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Improving science teacher performance through transformational leadership: A case study at Indonesian public elementary schools

Ai Sumarni, Ade Tutty R. Rosa, Teti Ratnawulan, Agus Mulyanto*

Doctoral Programme, Universitas Islam Nusantara
*Correspondence: E-mail: sumarniai1808@gmail.com

ABSTRACT

The quality of science education in Indonesia remains a critical concern, as reflected in students' low performance in PISA science assessments. One contributing factor is the suboptimal performance of elementary science teachers, which is closely linked to the quality of school leadership. This study investigates how transformational leadership by school principals improves the performance of science teachers (IPA) at SDN Ciparay 07 in Bandung Regency and SDN Ngamprah Kidul in West Bandung Regency. A qualitative case study approach was used, involving 14 participants, including two principals and twelve teachers, selected through purposive sampling. Data were collected through interviews, observations, and documentation, and analyzed using the Miles and Huberman model. The findings show that transformational leadership—through idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration—enhances teacher performance. Improvements include greater use of inquiry-based learning, increased integration of technology, and stronger collaborative planning. The integration of Sanusi's six-value system further strengthens teachers' professionalism and commitment. This study recommends that principals adopt a transformational leadership approach to improve the quality of science teaching.

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1. INTRODUCTION

Science education is a cornerstone of 21st-century learning, yet Indonesia's performance in international assessments continues to lag behind comparable nations. The Programme for International Student Assessment (PISA) 2022 placed Indonesia at rank 70 out of 81 countries in the science domain, underscoring a persistent quality gap that demands systemic intervention (OECD, 2023). At the elementary school level, where foundational scientific literacy is developed, the quality of science teaching (*Ilmu Pengetahuan Alam* [IPA]) is decisive in shaping students' long-term engagement with science (Kanya et al., 2021). Teacher performance, therefore, is not merely an administrative metric but a direct determinant of student learning outcomes in science.

In Indonesian elementary schools, IPA is taught by classroom teachers rather than specialist subject teachers, making their pedagogical competence and motivation particularly critical. However, many elementary classroom teachers report limited mastery of inquiry-based science instruction, inadequate access to laboratory or demonstration equipment, and insufficient professional development opportunities in science pedagogy (Andriani & Puspita, 2021; Fitri, 2021). These deficiencies are often exacerbated by school leadership styles that fail to inspire innovation or support teachers' professional growth (Sulfemi, 2020).

A preliminary study conducted at SDN Ciparay 07 in Bandung Regency and SDN Ngamprah Kidul in West Bandung Regency identified several performance-related challenges among science teachers. At SDN Ciparay 07, teachers reported low motivation to apply innovative approaches in science learning, partly due to an authoritarian leadership style that excluded them from instructional decision-making. Specifically, one teacher expressed that her efforts to develop creative science demonstration materials received no recognition from school leadership. At SDN Ngamprah Kidul, teachers indicated difficulty in adopting updated science curriculum materials and digital tools for science instruction due to the absence of structured training programs. These contextual problems align with documented patterns of science teaching quality deficits in Indonesian elementary schools (Rohman, 2020; Tanjung et al., 2021).

Transformational leadership has been widely recognized as an effective approach for improving teacher performance and instructional quality in schools (Ahmad & Rochimah, 2021; Bellibaş et al., 2021). By inspiring a shared vision, stimulating intellectual growth, and providing individualized support, transformational principals create the conditions under which teachers can develop and sustain high-quality instructional practices (Deng et al., 2023). In the specific context of science teaching, this leadership style encourages teachers to shift from rote-based instruction toward inquiry-oriented and problem-based approaches that align with current science education standards (Iskandar & Rahayu, 2023).

The theoretical framework of this study is the four-component transformational leadership model, including idealized influence, inspirational motivation, intellectual stimulation, and individual consideration (Akbar, 2024). Teacher performance is conceptualized as encompassing lesson planning quality, instructional delivery effectiveness, assessment practices, and professional development engagement (Tanjung et al., 2021). Furthermore, a value system consisting of six values—teleological, ethical, aesthetic, logical, physical-physiological, and theological—is incorporated as a contextual framework reflecting the moral and professional identity of Indonesian educators (Sanusi, 2017). In this study, these six values are referred to as Sanusi's value system.

