

The Influence of Principal Servant Leadership on Teacher Motivation in Developing 21st Century Learning: A Case Study at SMK Muhammadiyah Jatibarang, Indramayu

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Abstract

Social changes in education in the 21st century encourage school principals to act as servant leaders who foster teacher motivation. However, leadership practices in vocational high schools (SMK) still tend to be administrative and fail to empower teachers to innovate. This study aims to (1) describe the implementation of servant leadership by the principal, (2) analyze the level of teacher motivation in developing 21st-century learning, and (3) test the effect of servant leadership on teacher motivation at SMK Muhammadiyah Jatibarang, Indramayu. The study used a mixed-methods explanatory sequential design with 35 teachers as the quantitative sample (saturated sampling), and the principal, purposively selected through extreme-case and maximum-variation sampling, as qualitative informants. Quantitative data were analyzed using descriptive statistics, Pearson correlation, and linear regression, while qualitative data were analyzed using the Miles, Huberman, and Saldaña model. The results showed that servant leadership (84.4 % of the ideal score) and teacher motivation (81.2% of the ideal score) were in the very high category. Servant leadership had a significant positive effect on teacher motivation ($Y = 41.527 + 1.037X$; $r = 0.782$; $R^2 = 0.612$; $t = 7.212$; $p < 0.05$), confirming the qualitative findings that empowerment, professional support, and moral role models were the main mechanisms. This research contributes to the expansion of servant leadership theory and self-determination theory in the context of Islamic value-based vocational education. It offers a strategic leadership model for vocational school principals to encourage motivation and innovation in 21st-century learning.

Keywords: Servant Leadership, Teacher Motivation, 21st Century Learning, Principal, Vocational High School

INTRODUCTION

Comprehensive improvement in the quality of education requires a relevant curriculum, innovative pedagogy, educator competence, and a conducive learning ecosystem as prerequisites for developing competent, creative, and globally competitive human resources (Iqbal et al., 2024). Vocational High Schools (SMK) play a strategic role as a link between education and industry through real-world, practice-based learning. However, the implementation of vocational education is still overshadowed by serious problems, including limited practical facilities that cause only around 35% of SMKs to meet the minimum standards for learning facilities (Abdullah, 2018; Maslakhah & Saryanto, 2024), which contribute to the gap between graduate competencies and the needs of the workforce (Byrne et al., 2018; Utama et al., 2025). On the other hand, the transformation of education in the digital era demands mastery of 21st-century competencies that include the 4C (critical thinking, creativity, communication, and collaboration), digital literacy, and adaptive vocational competencies (Anwar et al., 2024), so that teachers are required to act as agents of change who integrate these competencies into innovative and contextual learning.

Current issues further emphasize the urgency of conducting this research. The government, through the Ministry of Primary and Secondary Education, has prioritized the "Vocational School of the Future" program, the integration of coding and artificial intelligence, and deep learning in its 2025 vocational education policy. It also simplifies the performance management system for teachers, principals, and supervisors, thereby promoting effective leadership in educational units (Fadlil et al., 2023). This policy requires principals not only to adapt to the acceleration of digital technology but also to maintain and foster teacher motivation amid rapid change. Recent studies have shown that the revitalization of vocational education based on Industry 4.0 still faces structural issues, such as limited industry experience among teachers and weak job readiness among vocational school graduates (Kaenong et al., 2023). On the other hand, current educational leadership research remains dominated by transformational models for explaining work motivation and student character development (Hollander, 2011; Shal et al., 2024), while the specific role of servant leadership in the context of Islamic-based vocational education remains limited and has not been systematically investigated. The combination of pressures from performance policy reform, the acceleration of digital technologies and AI in learning, and the demands of revitalizing vocational education makes the study of the influence of servant leadership on teacher motivation a current, relevant, and urgent research issue.

