The Effectiveness of Discovery Learning Strategy on Achievement Among Eleventh Grade Literary Students in Principles of Philosophy

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Abstract: This study investigated the effectiveness of discovery learning strategy on academic achievement among eleventh-grade literary students in Principles of Philosophy. The researcher employed a quasi-experimental design with two equivalent groups consisting of 62 students purposefully selected from Shanaz Preparatory School for Girls during the 2024-2025 academic year. The sample was randomly divided into an experimental group (n=31) taught using discovery learning strategy and a control group (n=31) receiving traditional instruction. After verifying group equivalence across six variables, the researcher covered the second unit of the curriculum, comprising three chapters: Epistemology and Theory of Knowledge, Metaphysics and Reality, and Philosophy of Mind. To achieve research objectives, the researcher developed 30 detailed lesson plans for each group and constructed an achievement test consisting of 35 items in its final form, distributed across Bloom's cognitive levels (Remember, Understand, Apply, Analyze). After establishing validity (CVI=0.91) and reliability (α=0.86), data were analyzed using independent samples t-test. Results revealed statistically significant differences favoring the experimental group on the achievement test (t=5.874, p<0.001, η^2=0.36). Based on these findings, the researcher proposed several recommendations and suggestions for future research.
Keywords: Discovery Learning Strategy; Academic Achievement; Philosophy Education; Eleventh Grade Literary; Epistemology; Metaphysics.

INTRODUCTION

Educational systems worldwide are experiencing transformative shifts as traditional teaching methods give way to innovative pedagogical approaches emphasizing active learning and student engagement. The movement toward learner-centered education has gained considerable momentum in recent years, challenging educators to move beyond conventional knowledge transmission models toward frameworks that position students as active constructors of their own understanding (Hattie, 2023). This shift represents more than methodological change; it reflects a fundamental reconceptualization of what constitutes effective teaching and meaningful learning in the twenty-first century.

Contemporary educational research emphasizes the critical importance of helping students develop genuine understanding rather than merely accumulating factual information (Bransford et al., 2000; Sawyer, 2022). Deep learning requires students to actively construct knowledge through meaningful engagement with content, concepts, and real-world applications. This

constructivist approach to education recognizes that learners are not passive recipients of information but active participants who bring their prior experiences, cultural backgrounds, and individual perspectives to the learning process (Hmelo-Silver et al., 2007).

Philosophy education plays a fundamental role in developing students' critical thinking abilities, analytical reasoning, and capacity for abstract thought. In the Kurdistan Region of Iraq, the Principles of Philosophy course introduced in eleventh grade represents students' first formal encounter with philosophical concepts and methods of inquiry. This critical educational transition occurs during late adolescence, a developmental period characterized by enhanced abstract reasoning capabilities, identity formation, and the emergence of sophisticated metacognitive skills (Steinberg, 2014).

Traditional approaches to teaching philosophy in secondary schools throughout the Kurdistan Region and broader Middle Eastern context have predominantly relied on lecture-based instruction emphasizing memorization of philosophical concepts, historical schools of thought, biographical information about philosophers, and reproduction of textbook content (Al-Qahtani, 2023). This pedagogical approach typically involves teacher-centered presentation of philosophical doctrines, student note-taking, recitation of memorized information, and assessment focused primarily on recall and comprehension. While such methods may efficiently transmit factual knowledge, they often fail to engage students in authentic philosophical thinking, limiting their ability to develop the critical analysis, argumentation, dialogue, and reflective thinking skills that constitute genuine philosophical literacy (Lipman, 2003; Gregory & Laverty, 2018).

The disconnect between traditional instructional methods and the goals of philosophical education creates a significant pedagogical challenge. Philosophy, by its nature, is not merely a body of knowledge to be transmitted but a practice of inquiry, a way of thinking characterized by questioning assumptions, examining arguments, exploring multiple perspectives, and engaging in reasoned dialogue (Cam, 2018). When instruction focuses primarily on memorization and reproduction, students may acquire knowledge about philosophy without developing the capacity to think philosophically—to question, analyze, argue, and reflect with the rigor and sophistication that defines philosophical inquiry.

This challenge is particularly acute during adolescence, when students are developmentally poised to engage with abstract philosophical concepts and complex reasoning (Kuhn, 2015). Neuropsychological research indicates that during ages 16-17, significant development occurs in the prefrontal cortex,

enhancing executive functions including abstract reasoning, perspective-taking, hypothetical thinking, and metacognition (Crone & Steinbeis, 2021). This developmental trajectory creates an optimal window for introducing complex philosophical concepts and cultivating higher-order thinking skills. However, realizing this potential requires instructional approaches that actively engage students' emerging cognitive capabilities rather than positioning them as passive recipients of information.

