Transformational Leadership Mechanisms in Enhancing Teacher Performance during Educational Digitalization: A Conceptual Framework Synthesis

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Abstract. Digitalization of education has restructured the learning paradigm, school governance, and teacher competency standards. Although transformational leadership is recognized as a driver of organizational effectiveness, the previous literature is still fragmented on how this leadership style operates when digital competencies and vocational industry expectations are the main outputs. This research aims to critically synthesize the mechanism of influence of transformational leadership on teacher performance in the digitalization era and formulate an integrative conceptual framework. A systematic literature review was conducted with reference to the PRISMA guidelines. Of the 142 records identified from five major databases (Scopus, Web of Science, ERIC, ScienceDirect, and Google Scholar), 26 empirical studies that met the criteria of synthesis and quality assessment were analyzed using thematic coding. The results of the study formulated a conceptual framework for two pathways of influence: (1) direct pathways that increase teachers' morale, commitment, and stress suppression of technology; and (2) indirect mediation channels through digital self-efficacy, psychological empowerment, and organizational learning climate. This study emphasizes the boundary conditions that transformational leadership does not stand alone, but requires integration with instructional leadership and distributed leadership, especially in the context of Vocational High Schools (SMK) which is bound by the differentiation of Industry 4.0/5.0 needs. The theoretical contribution of this manuscript lies in the elaboration of a conceptual framework that extends Bass and Avolio's theories into the DigCompEdu dimension.

Keywords: Transformational leadership, conceptual framework, teacher performance, digital competence, vocational high school, PRISMA.

1 Introduction

The integration of Information and Communication Technology (ICT) including cloud computing, Learning Management Systems (LMS), big data analytics, and gen-erative Artificial Intelligence (AI) has fundamentally transformed the education eco-system [1, 2]. This change expands the professional burden of teachers who are now

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required not only to master conventional pedagogical competencies, but also to integrate the Digital Competence Framework for Educators (DigCompEdu) into the planning, implementation, and evaluation of data-based learning [3, 4].

In Indonesia, national policies such as the Independent Teaching Platform (PMM) demand the adaptation of technology at all levels of education. This challenge is most crucial in the context of Vocational High Schools (SMK) [5]. Unlike public schools, vocational schools are directly tied to the level of precision and technological differentiation of the Business and Industrial World (DUDI) in the industry 4.0 and 5.0 era. The performance of vocational teachers is not only measured by academic achievement, but also by their ability to operate digital simulators and modern industrial automation [5]. The digital competency gap between teachers often stems from the absence of structured training, limited infrastructure, and the non-optimal role of school leadership as an agent of change [2, 4].

The transformational leadership model [6,7] is often proposed as a solution to encourage teacher performance in situations of fundamental change [8]. Transformational leaders are thought to be able to build a collective vision, foster intrinsic motivation, provoke intellectual stimulation, and provide individual consideration [8, 9, 10, 11]. However, a critical review of the previous literature reveals two main research gaps:

a. Dominance of Single Positive Narratives: Most literature tends to assume an always positive linear relationship between transformational leadership and teacher performance, without in-depth analysis of boundary conditions or cases when this leadership style is ineffective [21].
b. Conceptual Fragmentation in Vocational/Digital Contexts: There is a scarcity of an integrated conceptual framework that maps the dimensions of transformational lead-ership precisely with the field of educator digital competence (DigCompEdu) and in-dustry expectations in vocational education [2, 4, 11, 17].

To fill this gap, this study synthesizes a systematic literature to formulate a conceptual framework that explains the direct mechanisms, mediation pathways, and limiting con-ditions of transformational leadership in the digitalization era. Specifically, this study aims to:

a. Analyze the direct and indirect mechanisms that link principal transformational leadership to teacher performance.
b. Mapping the transformational leadership dimension into DigCompEdu's digital competency area.
c. Identify boundary conditions and specific characteristics of transformational leadership in the context of vocational schools that refer to DUDI standards.