The gap between ideal demands and the actual capacity of vocational high school teachers is evident. Teachers' Technological Pedagogical Content Knowledge (TPACK) competencies remain low, with 68% of Indonesian vocational high school teachers at the basic user level of digital literacy (Hanifah et al., 2022). Meanwhile, teacher competency development programs remain sporadic, leading to 75% of teachers failing to implement training outcomes due to limited institutional support (Maslakhah & Saryanto, 2024; Tigre et al., 2025). The dominance of teacher-centred learning also hinders the implementation of collaborative approaches, especially among long-tenured teachers (Winarno et al., 2024). This condition confirms that the success of the 21st-century learning transformation does not depend solely on curriculum policies but is greatly influenced by the quality of the principal's leadership in fostering teacher motivation to innovate.

The shift in educational paradigms demands that school principals act not merely as administrators, but as learning facilitators who build adaptive, collaborative environments oriented toward developing 21st-century competencies (Masitoh & Purbowati, 2024; Winaryati, 2018). One leadership model relevant to these demands is servant leadership, which positions the leader as a servant to the people they lead (Greenleaf, 1970). Servant leadership is viewed as a holistic leadership approach that emphasizes morality, concern for stakeholders, and follower empowerment across emotional, relational, and ethical dimensions (Canavesi & Minelli, 2022) and has been consistently shown to be associated with work engagement, well-being, and positive organizational outcomes (Batoool et al., 2024; Haleem et al., 2024; Van Dierendonck, 2011).

Previous studies have shown that principals who implement servant leadership successfully create a collaborative culture, increase stakeholder participation, and strengthen teacher motivation, commitment, and performance (Amin et al., 2026; Umuteme & Adegbite, 2023). However, most of these studies have not specifically integrated the context of vocational education (SMK), teacher motivation in 21st-century learning, and an explanatory sequential mixed-methods approach that allows for in-depth explanations of statistical relationships using field data. It is therefore important that this issue be studied empirically in the context of Islamic-based vocational high schools, such as Muhammadiyah Vocational High School, which was purposively selected because it institutionalizes Islamic values of *khidmah* (service) and *ukhuwah* (brotherhood) within its organizational governance, offering a theoretically relevant rather than merely convenient setting in which to examine servant leadership.

Theoretically, this research is based on two main frameworks: servant leadership theory (Greenleaf, 1970) and self-determination theory (Avolio et al., 2009; Wu et al., 2021). Servant leadership positions leaders

as servants who prioritize the empowerment and growth of their followers, fundamentally different from transformational leadership that emphasizes the vision and influence of idealized leaders, and transactional leadership, which is based on the exchange of incentives-performance. Academic debate has arisen regarding the suitability of servant leadership in collectivistic cultural contexts: some experts consider this concept to be rooted in Western individualist values, so that its application requires cross-cultural caution (Prabowo et al., 2022; Tigre et al., 2025), while other studies show that the values of service, trust, and exemplary in servant leadership are in fact aligned with Islamic leadership concepts such as *khidmah* (service) and *qudwah hasanah* (exemplary), so it is considered more contextually appropriate for application in educational institutions based on Islamic values than other Western leadership models that are more hierarchically oriented (Hornyak et al., 2022; Munirah et al., 2022).

In the realm of motivation, SDT explains motivation through the fulfilment of basic psychological needs in the form of autonomy, competence, and relatedness (Gagné & Deci, 2005) (see also Gagné et al., 2015, for the Multidimensional Work Motivation Scale used to operationalize this framework), in contrast to Herzberg's two-factor theory, which emphasizes structural-organizational hygiene-motivator factors or expectancy theory, which emphasizes rational calculations between effort, performance, and rewards. The relevance of these two motivational perspectives is often debated: SDT is considered more appropriate for explaining intrinsic motivation in professions that require professional autonomy, such as teaching. In contrast, incentive-based theory is considered more relevant to explaining extrinsic motivation, which depends on working conditions and material rewards. This study positions servant leadership theory and SDT as complementary frameworks for explaining how servant leadership behaviour psychologically fosters teacher motivation, not solely through structural incentive mechanisms.

The development of servant leadership research in the past decade (state of the art) shows a growing trend. A systematic review by Canavesi and Minelli (2022) identified a consistent relationship between servant leadership and follower work engagement and performance across sectors, while Bryman (2007) and Fries et al. (2021) confirmed the positive relationship between servant leadership and follower psychological well-being, while also criticizing the overlap of its construct with authentic leadership and ethical leadership, which makes its boundaries difficult to distinguish empirically. In Indonesia, studies by Siswadi et al. (2025) confirmed the positive influence of servant leadership on teacher performance and motivation. However, most studies used a single cross-sectional quantitative design and did not specifically link servant leadership to teacher motivation in the development of 21st-century learning. Few studies have been conducted in the context of vocational education (SMK), which is characterized by competency-based learning and unique industry links.