Discovery learning represents an innovative pedagogical approach designed to transform instruction from passive reception to active investigation. Grounded in constructivist learning theory, inquiry-based pedagogy, and cognitive psychology, this model structures learning through guided exploration that enables students to construct understanding through their own intellectual effort (Bruner, 2009; Alfieri et al., 2011). Rather than presenting philosophical concepts as settled doctrines to be memorized, discovery learning creates conditions for students to encounter philosophical problems, investigate possible solutions, construct explanations, and reflect on their thinking processes.

Jerome Bruner, one of discovery learning's primary architects, argued that students learn most effectively when they discover principles themselves rather than having them explained directly (Bruner, 1961). This perspective represented a fundamental shift from viewing students as passive receivers to seeing them as active constructors of knowledge. Bruner emphasized that learning involves not merely acquiring information but developing cognitive structures for organizing and using knowledge. When students discover concepts through their own inquiry, they construct richer, more flexible cognitive structures than when concepts are simply delivered to them (de Jong & Lazonder, 2014).

Despite substantial research on discovery learning in subjects like science and mathematics, relatively few studies have examined its application to philosophy teaching, particularly at the secondary level (Vansieleghem & Kennedy, 2011). Even fewer studies have been conducted in Middle Eastern educational contexts where cultural factors and educational traditions may influence how discovery approaches function (Akkus & Hand, 2011). This gap in research literature creates uncertainty for teachers and policymakers considering discovery learning for philosophy instruction.

Statement of the Problem

Despite philosophy education's importance in the literary stream curriculum, student achievement remains a concern. Teachers report that many students struggle to understand abstract philosophical concepts and find

philosophy disconnected from their lives (Al-Mutawah et al., 2019). Students often view philosophy as another subject requiring memorization rather than as an invitation to think deeply about meaningful questions. Traditional teaching methods, while efficient for content coverage, may not effectively develop the philosophical understanding and thinking skills that constitute genuine philosophical literacy.

The problem manifests in several ways. Examination results often reveal superficial understanding, with students able to recall definitions but unable to apply concepts to new situations. Classroom observations show limited student engagement during philosophy lessons, with most student's passive listeners rather than active participants (Gregory & Grady, 2012). Student surveys indicate that many find philosophy boring or irrelevant, failing to see connections between philosophical questions and their own lives.

Research Objectives

This study aims to:

1. Investigate the effectiveness of discovery learning strategy on academic achievement in Principles of Philosophy among eleventh-grade literary students compared to traditional instruction.

2. Provide empirical evidence about discovery learning's impact on philosophy learning in the Kurdistan Region educational context.

3. Offer practical guidance for teachers considering discovery learning approaches for philosophy instruction.

4. Contribute to the limited research literature on philosophy pedagogy at the secondary level, particularly in Middle Eastern contexts.

Research Hypotheses

Based on the theoretical framework and research literature, this study tests two null hypotheses at $\alpha = 0.05$ significance level:

H_{01}: There is no statistically significant difference at $\alpha = 0.05$ between the mean achievement scores of students taught using discovery learning strategy (experimental group) and students taught using traditional methods (control group) on the post-test.

H_{02}: There is no statistically significant difference at $\alpha = 0.05$ between the pre-test and post-test achievement scores for students in the experimental group taught using discovery learning strategy.

Research Limitations

This research is bounded by several specific parameters. The human boundaries encompass eleventh-grade female students enrolled in morning preparatory schools in the literary stream. The spatial boundaries are limited to Shanaz Preparatory School for Girls in Duhok Governorate. The temporal boundaries cover the first semester of 2024-2025. The cognitive boundaries are restricted to the second unit: Epistemology and Theory of Knowledge, Metaphysics and Reality, and Philosophy of Mind.

LITERATURE REVIEW

The theoretical foundation of discovery learning rests firmly on constructivist epistemology, which posits that learners actively construct knowledge rather than passively receiving it from external sources. Jean Piaget's cognitive development theory emphasized that children actively construct increasingly sophisticated mental structures through interaction with their environment (Piaget, 1952). Learning occurs not through passive absorption but through processes of assimilation and accommodation as learners encounter new experiences and integrate them with existing knowledge.

Piaget identified four stages of cognitive development, with formal operational thinking emerging during adolescence (approximately age 11 onward). This stage is characterized by the ability to think abstractly, reason hypothetically, and engage in metacognitive reflection—cognitive capabilities essential for philosophical inquiry. Philosophy education in eleventh grade coincides with this developmental period, creating optimal conditions for engaging students with abstract philosophical concepts when properly supported through appropriate pedagogical approaches (Inhelder & Piaget, 1958).