2 Research Method

2.1 Research Design

This study is a Systematic Literature Review (SLR) with a qualitative-synthetic descriptive approach [12]. The manuscript reporting and screening protocol is strictly prepared following the guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

2.2 Data Sources and Search Strategies (Boolean Search)

Systematic searches were carried out on five internationally and nationally reputable databases: Scopus, Web of Science (WoS), ERIC, ScienceDirect, and Google Scholar. Search points use the Boolean Operator combination syntax in English and Indonesian as follows:

("transformational leadership" OR "school leadership" OR "principal leadership") AND ("teacher performance" OR "instructional innovation") AND ("digital competence" OR "DigCompEdu" OR "educational digitalization" OR "educational technology") AND ("vocational school" OR "SMK" OR "secondary education")

2.3 Selection Process and Quality Assessment

a. Article selection was carried out through four stages of PRISMA (Figure 1). To ensure credibility and methodological transparency:
b. Inter-Reviewer Screening Process: The initial screening of titles and ab-stracts is carried out independently by two reviewers (RU and SH). Any disa-greement (discrepancy) is resolved through discussion with the third reviewer (KCK) until an inter-rater consensus level is reached (>90%)
c. Quality Assessment (QA): 45 full-text articles were evaluated against quality assessment criteria adapted from the MTI (Critical Appraisal Skills Programme). QA indicators include: (1) clarity of problem formulation, (2) accu-racy of research methodology, (3) instrumental/data collection reliability, and (4) contribution to theory/practice. Articles that do not meet the standards of methodological rigor are set aside.

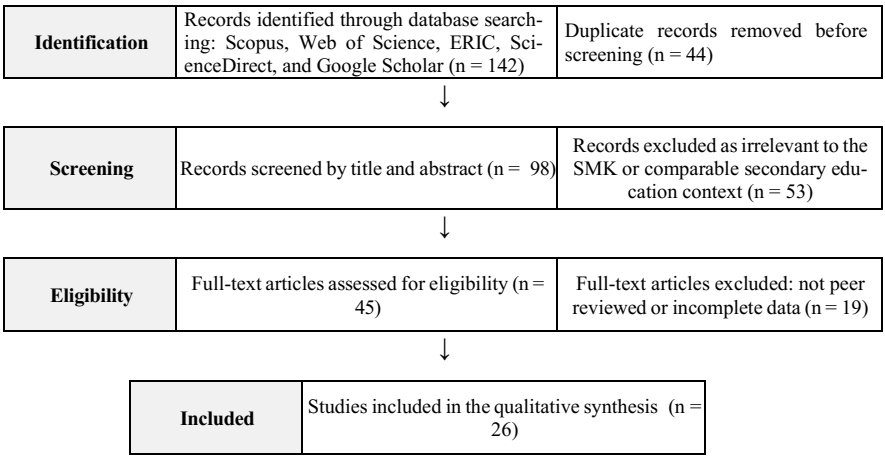


Fig. 1. PRISMA flow diagram of the study selection process, showing the number of records identified, screened, assessed for eligibility, and finally included in the review, together with the reasons for exclusion at each stage.

2.4 Inclusion and Exclusion Criteria

The criteria below were applied so that what entered the synthesis would be both relevant and trustworthy.

Inclusion criteria:

a. Published in the range 2015–2026.
b. Discuss transformational leadership variables, digital competencies, teacher performance, or teaching innovation.
c. Empirical research articles in peer-reviewed indexed/accredited journals.
d. Full text in English or Indonesian.
e. Focus on vocational schools or equivalent secondary education.

Exclusion criteria:

a. Non-peer-reviewed publications (partial proceedings abstracts, thesis drafts, or opinion articles);
b. Research of universities that have no connection with vocational education;
c. Manuscripts with incomplete or ambiguous reporting methods.Articles for which only an abstract could be obtained.

2.5 Data Analysis

The data synthesis process uses a thematic coding approach in stages:

a. Extraction of study characteristics.
b. Open coding to extract empirical findings.
c. Axial coding to group influence pathways (direct, indirect/mediate, and moderation), and
d. Selective coding to build an integrative conceptual framework.

3 Results and Discussion

3.1 Conceptual Framework of the Research Variables

Based on the synthesis of 26 selected studies, the characteristics of the entire literature are summarized in Table 1.

Table 1. Matrix of Characteristics of Reviewed Empirical Studies.