This gap is the basis of this research, namely: (1) contextual gap, due to the lack of studies on servant leadership in Islamic value-based vocational schools; (2) methodological gap, because the explanatory sequential mixed-methods approach that integrates qualitative explanations of quantitative findings is still rarely applied to this topic; and (3) conceptual gap, because the relationship between servant leadership and teacher motivation specifically in the development of 21st-century learning has not been modeled in an integrated manner.

The novelty of this research lies in the simultaneous integration of these three gaps, resulting in a conceptual model of servant leadership–teacher empowerment–motivation enhancement–21st-century learning development that is statistically tested and enriched with qualitative explanations. The urgency of this research is increasingly apparent, given the demands of the Industrial Revolution 4.0 and Society 5.0, which require vocational schools to transform immediately, while the leadership capacity of school principals to foster teacher motivation remains an under-researched factor at the vocational level. Theoretically, this

research contributes to expanding the application of servant leadership theory and self-determination theory to the realm of Islamic value-based vocational education; practically, this research provides an empirical basis for school principals, the Muhammadiyah Elementary and Secondary Education Council, and vocational education policymakers in designing programs to strengthen servant leadership as a strategy to increase teacher motivation and learning innovation.

Based on the description, this research is formulated to answer three main questions, namely: (1) how is the implementation of the principal's servant leadership model at SMK Muhammadiyah Jatibarang, Indramayu, West Java; (2) what is the level of teacher motivation in developing 21st-century learning at the school; and (3) is there a significant influence of the principal's servant leadership on teacher motivation in developing 21st-century learning. This research is expected to provide theoretical contributions to the development of the vocational education leadership literature, as well as practical recommendations for principals to foster teacher motivation to develop 21st-century learning.

METHOD

This study aims to analyze the influence of the principal's *servant leadership* on teacher motivation in developing 21st-century learning at SMK Muhammadiyah Jatibarang, Indramayu, West Java. The study used a *mixed-methods approach* with an *explanatory sequential design*. The study sample consisted of 35 teachers, selected using a saturated sampling technique. Quantitative data were collected through questionnaires and analyzed using descriptive statistics, Pearson correlation, and simple linear regression. Qualitative data were obtained through interviews to further explain the quantitative results. The acceleration of globalization, digital transformation, and artificial intelligence encourages the education system to shift from conventional models to adaptive, innovative, and responsive learning (Creswell, 2014).

This study uses a mixed-methods research approach with a sequential explanatory design consisting of two phases: a quantitative phase followed by a qualitative phase to deepen and explain the quantitative findings, which are then integrated in the final interpretation stage (Table 1). The study population comprised all teachers of SMK Muhammadiyah Jatibarang, Indramayu, West Java. A sample of 35 teachers was determined through a saturated sampling technique (census), given the limited population size ($N < 100$), to include the entire population and minimize sampling error.

Table 1. Stages of Explanatory Sequential Mixed Methods Research

Stage	Main Activities	Phase
1	Preparation and testing of research instruments	Quantitative
2	Quantitative data collection (questionnaire survey)	Quantitative
3	Quantitative data analysis (descriptive, correlation, regression)	Quantitative
4	Determination of focus and informants based on quantitative results	Transition
5	Qualitative data collection (in-depth interviews)	Qualitative
6	Qualitative data analysis (Miles, Huberman & Saldana)	Qualitative
7	Integration and interpretation of results (joint display)	Integration

The research variables are the principal's servant leadership (variable X) and teachers' motivation to develop 21st-century learning (variable Y), as detailed in Table 2. Quantitative data were collected using a Likert-scale questionnaire with 1–5 response options: a servant leadership instrument comprising 35 items across eight dimensions adapted from the Servant Leadership Survey developed by Van Dierendonck and Nuijten (2011) and a teacher motivation instrument comprising 48 items across three sub-variables (intrinsic motivation, extrinsic motivation, and 21st-century learning development behaviour), developed by the

researchers based on the indicators of self-determination theory (Ryan & Deci, 2000; Gagné & Deci, 2005) and 21st-century learning competencies (Trilling & Fadel, 2009). Both instruments were tested for validity using Pearson Product-Moment correlation and reliability using Cronbach's Alpha before being used in data collection.