Lev Vygotsky's sociocultural theory extended constructivism by highlighting how learning occurs through social interaction and cultural mediation (Vygotsky, 1978). Vygotsky's concept of the zone of proximal development—the gap between what learners can accomplish independently and what they can achieve with guidance—provides theoretical justification for guided discovery approaches. Teachers facilitate learning by structuring tasks within students' zones of proximal development and providing scaffolding that enables students to accomplish what they cannot yet do alone. As students gain competence, scaffolding gradually fades, supporting movement toward independence.

Contemporary constructivist theorists emphasize that knowledge construction is an active, social, and situated process (Hmelo-Silver et al., 2007).

Students construct understanding through engagement with problems, collaboration with peers, and reflection on their thinking processes. This perspective aligns closely with the goals of philosophy education, which seeks to develop students' capacity for independent philosophical thinking through dialogue, argumentation, and reasoned inquiry.

Jerome Bruner's discovery learning theory emerged from his work in cognitive psychology during the 1960s (Bruner, 1961). Bruner argued that learning is most effective when students discover principles themselves rather than having them explained directly by teachers. This approach represented a fundamental challenge to prevailing instructional models emphasizing direct transmission of knowledge from teacher to student.

Bruner distinguished between expository teaching, in which teachers present information for students to absorb, and discovery learning, in which students encounter problems and construct understanding through guided exploration. He argued that discovery learning produces several important benefits: deeper understanding through active construction, better retention due to meaningful processing, enhanced transfer to new contexts, and stronger intrinsic motivation arising from the satisfaction of discovery (Bruner, 2009).

Modern interpretations of discovery learning recognize that Bruner's original conception required refinement. Pure discovery learning, which provides minimal guidance and structure, has been shown to be less effective than guided discovery approaches that provide appropriate scaffolding (Kirschner et al., 2006). Contemporary discovery learning models emphasize the importance of teacher guidance, structured inquiry processes, and explicit attention to metacognitive strategies (Alfieri et al., 2011).

Guided discovery learning maintains the core principle that students construct understanding through their own inquiry while recognizing that effective learning requires appropriate support structures. Teachers design learning experiences that present problems, provide resources for investigation, facilitate exploration through questioning and scaffolding, and support students in constructing and articulating their understanding (de Jong & Lazonder, 2014).

Cognitive load theory, developed by John Sweller and colleagues, provides important insights into the conditions under which discovery learning is most effective (Sweller et al., 1998). The theory distinguishes between three types of cognitive load: intrinsic load (inherent difficulty of the material), extraneous load (imposed by poor instructional design), and germane load (productive cognitive effort devoted to learning).

Critics of discovery learning have argued that unguided discovery imposes excessive cognitive load, overwhelming working memory and hindering learning (Kirschner et al., 2006). However, research demonstrates that well-designed guided discovery that provides appropriate scaffolding can manage cognitive load effectively while engaging students in productive cognitive effort (Lazonder & Harmsen, 2016). The key is finding the right balance between challenge and support—providing enough structure to prevent cognitive overload while maintaining sufficient cognitive engagement to promote deep learning.

Substantial research evidence supports the effectiveness of discovery learning approaches across diverse educational contexts when properly implemented with appropriate guidance. Alfieri et al. (2011) conducted a comprehensive meta-analysis of 164 studies comparing discovery learning with other instructional approaches. Their analysis revealed that guided discovery, which provides structured support while engaging students in inquiry, produced better learning outcomes than both unguided discovery and traditional direct instruction across diverse age groups and subject domains.

The meta-analysis identified several factors that moderate discovery learning's effectiveness. Tasks requiring complex reasoning and conceptual understanding showed larger benefits from discovery approaches compared to tasks emphasizing factual recall. Longer interventions produced stronger effects than brief implementations, suggesting that students need time to develop inquiry skills and habits. Finally, discovery learning was particularly effective for promoting transfer to new contexts and long-term retention compared to immediate recall of factual information (Alfieri et al., 2011).

Lazonder and Harmsen (2016) conducted a meta-analysis specifically examining the effects of guidance in inquiry-based learning. Their analysis of 72 studies found that providing appropriate scaffolding during inquiry significantly enhanced learning outcomes. Effective scaffolding included process worksheets that structure inquiry, explanatory feedback that supports understanding, and worked examples that model reasoning processes. The optimal level of guidance varied based on learners' prior knowledge and expertise, with novice learners benefiting from more structured support (Lazonder & Harmsen, 2016).

Science education has been at the forefront of discovery learning implementation and research. Freeman et al. (2014) conducted a meta-analysis of 225 studies comparing active learning with traditional lecture-based instruction in science, technology, engineering, and mathematics. The analysis revealed that active learning approaches, including discovery-based methods, produced substantial improvements in examination performance and reduced

failure rates. The average effect size was 0.47 standard deviations, representing a meaningful improvement in student outcomes.