Ref.	Author and Year	Methodology and Context	Key Syntesis find-ing
[1]	Redecker and Punie (2017)	Framework development; European educational policy	Formulating 6 areas of digital compe-tence for educators
[3]	Caena and Redecker (2019)	Conceptual analysis; alignment of 21st-century compe-tences	Alignment of digital competencies with professionalism pol-icies
[4]	Beardsley et al. (2021)	Mixed methods (N = 312 teachers); post-pandemic context	Transformational leadership improves teachers' digital self-efficacy.
[5]	Syarif and Janata (2024)	Qualitative descriptive; vocational schools	The need to syn-chronize vocational technology with

Ref.	Author and Year	Methodology and Con-text	Key Syntesis find-ing
		(SMK) and Industry 4.0	DUDI standards.
[9]	Ross and Gray (2006)	Quantitative structural model (N = 3,042 teach-ers); efficacy paths	Leadership affects performance via the collective efficacy of teachers.
[10]	Leithwood & Jantzi (2008)	Quantitative (N=1.200) Student Learning	Indirect influence of leadership through the school climate
[11]	Hallinger (2011)	Systematic review of 40 years of empirical research	Integration of in-structional and transformational leadership.
[13]	Koh et al. (1995)	Quantitative surveyn(N = 846 teachers in 89 schools)	The direct influence of leadership on or-ganizational com-mitment.
[14]	Handford & Leithwood (2013)	Quantitative (N=450) Teacher Trust	Idealized Influence membangun organi-sational trust.
[16]	Mutiara et al. (2024)	Quantitative (N=85) SMK (Indonesia)	Competence and discipline affect teacher perfor-mance.
17]	Basilotta-Gómez-Pablos et al. (2022)	Systematic review (56 peer-reviewed articles analysed)	Mapping the level of teachers' digital competence at the global level.
[18]	Bakker et al. (2023)	Quantitative daily diary design (N = 178 respondents)	Daily leadership dictates the teach-er's daily morale and performance.
[19]	Breevaart & Bakker (2018)	Quantitative, Job Demands-Resources	Leadership sup-presses the anxiety of adopting new technologies.
[20]	Karimi et al. (2023)	Quantitative SEM (N=240), Work Innova-tion	Psychological capi-tal mediates leader-ship and innovation.
[21]	Pieterse et al. (2010)	Quantitative (N=230), Innovation Moderation	Leadership is inef-fective without psy-chological empow-erment.
[22]	Gong et al. (2009)	Quantitative SEM (N=195), Employee Crea-tivity	Creative self-effi-cacy mediates trans-formational leader-ship.
[23]	Sliwka et al. (2024)	Qualitative Cases,	Transformational leadership shapes
[24]	Valverde-Berrocoso et al. (2021)	Quantitative Surveys, School ICT Integration	The readiness of school culture deter-mines the adoption of ICT.
[25]	Marks & Printy (2003)	Quantitative Multilevel, School Performance	Transformational and instructional leadership synergy.
[26]	Hulpia et al. (2011)	Quantitative (N=1.518), Distributed Leadership	Distributed leader-ship increases teacher commit-ment.

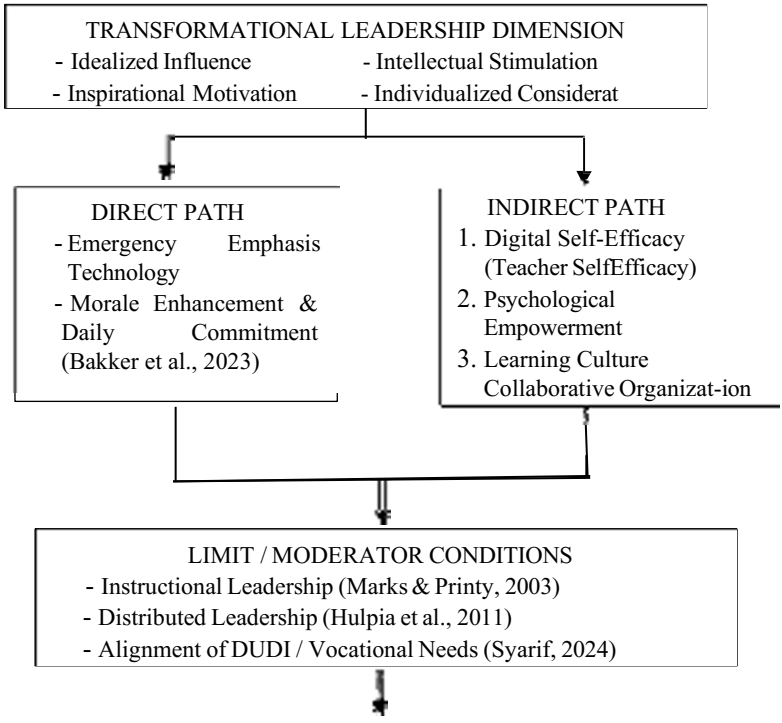
3.2 Mapping the Transformational Leadership Dimension to the DigCompEdu Area.