Table 2. Variables, Dimensions, and Number of Research Instrument Items

Variables	Dimensions / Sub-Variables	Number of Items
Servant Leadership (X)	Empowerment, accountability, standing back, humility, authenticity, courage, interpersonal acceptance, stewardship	35
Teacher Motivation (Y)	Intrinsic motivation, extrinsic motivation, and 21st-century learning development behaviour	48

Quantitative data analysis was conducted in stages using descriptive statistics, prerequisite tests, and hypothesis tests, as summarized in Table 3, with IBM SPSS Statistics version 31.0.1.0. Qualitative data were collected through in-depth interviews, limited observations, and documentation studies, with informants purposively selected using extreme-case and maximum-variation sampling strategies based on the results of the quantitative phase, including the principal and teachers with varying motivation scores and lengths of service. A total of [JUMLAH INFORMAN] informants were interviewed, and data collection was concluded once theoretical saturation was reached at the [KE-BERAPA] interview, when no further new themes emerged.

Table 3. Quantitative and Qualitative Data Analysis Techniques

Analysis Techniques	Objectives / Criteria
Descriptive statistics	Describes the mean, median, standard deviation, and categories of the two variables
Validity test (Pearson)	$r_{count} > r_{table}$ (0.334; N=35) and Sig. < 0.05
Reliability test (Cronbach's Alpha)	The value of $\alpha > 0.70$ is declared reliable.
Normality test (Kolmogorov-Smirnov)	Sig. > 0.05 indicates that the data is normally distributed.
Linearity test	Deviation from linearity > 0.05 indicates a linear relationship
Pearson Correlation	Measures the strength and direction of the X and Y relationship
Simple linear regression & t-test	Testing the influence and significance of X on Y (Sig. < 0.05)
Coefficient of determination (R^2)	Measuring the magnitude of X's contribution to the variation of Y
Miles, Huberman, and Saldaña's interactive analysis	Data condensation, data presentation, drawing and verifying qualitative conclusions

The integration of quantitative and qualitative results was achieved through a joint display during the interpretation stage, producing a complete meta-inference. The validity of quantitative data was ensured through instrument validity and reliability tests, as well as adherence to statistical assumptions. In contrast, the validity of qualitative data was maintained through triangulation of sources and techniques. This research adheres to the principles of research ethics, including informed consent, data confidentiality, and the anonymity of respondents and informants, and received ethical approval. Given the saturated, single-

institution sample (N = 35), statistical power for detecting smaller effects is limited, a constraint that is elaborated further in the Discussion section. The study was conducted at Muhammadiyah Jatibarang Vocational School in Indramayu Regency, West Java.

RESULTS AND DISCUSSION

Results

Implementation of Servant Leadership by School Principals

The results of the descriptive analysis of the 35 items of the servant leadership instrument showed a minimum score of 123, a maximum score of 171, a mean of 147.63, a median of 148, and a standard deviation of 11.27 (Table 4). When converted to the maximum ideal score (35 items $\times$ 5 = 175), the mean achievement in servant leadership was 84.4% of the ideal score, indicating that the principal's servant leadership was far above the midpoint of the scale. The distribution of categories shows that 68.57% of teachers rated the principal's servant leadership in the very high category, 28.57% in the high category, and only 2.86% in the medium category, with no assessments in the low or very low categories (Table 5), indicating that almost all teachers (97.14%) perceived the principal to implement servant leadership at a high or very high level.