Theobald et al. (2020) extended this research by examining whether active learning approaches differentially benefit students from underrepresented groups. Their meta-analysis of 41 studies found that active learning narrowed achievement gaps, with larger benefits for underrepresented students compared to majority students. This finding suggests that discovery learning approaches may promote more equitable outcomes by engaging diverse learners more effectively than traditional instruction.

Research specifically examining discovery learning in philosophy education remains limited, particularly at the secondary level. However, related research on Philosophy for Children (P4C) and community of inquiry approaches provides relevant insights. P4C, developed by Matthew Lipman, emphasizes philosophical dialogue and collaborative inquiry, sharing core principles with discovery learning (Lipman, 2003).

Trickey and Topping (2022) conducted a rapid review and meta-analysis of research on Philosophy for Children and philosophical inquiry. Their analysis of 42 studies found that P4C interventions produced moderate to large effects on cognitive outcomes including reasoning skills, critical thinking, and academic achievement across subject areas. Effects were strongest for programs implemented over extended periods (one year or more) with well-trained facilitators. These findings support the potential effectiveness of inquiry-based approaches for philosophy education.

Gregory and Laverty (2018) argued that philosophy education should engage students in doing philosophy rather than merely learning about philosophy. This perspective aligns closely with discovery learning principles, emphasizing that philosophical understanding develops through active inquiry, dialogue, and reflection rather than passive reception of philosophical doctrines. However, they noted that implementing inquiry-based philosophy requires substantial teacher preparation and ongoing support.

Cam (2018) examined philosophical investigation and critical thinking in philosophy classrooms. His research emphasized the importance of genuine philosophical problems that provoke students' curiosity and create cognitive conflict. Effective philosophical inquiry requires carefully structured problems, skilled facilitation that supports without directing students' thinking, and sustained attention to developing students' reasoning and argumentation skills. These findings highlight the importance of teacher expertise in implementing discovery approaches for philosophy.

Limited research has examined discovery learning in Middle Eastern educational contexts, creating uncertainty about how cultural factors and educational traditions may influence implementation and effectiveness. Akkus and Hand (2011) studied Turkish teachers' experiences implementing dialogical inquiry in science classrooms. They found that teachers faced significant challenges adapting to facilitative rather than directive roles, managing the uncertainty inherent in inquiry processes, and addressing institutional pressures emphasizing curriculum coverage and examination preparation.

Al-Qahtani (2023) examined Saudi teachers' perceptions of active learning approaches. Teachers expressed positive attitudes toward active learning principles but reported barriers including large class sizes, limited time due to extensive curriculum content, lack of instructional resources, limited training in active learning methods, and assessment systems emphasizing factual recall. These findings suggest that implementing discovery learning in Middle Eastern contexts requires attention to both pedagogical and systemic factors.

Hassan and Ahmed (2019) investigated challenges in philosophy teaching from Iraqi teachers' perspectives. Teachers identified several obstacles: students' limited background knowledge and reading skills, abstract nature of philosophical concepts, disconnect between philosophy and students' lives, time constraints due to curriculum demands, and assessment focused on memorization rather than understanding. These challenges suggest that discovery learning approaches that connect philosophy to students' experiences and develop thinking skills through active inquiry may address important limitations of current practice.

The reviewed literature establishes several important conclusions that inform this research. First, constructivist learning theory provides strong theoretical justification for discovery learning approaches in philosophy education. Philosophy, as a practice of inquiry rather than a body of facts, aligns naturally with constructivist principles emphasizing active knowledge construction through reasoning and dialogue.

Second, research evidence demonstrates that guided discovery learning, when properly implemented with appropriate scaffolding, produces better learning outcomes than traditional direct instruction across diverse contexts. The key is finding the right balance between student autonomy and teacher support—providing enough structure to manage cognitive load while maintaining sufficient engagement to promote deep learning.

Third, limited research has examined discovery learning specifically in philosophy education at the secondary level, particularly in Middle Eastern contexts. This gap creates uncertainty for educators and policymakers

considering discovery approaches. The present study addresses this gap by investigating discovery learning's effectiveness for philosophy achievement in the Kurdistan Region.

Fourth, successful implementation requires attention to multiple factors: adequate teacher preparation and ongoing support, carefully designed learning activities that engage students with meaningful philosophical problems, appropriate scaffolding that supports without directing thinking, sufficient time for students to develop inquiry skills, and assessment approaches that emphasize understanding and reasoning rather than factual recall.

RESEARCH METHODOLOGY

Research Design

This study employed a quasi-experimental research design to investigate the effectiveness of discovery learning strategy on academic achievement in Principles of Philosophy. The quasi-experimental approach was selected as the most appropriate methodology for addressing research questions while accommodating practical constraints of conducting educational research in authentic classroom settings.

