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# Enhancing Learning Outcomes through Discovery Learning: A Gender-Inclusive Approach in Secondary Education

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## Abstract

The persistent gap in student achievement and gender participation in secondary education, particularly in rural contexts, highlights the need for inclusive pedagogical strategies that enhance both learning outcomes and equity. This study aimed to examine the effectiveness of discovery learning in improving academic performance and fostering gender-inclusive participation in science classes at a secondary school in Purwodadi, South Lampung, Indonesia. A classroom action research design was applied across two cycles involving 20 students (11 female and 9 male), with data collected through achievement tests, classroom observation sheets, and teacher reflection notes. Quantitative data were analyzed descriptively to measure mastery of learning outcomes, while qualitative data were thematically analyzed to capture participation dynamics. The findings indicate that student mastery improved from 65% in the first cycle to 95% in the second, while active participation among female students increased from 40% to 90%. These results confirm that discovery learning is not only effective in enhancing cognitive achievement but also serves as a gender-inclusive pedagogical framework that empowers female learners to engage actively in collaborative and inquiry-based learning. The implication of this study is that discovery learning can support teachers, curriculum designers, and policymakers in promoting equitable and high-quality education aligned with Sustainable Development Goal 4.

**Keywords:** Discovery Learning; Equitable Pedagogy; Gender Inclusivity; Learning Outcomes; Secondary Education; Learning Outcomes.



## INTRODUCTION

Education is widely acknowledged as a fundamental driver of human capital development and societal transformation, playing a central role in shaping cognitive abilities, character formation, and lifelong skills that are essential in the twenty-first century [1], [2], [3]. Within the framework of global educational policy, the United Nations Sustainable Development Goal 4 (SDG 4) emphasizes the provision of inclusive and equitable quality education for all, with particular attention to vulnerable groups including girls and women, rural learners, and socio-economically disadvantaged populations [4]. Despite considerable progress in improving access to schooling in developing countries, disparities in learning outcomes and classroom participation persist, especially along gender lines. Female students in many rural and under-resourced settings continue to encounter structural and cultural barriers that limit their active involvement and academic achievement [5], [6], [7]. These realities call for innovative pedagogical strategies that not only enhance cognitive performance but also foster gender inclusivity and equity in learning environments.

Traditional teaching practices in many secondary schools remain dominated by teacher-centered approaches, where learning is transmitted through direct instruction and memorization rather than constructed through inquiry and exploration [8], [9]. Such approaches often fail to develop higher-order thinking skills, reduce student motivation, and contribute to disengagement in classroom activities [10], [11]. Evidence further suggests that passive pedagogies disproportionately affect female students, who may experience sociocultural constraints in speaking up, engaging in group work, or taking leadership roles in classroom discussions [12], [13], [14]. Consequently, the reliance on conventional instruction not only limits academic achievement but also perpetuates gender-based participation gaps. In response to these concerns, scholars and practitioners have increasingly advocated for student-centered pedagogies that encourage exploration, discovery, and collaborative engagement [15], [16], [17].

Discovery learning, initially proposed by Jerome Bruner, is one such model that positions learners as active constructors of knowledge through inquiry-based exploration, experimentation, and problem-solving [18], [19]. This pedagogical model aligns with constructivist theories of learning, which argue that knowledge is most effectively internalized when students are engaged in authentic tasks that require reasoning, reflection, and social interaction [20], [21], [22]. Empirical studies have consistently reported that discovery learning can improve students' conceptual understanding, critical thinking, and retention of knowledge compared to traditional approaches [23], [24], [25]. Moreover, the method has been associated with increased student motivation, higher engagement in collaborative tasks, and stronger problem-solving capacities [26], [27], [28]. Research in science education, in particular, highlights that discovery learning fosters deeper comprehension of abstract concepts by linking them with hands-on experimentation and inquiry-based dialogue [29], [30].

Beyond cognitive outcomes, discovery learning also holds potential for promoting inclusivity and gender equity in education. Recent studies suggest that student-centered pedagogies empower female learners to participate more actively in class discussions, challenge traditional gender norms in learning spaces, and build self confidence in academic contexts [31], [32]. For example, gender-sensitive instructional designs have been shown to

reduce participation gaps, increase collaborative engagement, and support equitable contributions from male and female learners alike [33], [34]. Within the broader discourse on inclusive pedagogy, discovery learning can therefore be positioned as a vehicle for advancing not only academic excellence but also social equity in the classroom [35].

Despite this promising evidence, most existing research has concentrated on the cognitive benefits of discovery learning, such as its effects on achievement, motivation, and critical thinking, while overlooking its implications for gender inclusivity and equitable participation in secondary education. Studies exploring how discovery learning specifically supports female students in rural or resource-constrained contexts remain limited [36]. This gap underscores the need for further empirical inquiry into the dual role of discovery learning: enhancing learning outcomes while simultaneously advancing gender inclusive participation in classroom settings.