This study aims to: (1) describe and analyze how each component of transformational leadership is implemented by school principals at SDN Ciparay 07 and SDN Ngamprah Kidul;

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(2) examine the relationship between transformational leadership and the improvement of science teacher performance at both schools; and (3) identify obstacles and propose a hypothetical model for improving science teacher performance through transformational leadership grounded in Sanusi's value system. The novelty of this study lies in its explicit focus on science teacher performance as the outcome variable, and in its cross-site comparative design within the West Java elementary school context—a nexus that has not been previously examined in the transformational leadership literature in Indonesia.

2. METHODS

2.1. Research design

This study uses a qualitative multi-site case study design to explore transformational leadership and its effects on science teacher performance within real school settings.

2.2. Research setting and site selection

The study was conducted at SDN Ciparay 07 (Bandung Regency) and SDN Ngamprah Kidul (West Bandung Regency). Both sites were selected purposively based on: (a) evidence of science teacher performance challenges; (b) principal willingness to participate; (c) comparable school size, accreditation status (both B), and student population; and (d) representativeness of peri-urban West Java public elementary schools.

2.3. Research participants

A total of 14 participants were involved: two principals and 12 science teachers in grades 4–6 (6 per school), each with at least 2 years of teaching experience. Participant profiles are shown in **Table 1**.

Table 1. Research participant profile.

Participant category	SDN Ciparay 07	SDN Ngamprah Kidul	Total
School principal	1 (female, 12 yrs experience)	1 (male, 9 yrs experience)	2
IPA teacher – grade 4	2 (female, >5 yrs)	2 (1 male, 1 female, >4 yrs)	4
IPA teacher – grade 5	2 (female, >3 yrs)	2 (1 male, 1 female, >3 yrs)	4
IPA teacher – grade 6	2 (1 male, 1 female, >4 yrs)	2 (female, >6 yrs)	4
Total	7	7	14

2.4. Data collection

Three instruments were used: (1) semi-structured interviews (45–60 minutes, audio-recorded and transcribed); (2) non-participant classroom observations (24 sessions total, guided by a structured checklist); and (3) documentation including teacher performance appraisal (*Penilaian Kinerja Guru* [PKG]) records, learning implementation plan (*Rencana Pelaksanaan Pembelajaran*), training logs, and meeting minutes.

2.5. Data analysis

Data were analyzed using the interactive model consisting of three simultaneous processes: data condensation, data display, and conclusion drawing (Miles et al., 2014). The codes were mapped to four dimensions of transformational leadership as sensitizing concepts.

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2.6. Validity and trustworthiness

To ensure the credibility, transferability, and reliability of the findings, four strategies were used: (1) source triangulation—comparing data obtained from principals, teachers, and documentation to cross-verify claims; (2) method triangulation—cross-referencing interview data with observation notes and documentary evidence; (3) member checking—returning summarized findings to three key participants (one principal and two teachers per school) to verify the accuracy of interpretations; and (4) peer review—conducting regular analytical discussions with a doctoral colleague not affiliated with the study to reduce researcher bias. An audit trail of all raw data, codes, and analytical memos was maintained throughout the study.

3. RESULTS AND DISCUSSION

The analysis of data collected through interviews, classroom observations, and documentation at SDN Ciparay 07 and SDN Ngamprah Kidul reveals that transformational leadership practices by school principals play a significant role in improving science teacher (IPA) performance. The findings are organized around four dimensions of transformational leadership, with each dimension analyzed through within-case and cross-case perspectives across both schools (Akbar, 2024). The discussion connects empirical findings with relevant theoretical literature and identifies implications for science teacher performance improvement.

3.1. Idealized influence and science teacher performance

Idealized influence refers to leaders' capacity to serve as admired role models whose values, behaviors, and decisions inspire trust and emulation among followers (Deng et al., 2023). At SDN Ciparay 07, the principal demonstrated this through participatory science teaching modeling, joining grade 5 and 6 IPA classes monthly as a co-facilitator and conducting hands-on experiment demonstrations using locally available materials. One grade-5 teacher noted: "When the principal teaches with us, we see that hands-on experiments do not require expensive equipment. That gives us confidence to try." At SDN Ngamprah Kidul, idealized influence was expressed through the establishment of a science corner (*pojok sains*) and the principal's consistent professional conduct as a behavioral reference for staff. As one teacher observed: "Our principal always arrives before anyone else and stays after school to check on teaching preparation. That discipline affects all of us." The principal also maintained transparent communication about science achievement data during monthly staff briefings (Malik et al., 2023). Both schools demonstrated idealized influence through complementary strategies—direct pedagogical modeling at SDN Ciparay 07 and structural-symbolic mechanisms at SDN Ngamprah Kidul—both of which strengthened teacher trust and professional commitment (Armiyanti et al., 2023; Sutrisna et al., 2023).

