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Attitudes of Science Teachers Towards Inquiry-Based Methods

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ABSTRACT

This study explores the attitudes of secondary-level science teachers toward inquiry-based teaching methods, aiming to understand their perceptions, beliefs, and readiness to implement such pedagogies in classroom settings. Inquiry-based methods emphasize student-centered exploration, critical thinking, and active engagement with scientific phenomena. Despite the documented benefits of inquiry learning for deep conceptual understanding and scientific literacy, widespread adoption remains limited, often due to teacher-related factors. A cross-sectional survey design was employed, gathering quantitative data from 350 science teachers across urban and rural schools. The instrument—a 30-item Likert-scale questionnaire—assessed dimensions including perceived efficacy, self-efficacy, resource availability, and perceived barriers. Data analysis incorporated descriptive statistics, factor analysis, and inferential tests (t-tests, ANOVA) to examine demographic differences.

Fig.1 Inquiry-Based Methods,Source([1])

Results reveal generally positive attitudes, with high scores on beliefs about the value of inquiry for student engagement and learning outcomes. However, moderate self-efficacy scores and concerns about constraints—such as limited time, large class sizes, and lack of materials—indicate areas for professional development. Significant differences emerged by teaching experience and school context, with early-career teachers reporting greater enthusiasm but lower confidence, and rural teachers citing more resource-related barriers. The study concludes with recommendations for targeted training programs, institutional support mechanisms, and collaborative communities of practice to bolster teacher confidence and capacity. Implications for policy and future research directions are discussed.

KEYWORDS

Inquiry-based learning; science teachers; teacher attitudes; self-efficacy; professional development; pedagogical innovation

INTRODUCTION

Science education reforms worldwide advocate for student-centered pedagogies that promote inquiry, critical thinking, and authentic problem solving. Traditional teacher-centered, lecture-based approaches—while efficient in content coverage—often fall short in fostering deeper conceptual understanding and scientific reasoning skills. Inquiry-based learning (IBL), grounded in constructivist theories, positions students as active investigators who pose

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questions, design experiments, analyze data, and draw evidence-based conclusions. Such engagement mirrors the practices of working scientists and cultivates not only content knowledge but also scientific habits of mind.

Despite widespread endorsement by curriculum frameworks and policy documents, IBL implementation varies substantially across classrooms. A critical mediator of this variation is teacher attitude. Teachers who perceive inquiry positively and feel confident in its facilitation are more likely to integrate inquiry tasks, scaffold student investigations effectively, and persist through initial challenges. Conversely, teachers holding reservations—about classroom management, assessment complications, or insufficient content knowledge—may revert to didactic strategies.

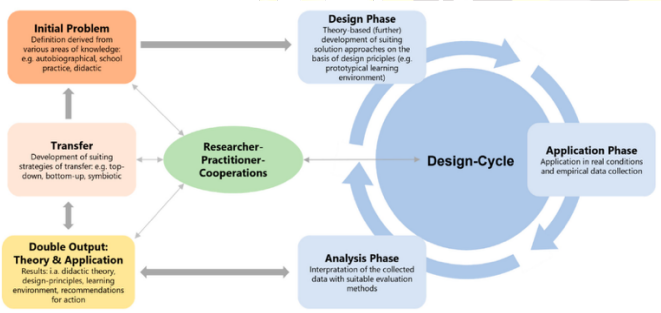

Fig.2 Attitudes of Science Teachers Towards Inquiry-Based Methods,Source([2])

The present study addresses a gap in the literature by systematically assessing the attitudes of science teachers toward IBL across diverse contexts. Whereas prior qualitative investigations provide in-depth narratives of individual teacher experiences, large-scale quantitative studies are fewer, limiting generalizability. Moreover, the interplay between demographic variables (e.g., teaching experience, school location) and attitude dimensions remains under-explored. Understanding these relationships can inform differentiated professional development and support structures.

Research Objectives

1. To measure overall attitudes of secondary science teachers toward inquiry-based teaching methods.
2. To examine sub-dimensions of attitude, including perceived value, self-efficacy, resource availability, and perceived barriers.
3. To analyze demographic differences in attitude scores based on teaching experience, educational qualification, and school context (urban vs. rural).

Research Questions

- What is the general disposition of science teachers toward IBL?
- Which factors most strongly influence teacher attitudes?
- How do attitudes vary across teacher demographics?