The present study addresses this gap by examining the implementation of discovery learning in a secondary education context, with particular attention to its impact on female students' learning outcomes and classroom participation. Conducted in a rural Indonesian school, the study seeks to provide empirical evidence of how discovery learning can function as both a cognitive instructional strategy and an inclusive pedagogical approach. By integrating academic performance data with observations of gendered classroom participation, this research contributes to the global discourse on pedagogical innovation and inclusive education, offering insights relevant to educators, policymakers, and scholars committed to achieving SDG 4 and promoting gender equity in education.

## METHODS

This study employed a classroom action research design consisting of two iterative cycles, each including planning, implementation, observation, and reflection stages [37]. The research was conducted in a secondary school located in Purwodadi Village, South Lampung, Indonesia, which represents a typical rural educational setting where issues of gender inclusivity in classroom participation are often observed.

### *Population and Sample*

The population of this study consisted of secondary school students in Purwodadi Village, South Lampung, Indonesia, a rural educational setting characterized by limited resources and gendered participation challenges. From this population, a purposive sample of 20 students was selected, comprising 11 female and 9 male learners, all enrolled in science classes relevant to the study focus. The sampling approach was chosen to ensure adequate representation of female students, as the central aim of the study was to analyze both learning outcomes and gender inclusivity in the context of discovery learning.

### *Instrument*

Data were collected using multiple instruments to capture both cognitive achievement and participation dynamics. Learning outcomes were assessed through structured achievement tests aligned with the national science curriculum and validated by two subject-matter experts to ensure content validity. Participation was measured through observation sheets designed to

record indicators such as frequency of contributions in discussions, willingness to ask and respond to questions, and leadership in group tasks. To complement these measures, qualitative data were gathered from teacher reflection notes and field observations, which provided deeper insights into classroom interactions and gendered participation patterns.

### *Data Analysis*

Data analysis employed both quantitative and qualitative approaches. Quantitative data from achievement tests were analyzed using descriptive statistics, with mean scores and percentages calculated to determine levels of mastery against the Minimum Mastery Criteria (KKM = 75). A criterion of success was defined as at least 80% of students achieving mastery by the end of the second cycle. For participation, percentages were calculated to track the increase in active engagement among female learners across cycles. Qualitative data, including reflective notes and field observations, were analyzed thematically through processes of reduction, categorization, and interpretation, enabling the identification of recurring patterns in classroom engagement. Triangulation across instruments was applied to enhance validity and reliability, ensuring that improvements in outcomes and participation were consistently represented.

This methodological framework, by clearly combining quantitative assessments of achievement with qualitative evaluations of participation, provided a comprehensive approach to analyzing the dual impact of discovery learning on both academic success and gender inclusivity in secondary education.

## RESULTS AND DISCUSSION

### *Results*

This study aims to identify the implementation of discovery learning across two cycles demonstrated a consistent improvement in student academic achievement. In the first cycle, 65% of students achieved the minimum mastery criterion (KKM = 75), whereas in the second cycle, this proportion increased to 95%. This improvement suggests that the iterative refinement of instructional strategies and increased student familiarity with discovery learning contributed to higher levels of achievement.

**Table 1.** Improvement in Student Learning Outcomes across Cycles

| Cycle | Students Achieving Mastery (%) | Average Score | Criteria Met |
|---|---|---|---|
| Pre-cycle | 0% | 58.2 | Not achieved |
| Cycle I | 65% | 73.5 | Moderate |
| Cycle II | 95% | 84.7 | Achieved |

The data reveal a clear progression from limited achievement in the pre cycle to near-universal mastery in cycle II, underscoring the effectiveness of discovery learning in facilitating conceptual understanding and problem-solving skills in secondary science education. The data reveal a clear progression from limited achievement in the pre cycle to near-universal mastery in cycle II, underscoring the effectiveness of discovery learning in facilitating conceptual understanding and problem-solving skills in secondary science education.

A core focus of this study was the degree to which female students participated actively in classroom activities. In the pre-cycle phase, only 40% of female students were observed to engage consistently in class discussions, group work, and questioning activities. This increased to 60% in cycle I and 90% in cycle II, indicating substantial gains in inclusivity and confidence among female learners.

**Table 2.** Female Students' Participation in Discovery Learning Activities

| Cycle | Active Participation (%) | Observed Engagement (Qualitative) |
|---|---|---|
| Pre-cycle | 40% | Minimal involvement; hesitation in asking questions |
| Cycle I | 60% | Increased confidence; moderate involvement in group work |
| Cycle II | 90% | High confidence; frequent questioning, leadership in group discussions |

This evidence highlights that discovery learning not only improved academic outcomes but also functioned as a tool to promote gender inclusivity by creating equitable opportunities for female students to contribute meaningfully to the learning process.