3.2. Inspirational motivation and science teacher performance

Inspirational motivation involves leaders articulating a compelling vision and communicating high expectations that foster teacher enthusiasm and commitment (Bellibaş et al., 2021). At SDN Ciparay 07, the principal restructured weekly briefings (*apel mingguan*) to include recognition of teachers who implement innovative science lessons, ranging from verbal appreciation to the display of exemplary lesson plans on the notice board. After six months, three grade 4–5 teachers independently developed project-based science modules tied to local environmental themes (Rifa'i, 2020; Supandi, 2023). At SDN Ngamprah Kidul, an

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annual inter-class science fair (*pameran sains*) created a tangible, goal-oriented motivation structure, with observation data showing a measurable increase in demonstration-based and activity-based science lessons in the months preceding the event (Iqbal, 2021). Both approaches significantly enhanced science teachers' instructional engagement and willingness to adopt student-centered practices (Ahmad & Rochimah, 2021).

3.3. Intellectual stimulation and science teacher performance

Intellectual stimulation refers to leadership behaviors that encourage creative thinking and promote innovation in followers' work approaches (Chen & Jiang, 2018). At SDN Ciparay 07, the principal facilitated three IPA-focused professional development workshops in collaboration with the District Education Office regional technical implementation unit (*Unit Pelaksana Teknis Daerah*) and a university faculty, covering inquiry-based learning, differentiated science instruction, and low-cost materials aligned with *Kurikulum Merdeka* (Nurrochman et al., 2023). Post-workshop observations revealed that six of seven teachers began incorporating at least one hands-on activity per IPA topic unit, a significant departure from prior textbook-based instruction (Muspawi, 2021). At SDN Ngamprah Kidul, intellectual stimulation was most visible through digital integration: the school procured four tablets and a portable projector, and in-house technology training was arranged for grade 4–6 teachers. One grade-6 teacher reported: "Before, I never used videos in science class. Now my students ask questions I have to research—that changes how I prepare." Both schools experienced significant instructional shifts, though through different channels—external capacity building at SDN Ciparay 07 and internal technology integration at SDN Ngamprah Kidul—both of which improved the quality and depth of science instruction (Bellibaş et al., 2021; Iskandar & Rahayu, 2023).

3.4. Individualized consideration and science teacher performance

Individualized consideration reflects the leader's attention to each follower's unique needs, developmental stage, and professional aspirations (Kanya et al., 2021). At SDN Ciparay 07, the principal implemented a structured mentoring program pairing junior and senior science teachers, with fortnightly meetings and monthly one-on-one check-ins covering instructional performance, career aspirations, and well-being. This reduced professional isolation among new teachers and improved lesson plan quality in PKG evaluations (Sancoko & Sugiarti, 2022; Tanjung et al., 2021). At SDN Ngamprah Kidul, individualized consideration was operationalized through competence-based task differentiation: following a competence mapping exercise, teachers were assigned development pathways aligned with their strengths and gaps. For example, a grade-4 teacher strong in visual learning led the science display committee, while a grade-5 teacher with assessment gaps was enrolled in an online assessment course. This targeted approach yielded measurable improvements in assessment diversity across IPA lessons (Fitria & Sutiah, 2024; Kusumawati, 2023). Collectively, both schools confirm that individualized attention enhances teacher agency, professional identity, and the quality of science instruction (Deng et al., 2023).

3.5. Obstacles and solutions in implementing transformational leadership

Despite the positive outcomes, both schools encountered implementation obstacles. **Table 2** presents a cross-case comparison of challenges and responsive solutions across the four dimensions.

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Table 2. Cross-case comparison of transformational leadership implementation at SDN Ciparay 07 and SDN Ngamprah Kidul.