To generate new theoretical contributions, the 4 dimensions of transformational leadership [8] are conceptually mapped into the 6 areas of digital compe-tence of DigCompEdu [1, 3] in the context of SMK:

a. Idealized Influence Professional Engagement. → Principals who transpar-ently utilize digital platforms build professional credibility and foster organi-sational trust [14], which encourages teachers to emulate the adoption of the technology.
b. Inspirational Motivation Digital Pedagogy & Resources: → An inspiring vision transforms teachers' perceptions from treating ICT as an administrative burden to a means of instructional enrichment [10, 11].
c. Intellectual Stimulation Digital Assessment & Empowering Learners: → Intellectual stimulation provokes teachers to explore new digital assessment instruments as well as apply technology-integrated learning methods without fear of failure [8, 20].
d. Individualized Consideration Facilitating Learners' Digital Competence: →Through individualized coaching, principals help vocational teachers overcome specific technical barriers according to their skill cluster [3, 14].

3.3 Integrative Conceptual Framework

A thematic synthesis of 26 empirical articles resulted in a Conceptual Framework for Digital Transformational Leadership as illustrated in Figure 2.



PERFORMANCE OF VOCATIONAL TEACHERS
- DigCompEdu-Based Instructional Innovation
- Mastery of Industry Standard Digital Tools (DUDI)

Figure 2. Conceptual Framework for the Synthesis of Transformational Leader-ship Mechanisms in Improving Teacher Performance in the Digital Era.

3.4 Critical Analysis, Finding Inconsistencies, and Boundary Constraintsy.

In contrast to conventional literature reviews that are single-narrative, the results of the synthesis critically reveal **empirical inconsistencies and boundary conditions:**

a. Critique of Teacher Autonomy (Psychological Empowerment): Pieterse et al. [21] found that transformational leadership does not automatically increase innovation. When teachers experience limited operational autonomy (low psychological empowerment), transformational encouragement from the principal actually triggers anxiety and negatively impacts performance.
b. The Need for Instructional Leadership Integration: Marks and Printy [25] as-sert that transformational leadership that focuses too much on abstract visions without direct involvement in the curriculum (instructional leadership) fails to transform teaching practices in the classroom.
c. Differentiation of Vocational Contexts and DUDI Standards: In vocational schools, the success of technology adoption is highly dependent on alignment with the industry [5]. Vocational school principals are required to practice distributed leadership [26] by involving the head of the expertise program who understands specific technical skills.

4 Conclusion and Recommendation

4.1 Conclusion

The limitation of this study lies in the nature of its analysis which is based on secondary data. The future empirical research agenda needs to test quantitatively (Structural Equation Modeling) this conceptual framework longitudinally in a sample of vocational schools in various regions of Indonesia by placing digital self-efficacy and psychological empowerment as mediation/moderation variables.what its leader makes possible. Treating transformational leadership as a core competence of vocational principals is therefore not an administrative preference. It is a condition of the thing working at all.

4.2 Practical Implications and Recommendations

Three measures follow for the management of vocational high schools, including institutions within the scope of Universitas Sarjanawiyata Tamansiswa (UST).

a. Digital-Based Leadership Training Model: Vocational principal preparation programs should integrate digital instructional leadership and technology change

management, not just general management theory.
b. Strengthening Teacher Autonomy and Efficacy: Schools need to provide a safe space for teachers to experiment with digital technologies without the worry of administrative sanctions.
c. Vocational-DUDI Alignment: Principals should facilitate strategic partnerships with DUDI to ensure digital devices adopted in vocational schools are relevant to the needs of the cutting-edge industry.

4.3 Limitations and Future Research Agenda

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