367. <https://doi.org/10.1007/s11422-021-10078-z>
- [10] Mega, C., Ronconi, L., & De Beni, R. (2014). What makes a good student? How emotions, self-regulated learning, and motivation contribute to academic achievement. *Journal of Educational Psychology*, 106(1), 121-131. <https://doi.org/10.1037/a0033546>
- [11] Muis, K. R., & Duffy, M. C. (2013). Epistemic climate and epistemic change: Instruction designed to change students' beliefs and learning strategies and improve achievement. *Journal of Educational Psychology*, 105(2), 293-307. <https://doi.org/10.1037/a0030690>
- [12] Perry, W. G. (1970). *Forms of intellectual and ethical development in the college years: A scheme*. Holt, Rinehart & Winston.
- [13] Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, 82(1), 33-40. <https://doi.org/10.1037/0022-0663.82.1.33>
- [14] Salazar, M. del C., Norton, A. S., & Tuitt, F. A. (2010). Weaving promising practices for inclusive excellence into the higher education classroom. In L. B. Nilson & J. E. Miller (Eds.), *To improve the academy: Resources for faculty, instructional, and organizational development* (Vol. 28, pp. 208-226). Jossey-Bass.
- [15] Schommer, M. (1990). Effects of beliefs about the nature of knowledge on comprehension. *Journal of Educational Psychology*, 82(3), 498-504. <https://doi.org/10.1037/0022-0663.82.3.498>

- [16] Tirca, A., & Stanciu, S. (2024). Fostering collaborative learning environments: Strategies for enhancing student engagement and knowledge co-construction. *European Journal of Social Science Education and Research*, 11(1), 7-16. <https://doi.org/10.26417/ejser.v11i1.p7-16>
- [17] Tweyman, S. (2024). Trauma and Healing in Descartes' Meditations on First Philosophy: An Essay. *European Journal of Social Science Education and Research*, 11(4), 7-14.
- [18] Usher, E. L., & Pajares, F. (2008). Sources of self-efficacy in school: Critical review of the literature and future directions. *Review of Educational Research*, 78(4), 751-796. <https://doi.org/10.3102/0034654308321456>
- [19] Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology*, 25(1), 82-91. <https://doi.org/10.1006/ceps.1999.1016>