By illuminating these facets, the study aims to guide stakeholders—teacher educators, school leaders, and policymakers—in designing targeted interventions that foster a supportive environment for inquiry pedagogy.

LITERATURE REVIEW

Inquiry-based learning (IBL) traces its roots to pedagogical philosophies of John Dewey and Jerome Bruner, who argued that learning occurs most robustly when students actively construct knowledge. Modern frameworks define IBL along a continuum, ranging from structured inquiry (teacher provides question and procedure) to open inquiry (students formulate questions and methods themselves). Meta-analyses confirm that IBL enhances conceptual understanding, motivation, and transfer of learning, particularly in science disciplines where empirical investigation is integral.

Teacher Beliefs and Perceived Value

Teachers' beliefs about the nature of science learning shape instructional choices. When teachers view science as a dynamic, investigative discipline rather than a fixed body of facts, they are more inclined to adopt inquiry activities. Positive correlations have been documented between belief in student autonomy and frequency of inquiry tasks. Furthermore, teachers perceiving IBL as relevant to

real-world problem solving report higher intrinsic motivation to implement it.

Self-Efficacy and Confidence

Bandura's social cognitive theory highlights self-efficacy as a critical determinant of behavior. In the context of IBL, teacher self-efficacy refers to confidence in designing inquiry tasks, facilitating student investigations, and managing associated classroom dynamics. Research indicates that self-efficacy grows through mastery experiences (successful implementation), vicarious experiences (observing peers), and targeted training with feedback. Low self-efficacy often leads to partial implementation or superficial "inquiry-style" lessons that lack genuine student agency.

Resource Constraints and External Barriers

Practical barriers—including large class sizes, limited lab equipment, rigid curricula, and high-stakes testing—are frequently cited impediments to IBL. Studies show that teachers in resource-constrained environments often resort to demonstration-based approaches, citing safety concerns and logistical challenges. Time pressure, both in planning and classroom execution, further discourages comprehensive inquiry units.

Demographic and Contextual Influences

Emerging research points to demographic variables influencing attitudes. Early-career teachers, imbued with recent pedagogical training, may be more open to IBL, yet their limited classroom experience can undermine confidence. Conversely, veteran teachers possess classroom management skills but may adhere to ingrained routines. Urban–rural divides also emerge: urban schools often have better lab infrastructure, while rural teachers report adapting inquiry to outdoor or simulated contexts.

Professional Development Models

Effective professional development (PD) for IBL transcends one-off workshops, emphasizing sustained, collaborative, and practice-focused approaches. Models integrating reflective practice, peer observation, and inquiry design labs show promise in shifting teacher beliefs and practices. Moreover, PD that addresses both content knowledge and pedagogical skills elicits more robust outcomes.

Gaps in the Literature

While qualitative case studies richly describe teacher journeys, there remains a dearth of large-scale quantitative assessments that capture attitude profiles across contexts. Few studies disaggregate attitude components or link them systematically to teacher demographics. The present survey aims to fill this gap, quantifying attitudes and exploring predictors of positive orientation toward IBL.

METHODOLOGY

A cross-sectional survey design was selected to capture a snapshot of attitudes among secondary science teachers. The following subsections detail participants, instrument development, data collection, and analysis procedures.

Participants and Sampling

A target population of science teachers (biology, chemistry, physics) from grades 9–12 was identified. Using stratified random sampling, 20 schools were selected—ten in urban districts and ten in rural districts—to ensure contextual representation. From each school, all science teachers were invited to participate. Of 400 eligible teachers, 350 returned valid questionnaires (response rate 87.5%). Participant demographics: 60% female, 40% male; mean teaching experience 8.2 years (SD = 4.5); 55% held master's degrees in science education.

Instrument Development

A 30-item questionnaire was developed, structured into four subscales:

1. **Perceived Value of IBL (8 items):** beliefs about the importance and effectiveness of inquiry.
2. **Teacher Self-Efficacy (8 items):** confidence in planning, facilitating, and assessing inquiry activities.

3. **Resource Availability (7 items):** perceived adequacy of materials, time, and lab facilities.
4. **Perceived Barriers (7 items):** logistical, curricular, and assessment-related constraints.

Items were framed on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). Face and content validity were established through expert review by three science education professors. A pilot study with 30 teachers yielded Cronbach's alpha coefficients of .84–.90 across subscales, indicating high internal consistency.