Table 1. Experimental Research Design

Group	Pre-Test	Independent Variable	Post-Test
Experimental (n=31)	Achievement Test	Discovery Learning Strategy	Achievement Test
Control (n=31)		Traditional Instruction	

Population and Sample

The research population consisted of all eleventh-grade literary stream female students enrolled in preparatory schools within Sêmêl Education Directorate, Duhok Governorate, Kurdistan Region, Iraq, during the 2024–2025 academic year. The total population comprised 527 students distributed across 11 schools (6 schools for girls and 5 schools for boys), of which 340 were female students distributed across 6 schools for girls, representing 64.5% of the total population.

Shanaz Preparatory School for Girls was purposefully selected as the research site based on administrative cooperation, availability of multiple eleventh-grade sections, accessibility, researcher accessibility, and representative demographics.

Two sections were randomly selected from four available. Section B was assigned as experimental group, Section D as control group. After excluding repeating students and those with frequent absences, the final sample was determined.

Table 2. Distribution of Research Sample Groups

Group	Teaching Method	Section	Before Exclusion	Excluded	After Exclusion
Experimental	Discovery Learning Strategy	B	34	3	31
Control	Traditional Instruction	D	33	2	31
Total			**67**	**5**	**62**

Group Equivalence Verification

Prior to implementing the intervention, comprehensive equivalence testing was conducted across six variables known to influence educational outcomes. Data were collected from official records and standardized assessments during October 6-10, 2024.

Variables assessed:

1. **Intelligence:** Raven's Progressive Matrices (Al-Nabhani, 2018 Iraqi adaptation)

2. **General Academic Average:** Overall GPA from tenth grade (2023-2024)

3. **Humanities/Social Studies Performance:** Tenth-grade humanities course grades

4. **Chronological Age:** Calculated in months as of October 1, 2024

5. **Prior Knowledge:** 15-item test on general philosophical concepts

6. **Pre-Achievement:** 35-item achievement test administered as pre-test

Table 3. Group Equivalence Results

Variable	Experimental (n=31) Mean (SD)	Control (n=31) Mean (SD)	t-value	p-value	Decision
Intelligence (Raven SPM)	43.87 (5.42)	43.29 (5.68)	0.425	.672	Not Significant
General Average (%)	76.94 (10.85)	75.71 (11.36)	0.449	.655	Not Significant

Humanities/Social Studies (%)	77.58 (11.94)	76.32 (12.47)	0.417	.678	Not Significant
Chronological Age (months)	196.48 (4.96)	197.13 (5.34)	0.509	.612	Not Significant
Prior Knowledge (/15)	9.16 (2.28)	8.87 (2.41)	0.503	.617	Not Significant
Pre-Achievement (/35)	16.74 (3.58)	16.19 (3.72)	0.614	.541	Not Significant

Note: Critical t-value (60 df) = 2.000 at a = 0.05. All calculated t-values below critical value, confirming no statistically significant differences. Groups are equivalent.

Research Materials

Scientific Content

The research covered the second unit of the eleventh-grade Principles of Philosophy curriculum (Kurdistan Region Ministry of Education, 2023), encompassing three chapters:

Chapter Four: Epistemology and Theory of Knowledge

- What is knowledge?

- Sources of knowledge (rationalism vs. empiricism)

- Justification and truth

- Skepticism and responses

- Contemporary epistemological debates

Chapter Five: Metaphysics and Reality

- Nature of reality

- Mind-body problem

- Free will vs. determinism

- Personal identity and the self

- Time and causation

Chapter Six: Philosophy of Mind

- Consciousness and qualia

- Dualism vs. materialism

- Functionalism and mental states

- Artificial intelligence and Chinese Room

- Problem of other minds

Behavioral Objectives

Behavioral objectives were formulated according to Bloom's revised taxonomy (Anderson & Krathwohl, 2001), encompassing remembering, understanding, applying, and analyzing levels. Validity was established through expert review by 11 philosophy education specialists and educational psychology professors.

Table 4. Distribution of Behavioral Objectives by Bloom's Taxonomy

Chapter	Remember	Understand	Apply	Analyze	Total
Chapter Four	9	12	7	5	33
Chapter Five	10	13	8	6	37
Chapter Six	8	11	6	5	30
Total	**27**	**36**	**21**	**16**	**100**

Lesson Plans

Two distinct instructional models were developed:

a. **Experimental Group:** Discovery learning with five phases: (1) Problem Presentation, (2) Data Collection, (3) Data Analysis, (4) Formulation of Explanations, (5) Reflection and Application.

b. **Control Group:** Traditional instruction with five phases: (1) Introduction and Review, (2) Teacher Presentation, (3) Examples and Illustrations, (4) Guided Practice, (5) Summary and Homework.