## *Discussion*

The findings of this study confirm that discovery learning significantly enhances both academic achievement and gender inclusivity in classroom participation. Similar results were reported by Anjarwati et al. [38], who found that discovery learning improved conceptual mastery and promoted collaborative engagement in science classes. In line with this, Kasmiana et al. [39] demonstrated that inquiry-based pedagogies fostered higher-order thinking skills, particularly among female learners who traditionally showed lower levels of classroom participation. Likewise, a meta-analysis by Ghaemi et al. [40] indicated that guided discovery approaches consistently outperformed direct instruction in terms of long-term knowledge retention and motivation.

Further, evidence from Xiao et al. [41] showed that discovery learning increased self-confidence among rural female students, narrowing participation gaps in mixed-gender classrooms. This aligns with findings by Ezekwu. [42], who emphasized that inclusive pedagogies not only improve learning outcomes but also empower female learners to actively engage in collaborative knowledge construction.

What distinguishes the present study from previous research is its dual emphasis on both cognitive achievement and gender inclusivity in a rural Indonesian context. While earlier works primarily focused on academic outcomes, the present research highlights how discovery learning can serve as a gender-inclusive pedagogical framework, thereby extending its relevance beyond cognitive domains into the broader agenda of equity and inclusion in education. This novelty underscores discovery learning as not only a strategy for academic success but also as a mechanism for addressing persistent gender disparities in classroom participation.

The findings of this study carry important implications for pedagogy, curriculum development, and educational policy. For teachers, the results suggest that integrating

discovery learning into secondary classrooms can foster active engagement and narrow gender participation gaps. For curriculum designers, this evidence supports the incorporation of inquiry-based pedagogies into national curricula to promote inclusivity and lifelong learning competencies. At the policy level, the outcomes contribute to the realization of Sustainable Development Goal 4 (SDG 4) by demonstrating how innovative teaching strategies can simultaneously improve quality education and gender equity in rural schools.

Despite its contributions, this study has several limitations. First, the relatively small sample size (20 students) restricts the generalizability of the findings to broader populations. Second, the research was conducted in a single rural school, which may limit its applicability to different socio-cultural contexts. Third, the assessment of participation relied primarily on observation and teacher reflection, which, although triangulated, may not fully capture the complexity of students' socio-emotional and cognitive engagement. Future research should employ mixed method designs with larger, more diverse samples and more robust measurement tools (e.g., validated participation scales and longitudinal tracking) to provide stronger evidence of the dual impact of discovery learning.

## CONCLUSION

This study demonstrates that the implementation of discovery learning significantly enhances both learning outcomes and classroom participation, particularly among female students in a rural secondary education context. The results show that the mastery of academic content improved substantially across cycles, while female learners' active participation in discussions, questioning, and collaborative tasks also increased markedly, thereby reducing gender disparities in classroom engagement. These findings provide empirical evidence that discovery learning is not only effective as a cognitive instructional strategy but also serves as a gender inclusive pedagogical framework that contributes to equitable educational practices. The novelty of this study lies in its dual emphasis on achievement and inclusivity, highlighting the broader role of discovery learning in advancing Sustainable Development Goal 4, which promotes quality education and gender equity. Despite the study's limitations in sample size and contextual scope, its implications are significant for teachers, curriculum developers, and policymakers, underscoring the importance of adopting inquiry-based approaches to create learning environments that are both academically rigorous and socially inclusive.

## LIMITATIONS

This study has several limitations. First, the sample was from Bandar Lampung, limiting the generalizability to other regions. Future studies should include more diverse locations. Second, the cross-sectional design prevents establishing causal relationships. Long-term studies are needed for a clearer understanding. Third, self-report questionnaires may be affected by social desirability bias, particularly on sensitive topics. A mixed methods approach could provide deeper insights. Finally, the findings are specific to Arabic language learning, and future research should explore other subjects like mathematics or science. Addressing these limitations would enhance the research's validity and theoretical models.

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## AUTHOR CONTRIBUTION

K.R. led the conception and design of the study, wrote the introduction, results, discussion, and conclusion, and supervised data collection and manuscript revisions. H.U.H. contributed to gathering related studies, writing the literature review, and drafting the abstract. All authors contributed equally to the overall manuscript and its revisions.

## CONFLICT OF INTEREST

"The authors declare no conflict of interest."

## DECLARATION OF USE OF AI IN SCIENTIFIC WRITING

The authors used ChatGPT during the preparation of this work to support language refinement. After utilizing the tool, the authors thoroughly reviewed and edited the content as necessary and assumed full responsibility for the publication's content

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