Table 4. Descriptive Statistics of Servant Leadership Variables

Statistics	Mark
Number of Respondents	35
Minimum Score	123
Maximum Score	171
Mean	147.63
Median	148
Standard Deviation	11.27

Table 5. Distribution of Servant Leadership Categories

Category	Frequency	Percentage
Very high	24	68.57%
High	10	28.57%
Moderate	1	2.86%
Low	0	0%
Very Low	0	0%

Qualitative findings reinforce these data. Teachers expressed complete confidence in developing project-based learning and using digital technology tailored to students' needs. They viewed the principal as a figure who was consistent in words and actions related to discipline, service, and commitment to school progress. The relatively small standard deviation (11.27, with a mean of 147.63) also indicated that teachers' perceptions of servant leadership were homogeneous rather than polarized across respondents. These findings suggest that empowerment and moral example are the most prominent characteristics of servant leadership implementation in this study's context.

Teacher Motivation Level in Developing 21st Century Learning

The analysis of 48 items of the teacher motivation instrument showed a minimum score of 161, a maximum score of 227, a mean of 194.87, a median of 195, and a standard deviation of 15.12 (Table 6). Converted to the maximum ideal score (48 items $\times$ 5 = 240), the mean achievement of teacher motivation is

equivalent to 81.2 % of the ideal score. A total of 71.43 % of teachers are in the very high motivation category, 25.71% in the high category, and 2.86% in the medium category, with no teachers in the low or very low categories (Table 7).

Table 6. Descriptive Statistics of Teacher Motivation Variables

Statistics	Mark
Number of Respondents	35
Minimum Score	161
Maximum Score	227
Mean	194.87
Median	195
Standard Deviation	15.12

Table 7. Distribution of Teacher Motivation Categories

Category	Frequency	Percentage
Very high	25	71.43%
High	9	25.71%
Moderate	1	2.86%
Low	0	0%
Very Low	0	0%

Table 8. Comparison of Actual Score Achievements to Ideal Scores

Variables	Actual Mean	Maximum Ideal Score	Achievement (%)	Category
Servant Leadership	147.63	175	84.4%	Very high
Teacher Motivation	194.87	240	81.2%	Very high

The difference in achievement between servant leadership (84.4 %) and teacher motivation (81.2%) indicates an alignment between the high level of teachers' perceptions of the principal's servant leadership and the high level of teacher motivation itself, strengthening the suspicion of a unidirectional relationship between the two variables that will be further tested through inferential analysis. Instrument testing shows that all items in both variables are valid (r count ranges from 0.421–0.867, greater than the r table value of 0.334 at N=35) with very high reliability (Cronbach's Alpha for servant leadership = 0.947; teacher motivation = 0.958). Qualitatively, the high level of teacher motivation is explained through the theme of ongoing professional support, namely training, workshops, and mentoring that make teachers feel valued and encouraged to continue learning and applying the 4C skills, digital literacy, and student-centred learning.

The Influence of Principal Servant Leadership on Teacher Motivation

The prerequisite analysis shows that the data for both variables are normally distributed (servant leadership significance = 0.200; teacher motivation = 0.173, both > 0.05) and linearly related (deviation from linearity = 0.621 > 0.05), so the linear regression assumption was met. Pearson correlation analysis yielded $r = 0.782$, which, based on the interpretation guidelines for correlation coefficients commonly used in educational research (the range of 0.60–0.799 is categorized as strong), indicates a positive and strong relationship between the principal's servant leadership and teacher motivation (Table 9).

Table 9. Pearson Correlation Test Results

Variables	R	Category
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X against Y	0.782	Strong
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Simple linear regression analysis yielded the equation $Y = 41.527 + 1.037X$, which means that every one-unit increase in servant leadership is associated with a 1.037-point increase in teacher motivation, while the constant 41.527 indicates that teacher motivation has an estimated baseline value when servant leadership does not increase. The t-test shows that the calculated t value of 7.212 is greater than the critical t value of 2.034 with a significance of $p = 0.000 (<0.05)$, so that H_0 is rejected and H_a is accepted (Table 10): the principal's servant leadership is positively and significantly associated with teacher motivation in developing 21st-century learning.

Table 10. t-Test Results

Variables	t count	t table	Sig.
Servant Leadership	7,212	2,034	0,000

The coefficient of determination (R^2) of 0.612 indicates that 61.2 % of the variation in teacher motivation can be explained by the principal's servant leadership (Table 11). Converted to Cohen's effect size $f^2 = R^2/(1-R^2) = 1.58$, this value far exceeds the threshold of 0.35, which is categorized as a large effect according to Cohen's (1988) convention, confirming that the influence of servant leadership on teacher motivation in the context of this study is not only statistically significant, but also practically significant. The remaining 38.8 % of the variation is associated with other factors outside this research model, such as school culture, teacher competence, learning facilities, and organizational climate.