Both sets were validated by experts. A total of 30 detailed lesson plans were prepared for each group.

Achievement Test Development

The development required systematic attention to test construction principles and psychometric properties.

Content Analysis: Systematic analysis of Chapters 4-6 identified 100 content elements. A test specification table ensured appropriate item distribution:

Table 5. Test Specification Chart for Achievement Test

Chapter	Content Elements	Focus %	Items	Remember	Understand	Apply	Analyze	Total
Chapter Four	33	33%	12	3	4	3	2	12
Chapter Five	37	37%	13	3	4	4	2	13
Chapter Six	30	30%	10	2	3	3	2	10
Total	**100**	**100%**	**35**	**8**	**11**	**10**	**6**	**35**

Item Development

Initially 40 items were drafted:

- 28 multiple-choice items (four options)

- 12 short-answer items

Items followed established guidelines for clarity, appropriate difficulty, and alignment with objectives.

Validity

Content Validity: Expert panel of 11 specialists reviewed all items:

- 5 philosophy education professors

- 4 educational psychology/assessment professors

- 2 experienced philosophy teachers (10+ years)

Content Validity Index (CVI) = 0.91, indicating excellent validity.

Pilot Testing

Administered to 110 students from Soriya Preparatory School for Girls on September 18, 2024.

Item Analysis:

- Difficulty indices: 0.36 – 0.74 (appropriate range)

- Discrimination indices: 0.35 – 0.78 (all exceeding 0.30 threshold)

Reliability

- **Cronbach's alpha:** $\alpha = 0.86$ (strong internal consistency)

- **Test-retest:** $r = 0.83$, $p<.001$ (strong temporal stability, n=38, two weeks)

Scoring

- Multiple-choice: 1 point correct, 0 incorrect

- Short-answer: 0-2 points based on rubric

- Total: 35 points maximum

Experimental Implementation

Timeline: October 14 – December 20, 2024 (10 weeks)

- 3 lessons per week (80 minutes each)

- 30 total instructional lessons

Teacher: Same teacher for both groups (female, age 37, Master's in Philosophy Education, 14 years experience)

Training: Three-day workshop (September 22-24, 2024):

- Day 1: Discovery learning theory

- Day 2: Five phases with examples

- Day 3: Practice through micro-teaching

Implementation Fidelity:

- 7 classroom observations

- Mean fidelity score: 89% (range: 84-94%)

- All five phases present in every lesson

Discovery Learning Implementation (Experimental Group)

Phase 1: Problem Presentation (10-12 min) Students encountered philosophical problems designed to provoke curiosity and cognitive conflict.

Example: "How can we be certain we're not dreaming right now? What distinguishes waking experience from dreams?"

Phase 2: Data Collection (15-18 min) Students gathered information from textbook, supplementary readings, thought experiments, and historical examples.

Phase 3: Data Analysis (18-20 min) Students analyzed data in small groups (4-5 students), identifying patterns, comparing philosophical positions, evaluating arguments.

Phase 4: Formulation of Explanations (18-20 min) Groups synthesized analysis into coherent positions, constructed arguments, identified evidence, anticipated objections.

Phase 5: Reflection and Application (12-15 min) Groups presented conclusions, class discussed different positions, students reflected on learning and applied concepts to new contexts.

Traditional Instruction (Control Group)

Each 80-minute lesson followed conventional structure:

1. **Introduction and Review (8-10 min):** Teacher stated objectives and reviewed previous material

2. **Teacher Presentation (30-35 min):** Lecture on concepts, theories, philosophers' positions

3. **Examples and Illustrations (15-18 min):** Demonstrations and examination question examples

4. **Guided Practice (12-15 min):** Students worked on textbook exercises

5. **Summary and Homework (5-7 min):** Review key points and assign homework

Data Collection

The achievement test was administered on December 22, 2024, to all participants under standardized conditions. Clear instructions were provided, students directed to respond to all items, sessions conducted in regular classroom environments.

Data Analysis

Data analysis was conducted using SPSS Version 27.0. Primary statistical procedure was independent samples t-test. Additional procedures included paired samples t-test, Cronbach's alpha, and effect size calculations (η^2 and Cohen's d).

Ethical Considerations

Research received formal ethical approval from:

- Ministry of Education, Kurdistan Region (Reference #DE-2024-1687, September 10, 2024)

Parental consent obtained from all participants (93% response rate, 62/67 forms returned with consent). Students provided verbal assent. Confidentiality

maintained through coded identification. Control group offered discovery learning materials after study completion.