Dimension	SDN Ciparay 07 obstacle / solution	SDN Ngamprah Kidul obstacle / solution
Idealized Influence	Teachers perceived modeling as evaluative / Principal reframed co-teaching as collaborative	Science corner underused / Principal scheduled weekly guided exploration time
Inspirational Motivation	Senior teachers resisted public recognition / Shifted to team-based acknowledgment	Teachers pressured by fair timeline / Fair preparation integrated into lesson planning cycles
Intellectual Stimulation	Limited release time for workshops / School rotated attendance to avoid unsupervised classes	Unequal digital literacy delayed adoption / Peer-assisted technology mentoring pairs formed
Individualized Consideration	Mentoring difficult to schedule / Embedded into existing weekly teacher working group (*Kelompok Kerja Guru*) meetings	Competency mapping caused anxiety / Principal normalized it as a planning tool, not evaluation

The most recurring obstacle across both schools was teacher resistance to change, particularly among experienced teachers who perceived transformational initiatives as implicit criticism of their existing practice (Al Faruq & Supriyanto, 2020; Hermawati et al., 2021). This was successfully addressed by reframing leadership interventions as collaborative professional development rather than performance management (Armiyanti et al., 2023).

3.4. Integration of Sanusi's value system

The integration of Sanusi's value system—teleological, ethical, aesthetic, logical, physical-physiological, and theological—provided a culturally grounded framework for understanding the motivational structures underlying teacher performance improvement (Sanusi, 2017). Teachers who articulated strong teleological values demonstrated consistently higher instructional creativity and persistence. The principal at SDN Ciparay 07 explicitly connected the school's IPA improvement agenda to national education goals (*Indonesia Emas* 2045), aligning teachers' professional identity with broader teleological and theological values, which strengthened intrinsic motivation and reduced susceptibility to burnout (Iqmalia et al., 2022; Xie, 2020). These findings suggest that value-aligned transformational leadership functions not merely as a motivational mechanism but as an ethical and cultural anchor sustaining long-term improvement in science teacher performance within the Indonesian context (Mu'min & Maulida, 2023).

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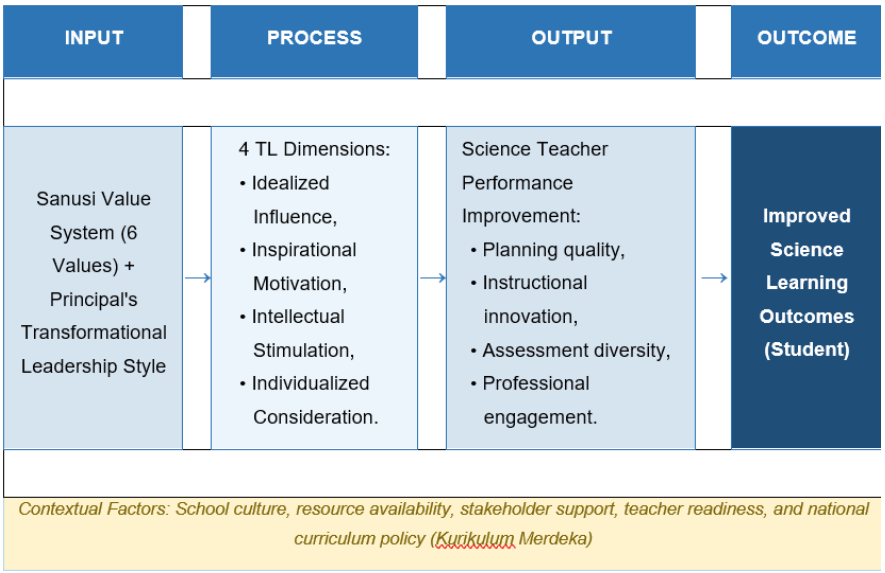

Figure 1. Hypothetical model for improving science teacher performance through transformational leadership based on sanusi's value system.

4. CONCLUSION

This study demonstrates that transformational leadership by school principals effectively improves the performance of science teachers (IPA), as evidenced across all four dimensions—idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration—at both SDN Ciparay 07 and SDN Ngamprah Kidul. Although the specific mechanisms varied across schools, the underlying dynamic was consistent: transformational leadership fostered professional trust and intrinsic motivation, which translated into measurable instructional improvements. The integration of Sanusi's value system further anchored these improvements in shared professional values and a sense of higher educational purpose. The hypothetical model proposed in this study offers a practical framework for principals and education administrators in designing transformational leadership practices oriented toward science teaching quality. At the same time, future research is encouraged to employ mixed-methods or quasi-experimental designs across broader urban and rural school contexts in Indonesia.

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