Table 11. Results of the Determination Coefficient and Effect Size

Statistics	Mark
R	0.782
R Square	0.612
Adjusted R-Square	0.600
Cohen's f^2 (effect size)	1.58 (large)

Table 12. Summary of Hypothesis Testing

Statistical Test	Results	Criteria	Decision
Pearson Correlation (r)	0.782	0.60–0.799 = strong	Strong & positive relationship
t-test	7,212 > 2,034	Sig. 0.000 < 0.05	H_0 is rejected, H_a is accepted
Coefficient of Determination (R^2)	0.612	$f^2 = 1.58$ (large)	Significant influence & practical meaning

Integration of qualitative findings through the joint display (Table 13) confirms the convergence of these quantitative results.

Table 13. Joint Display Integration of Quantitative and Qualitative Results

Quantitative Findings	Qualitative Findings	Meta-Inference
$r = 0.782$	Teachers feel supported and empowered	Principal support increases motivation
$t = 7.212; p < 0.05$	Teachers gain trust and autonomy	Empowerment is a key factor
$R^2 = 0.612$	Teachers actively participate in learning innovations	Servant leadership contributes greatly to motivation

Very high motivation (81.2 %)	Teachers feel valued and appreciated	Recognition strengthens intrinsic & extrinsic motivation
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Teachers who feel empowered and have autonomy demonstrate greater motivation to innovate; teachers who feel professionally supported are more active in learning and development; and teachers who feel valued and appreciated demonstrate stronger intrinsic and extrinsic motivation. The meta-inference from this integration suggest that servant leadership is not only statistically associated with teacher motivation and characterized by a large effect size, but also creates psychological and organizational conditions that support the growth of teacher motivation to develop 21st-century learning sustainably.

Discussion

The finding that school principals' implementation of servant leadership falls into the very high category strengthens the core concept put forward by Greenleaf (1970), that the essence of true leadership is serving and fulfilling the needs of others, not just leading with authority. The high scores on the empowerment and moral exemplar dimensions in this study are in line with the characteristics of servant leadership as a holistic leadership approach that places morality and concern for stakeholders at the core of its practice (Canavesi & Minelli, 2022), as well as being relevant to the values of trust and exemplary behaviour upheld in Muhammadiyah-based educational institutions (Asuga et al., 2015).

The high motivation of teachers in developing 21st-century learning can be interpreted through the perspective of self-determination theory (Ryan & Deci, 2000), which explains that individual motivation grows optimally when three basic psychological needs autonomy, competence, and relatedness are met (Gagné & Deci, 2005; Van den Broeck et al., 2016). In this study, teacher empowerment practices fulfil the need for autonomy, ongoing professional support fulfils the need for competence, and warm interpersonal relationships between the principal and teachers fulfil the need for relatedness, thereby potentially encouraging teachers' intrinsic motivation to innovate.

The correlation value of $r = 0.782$ and the coefficient of determination $R^2 = 0.612$ in this study are consistent with several previous studies that found a positive relationship between servant leadership and teacher motivation and performance (Hasra et al., 2024), while also strengthening the conclusion of systematic reviews that servant leadership is consistently associated with follower work engagement and well-being (Skakon et al., 2010). The large contribution of 61.2 % indicates that servant leadership is a strong predictor, but not the sole the remaining 38.8% of unexplained variation indicates the role of other factors such as job resources and job demands as explained by job demands–resources theory (Bakker et al., 2023), including limited practice facilities commonly found in vocational schools and the teacher digital competency gap (Anh et al., 2019; Wismayanti et al., 2025).