RESULTS AND DISCUSSION

Results

Research findings are presented in accordance with stated research hypotheses.

First Hypothesis

H$_{01}$: There is no statistically significant difference at α=0.05 between mean achievement scores of experimental and control groups on post-test.

Table 6. t-test Results for Achievement Post-Test (Between Groups)

Group	N	Mean	SD	t-value	p-value	η² (Eta Squared)
Experimental	31	28.87	3.24	5.874	<.001***	0.36 (Large Effect)
Control	31	23.45	4.16			

*Note: Maximum score = 35. Critical t-value (60 df) = 2.000 at a = 0.05 ***p < .001. η² = 0.36 indicates 36% of variance in achievement scores explained by instructional method (large effect per Cohen, 1988)*

The calculated t-value of 5.874 substantially exceeds the critical value of 2.000, indicating statistically significant difference favoring the experimental group. The experimental group's mean of 28.87 represents 82.5% of maximum score compared to 67.0% for control group—a 15.5 percentage point advantage.

The effect size (η² = 0.36) indicates that 36% of variance in achievement can be attributed to instructional method. According to Cohen's (1988) guidelines, eta squared values of 0.01, 0.06, and 0.14 represent small, medium, and large effects. The obtained value of 0.36 substantially exceeds the large effect threshold, representing very large practical significance.

The smaller standard deviation for experimental group (SD = 3.24) compared to control (SD = 4.16) suggests more consistent performance among discovery learning students.

Decision: Reject the null hypothesis. There is statistically significant difference favoring discovery learning strategy.

Second Hypothesis

H$_{02}$: There is no statistically significant difference at α=0.05 between pre-test and post-test scores for experimental group.

Table 7. Paired t-test Results for Experimental Group (Pre-Post Comparison)

Test	N	Mean	SD	Mean Difference	t-value	df	p-value	Cohen's d
Pre-test	31	16.74	3.58	12.13	16.842	30	<.001***	2.98 (Very Large Effect)
Post-test	31	28.87	3.24					

*Note: Maximum score = 35. Critical t-value (30 df) = ±2.042 at a = 0.05 ***p < .001. Cohen's d = 2.98 represents very large effect size (far exceeds 0.80 threshold)*

The results demonstrate significant improvement from pre-test (M=16.74, SD=3.58) to post-test (M=28.87, SD=3.24), t(30)=16.842, p<.001. The mean difference of 12.13 points represents a 72.5% increase from baseline, with students improving from 47.8% to 82.5% of maximum score.

Cohen's d of 2.98 indicates exceptionally large effect. According to Cohen's (1988) conventions, d values of 0.20, 0.50, and 0.80 represent small, medium, and large effects. The obtained value of 2.98 is nearly four times the large effect threshold, suggesting profound learning gains. This extraordinary effect size indicates that the average student after instruction performed better than 99.9% of students at baseline.

The slight reduction in standard deviation from pre-test (SD = 3.58) to post-test (SD = 3.24) indicates students became more consistent in performance, suggesting discovery learning benefited students across the achievement spectrum.

Decision: Reject the null hypothesis. There is statistically significant improvement from pre-test to post-test for experimental group.

Discussion

The significant findings can be attributed to several key characteristics of discovery learning strategy and its implementation.

Discovery learning's emphasis on active student engagement in constructing knowledge rather than passive reception created optimal conditions for meaningful learning. Research in cognitive science demonstrates that knowledge constructed through active discovery serves as essential prerequisite for genuine understanding (Chi & Wylie, 2014; Dunlosky et al., 2013). The systematic progression through five phases provided students

multiple opportunities to examine concepts from various perspectives while developing deep comprehension.

The emphasis on problem-based learning within the framework proved particularly effective in promoting engagement and conceptual development. Carefully designed activities challenged students to apply knowledge in novel contexts while receiving continuous feedback and support. This aligns with contemporary research showing students achieve deeper understanding when actively constructing knowledge (Freeman et al., 2014; Theobald et al., 2020).

The structured yet flexible learning environment fostered by discovery learning supported both cognitive and social dimensions. Students worked collaboratively on authentic philosophical problems while engaging in meaningful dialogue. This social constructivist approach provided opportunities to articulate thinking, consider alternative perspectives, and refine understanding through negotiation and shared inquiry (Mercer et al., 2019; Michaels et al., 2008).

The reflection component contributed significantly by providing structured opportunities for metacognitive awareness. Students regularly considered what they learned, how thinking changed, what strategies proved effective, and what questions remained. This metacognitive dimension enhanced learning by helping students monitor progress and adjust learning strategies (Panadero, 2017).