Data Collection Procedure

After obtaining institutional permissions and informed consent, questionnaires were administered in paper form during staff meeting sessions. Participants were assured of confidentiality and encouraged to respond candidly. Completed surveys were collected immediately to maximize response rates. Data entry employed double-entry verification to minimize errors.

Data Analysis

Data were analyzed using SPSS (Version 25). Descriptive statistics (means, standard deviations) characterized overall attitude profiles. Exploratory factor analysis (principal axis factoring with oblique rotation) confirmed the subscale structure. Independent-samples t-tests and one-way ANOVA tested differences in attitude scores by gender, teaching experience (categorized as early-career: ≤5 years; mid-career: 6–15 years; veteran: >15 years), and school context. Pearson correlations examined relationships among subscales. Significance was set at $p < .05$.

RESULTS

Descriptive Overview

Overall, teachers reported positive attitudes toward IBL ($M = 4.12$, $SD = .58$). Subscale means were: Perceived Value ($M = 4.48$, $SD = .42$), Teacher Self-Efficacy ($M = 3.78$, $SD = .63$), Resource Availability ($M = 3.52$, $SD = .71$), and Perceived Barriers ($M = 2.95$, $SD = .68$). These figures suggest strong endorsement of inquiry's benefits but moderate confidence and tangible concerns about external constraints.

Factor Structure

Exploratory factor analysis supported a four-factor solution accounting for 68% of total variance. Factor loadings for items ranged from .62 to .87, confirming construct validity of subscales.

Demographic Differences

- **Teaching Experience:** Early-career teachers ($n = 115$) scored higher on Perceived Value ($M = 4.62$) than veteran teachers ($n = 45$; $M = 4.33$; $t(158) = 3.12$, $p = .002$), but lower on Self-Efficacy ($M = 3.55$ vs. $M = 4.02$; $t(158) = –4.28$, $p < .001$). Mid-career teachers ($n = 190$) displayed intermediate scores.
- **School Context:** Urban teachers ($n = 175$) reported greater Resource Availability ($M = 3.82$) than rural teachers ($n = 175$; $M = 3.23$; $t(348) = 7.18$, $p < .001$). Rural teachers expressed higher Perceived Barriers ($M = 3.14$ vs. $M = 2.76$; $t(348) = 4.12$, $p < .001$).
- **Gender:** No significant gender differences emerged across subscales (all $p > .05$).

Correlational Findings

Perceived Value correlated strongly with Self-Efficacy ($r = .61$, $p < .001$) and negatively with Perceived Barriers ($r = –.48$, $p < .001$). Resource Availability also correlated positively with Self-Efficacy ($r = .54$, $p < .001$), indicating that teachers who perceive adequate resources feel more confident.

Qualitative Comments

Open-ended comments (submitted by 120 teachers) echoed quantitative patterns: enthusiasm for student-led exploration, tempered by practical concerns such as "insufficient lab periods" and "difficulty grading open-ended investigations."

CONCLUSION

The findings underscore a generally favorable orientation among secondary science teachers toward inquiry-based pedagogy, affirming its perceived importance for student engagement and conceptual mastery. High perceived value indicates fertile ground for expanding inquiry initiatives. However, moderate self-efficacy and pronounced concerns about resources and barriers highlight critical support needs.

Implications for Practice

1. **Targeted Professional Development:** Workshops should pair inquiry-design training with hands-on practice in real classrooms, offering scaffolds for novices and strategies for veteran teachers to transition out of lecture-driven models. Mentorship programs pairing early-career teachers with experienced inquiry practitioners can build confidence.

2. **Resource Allocation:** School leadership must prioritize lab infrastructure upgrades and allocate dedicated time for inquiry lessons. Shared resource banks and low-cost experimental kits can mitigate material shortages, especially in rural settings.

3. **Collaborative Communities:** Professional learning communities (PLCs) focused on inquiry can foster peer support, resource sharing, and reflective discourse, helping teachers navigate challenges collectively.

Limitations and Future Research

The cross-sectional design precludes causal inferences. Self-report measures may be subject to social desirability bias. Future studies could incorporate classroom observations to triangulate data and longitudinal designs to track attitude changes post-intervention. Exploring student outcomes in tandem with teacher attitudes would further elucidate the impact of pedagogical shifts.

In sum, bolstering teacher self-efficacy and addressing contextual barriers through coherent policy and supportive structures is essential for realizing the transformative potential of inquiry-based science education.

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