Discovery learning's emphasis on genuine philosophical problems that connected to students' experiences and concerns created meaningful learning contexts that enhanced motivation and engagement. Students could see relevance of philosophical concepts to their lives and intellectual development, which increased investment in learning and appreciation for philosophical inquiry (Wartenberg, 2020; Gregory & Laverty, 2018).

The teacher's role as facilitator rather than information transmitter created an environment encouraging student autonomy and intellectual risk-taking. This supported development of philosophical thinking skills and dispositions while helping students develop confidence in their ability to construct understanding independently. Research indicates such environments are particularly effective in promoting both cognitive and affective outcomes (Ritchhart & Church, 2020).

CONCLUSION

The findings provide compelling evidence for the effectiveness of discovery learning strategy in enhancing academic achievement among eleventh-

grade literary students in Principles of Philosophy. The statistically significant differences observed between experimental and control groups on the achievement test demonstrate that this innovative pedagogical approach offers substantial advantages over traditional instructional methods.

The large effect sizes observed for both between-group comparisons ($\eta^2 = 0.36$) and within-group growth ($d = 2.98$) indicate that these differences have practical significance beyond statistical significance. Students who experienced discovery learning demonstrated markedly superior achievement while simultaneously showing more consistent performance. These dual outcomes suggest the framework successfully addresses both depth of understanding and breadth of student success.

The research findings align closely with contemporary theories of learning and instruction emphasizing active knowledge construction, authentic problem-solving, and metacognitive reflection. Discovery learning strategy appears to provide an effective framework for implementing these theoretical principles in practical educational settings while maintaining alignment with curricular standards.

The success of this intervention suggests that philosophy educators should consider adopting pedagogical approaches that prioritize active discovery over passive reception while providing opportunities for students to engage in authentic philosophical inquiry. The integration of structured problem-solving, collaborative investigation, and metacognitive reflection appears particularly important.

These findings have important implications for teacher preparation and professional development programs, which should provide educators with both theoretical understanding of discovery learning principles and practical knowledge of implementation. Successful implementation requires significant shifts in pedagogical thinking and practice that may require sustained support and collaboration among educators.

Recommendations

Based on findings, the researcher proposes several recommendations:

For Educational Practice

1. Philosophy teachers should implement discovery learning strategy or similar active learning approaches, as the consistently large effects suggest substantial benefits over traditional instruction.

2. Educational authorities should organize intensive training workshops for philosophy teachers on discovery learning, including theoretical foundations and practical implementation strategies.

3. Curriculum developers should create comprehensive teacher guides, lesson plan templates, and problem scenarios specifically designed for discovery-based philosophy instruction.

4. Schools should revise philosophy assessments to emphasize higher-order thinking and problem-solving rather than primarily testing recall.

5. Classroom arrangements should facilitate collaborative work, with flexible seating supporting small group investigation and whole-class dialogue.

For Future Research

1. Conduct longitudinal studies examining long-term retention and continued philosophical development 6 months, 1 year, and 2 years post-intervention.

2. Replicate with male students, mixed-gender classes, different grade levels, rural schools, and diverse socioeconomic contexts to assess generalizability.

3. Investigate whether achievement gains in philosophy transfer to other academic domains and real-world contexts requiring critical thinking.

4. Conduct component analysis using dismantling designs to identify which phases of discovery learning contribute most to outcomes.

5. Compare discovery learning strategy versus other active learning approaches for philosophy (Community of Inquiry, Socratic Seminar, Problem-Based Learning).

6. Explore affective outcomes: attitudes toward philosophy, philosophical self-efficacy, intellectual curiosity, and intrinsic motivation for philosophical inquiry.

7. Research optimal professional development models for preparing teachers, identifying essential competencies and effective training approaches.

8. Examine whether the strategy differentially benefits students with various characteristics (prior achievement levels, learning styles, cognitive abilities).

For Policy Makers

1. Revise curriculum standards to emphasize active discovery and higher-order thinking alongside content knowledge in philosophy education.

2. Allocate resources for piloting and scaling discovery learning approaches, including funding for professional development and instructional materials.

3. Redesign standardized philosophy examinations to assess problem-solving, analytical thinking, and philosophical reasoning rather than primarily recall.

4. Incorporate discovery learning pedagogy into pre-service teacher education programs for philosophy teachers.

5. Commission large-scale studies examining effectiveness and feasibility across the educational system.

Future Directions

Future research should explore long-term effects of discovery learning strategy implementation on student achievement, motivation, and continued engagement with philosophy. Additionally, investigation of the strategy's effectiveness across diverse educational contexts and student populations would provide valuable insights into generalizability and adaptability.

Research examining the specific components of the framework that contribute most significantly to positive outcomes could inform efforts to refine and optimize implementation strategies. The development of comprehensive professional development programs and instructional resources to support widespread implementation represents an important area for future work.■

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