In the context of SMK Muhammadiyah Jatibarang, servant leadership not only increases intrinsic motivation but also strengthens teachers' extrinsic motivation through appreciation, professional development opportunities, and the provision of learning facilities, which in turn encourages the implementation of project-based learning, digital technology integration, and strengthening of 4C skills (Syahputra et al., 2019; Trilling & Fadel, 2009). These findings expand the literature on servant leadership, which has been studied primarily in general education or higher education contexts (Bass & Avolio, 1994; Tan et al., 2015), by presenting empirical evidence in the context of Islamic value-based vocational education, while also confirming the relevance of this model as an educational leadership strategy to address the challenges of the Industrial Revolution 4.0 and Society 5.0.

These findings also need to be read critically amid the academic debate over the position of servant leadership relative to other leadership models. Liden and Knippenberg (2025) caution that servant leadership risks conflating constructs with authentic and ethical leadership, leading some scholars to question whether the observed effects are attributable to specific 'serving' behaviours or to the broader effects of ethical leadership. Furthermore, compared with transformational leadership, which emphasizes visionary inspiration and intellectual stimulation, servant leadership emphasizes empowerment and personal service to followers' needs. In the context of this study, the dominance of empowerment and moral role models in the qualitative data indicates that personal service mechanisms rather than simply organizational vision strongly explain teacher motivation, thus strengthening servant leadership's position as a more appropriate framework than transformational leadership in this context (Nhongo et al., 2024; Tucker & Russell, 2004).

The R^2 of 0.612 in this study is also relatively high compared to the general trend in leadership-motivation studies in general education, which often report contributions in the moderate range; This high contribution is thought to be related to the alignment of values between servant leadership and Muhammadiyah's organizational culture which upholds trust and brotherhood, so that teachers may be more receptive to the principal's serving behaviour than they would be in a secular institution; because this study did not include a comparison sample from secular institutions, this remains a hypothesis for future comparative research rather than a confirmed conclusion.

A similar debate is also relevant in motivational theory. Some experts believe that self-determination theory under-represents structural factors such as financial incentives and career paths, which are emphasized by expectancy theory and Herzberg's two-factor theory (Badura et al., 2020; Horner, 1997). However, this study's findings indicate that non-material dimensions, including empowerment, trust, and recognition are far more dominant in teachers' narratives than material incentives, thus empirically supporting the superiority of SDT explanations for the teaching profession, which demands high levels of professional autonomy (ten Cate et al., 2011). Nevertheless, the 38.8 % of motivational variation unexplained by servant leadership still opens up room for explanations based on job demands-resources theory (Bakker et al., 2023), which emphasizes that motivation also depends on structural resources such as facilities, workload, and external support, serving as a reminder that servant leadership, while influential, is not the sole determinant and needs to be complemented by adequate structural policies.

This study has several limitations that warrant caution in interpreting and generalizing its findings. First, the research was conducted at a single institution with a saturated sample of 35 respondents, which constrains statistical power and limits generalizability beyond SMK Muhammadiyah Jatibarang. Second, because servant leadership and teacher motivation were both measured through self-report questionnaires completed by the same respondents, the findings are subject to potential common-method bias that may inflate the observed relationship. Third, reliance on a perceptual instrument means the results reflect teachers' subjective perceptions rather than directly observed leadership behaviour. Future research is therefore recommended to involve vocational schools from different regions and educational backgrounds with larger samples to improve generalizability; to test mediating or moderating variables such as teacher self-efficacy, psychological empowerment, organizational commitment, organizational culture, and digital competence using a structural equation modelling approach; and to adopt longitudinal or mixed-methods designs capable of tracking changes in teacher motivation over time and verifying the organizational-culture value-alignment argument proposed in this study through direct comparison with secular institutions. Such approaches would enrich the theoretical development of servant leadership and self-determination theory while providing stronger empirical evidence for educational leadership practice in vocational education.

CONCLUSION

Based on the quantitative and qualitative analysis, this study concludes that the principal's servant leadership at SMK Muhammadiyah Jatibarang is implemented at a very high level, that teacher motivation in developing 21st-century learning is likewise very high, and that servant leadership is positively and significantly associated with teacher motivation, explaining 61.2% of its variance ($r = 0.782$; $t = 7.212$; $p < 0.05$). These findings position servant leadership as a strategic model for vocational school principals to foster teacher motivation, while extending the application of servant leadership and self-determination theory to Islamic value-based vocational education; principals are accordingly advised to strengthen empowerment practices, sustained professional mentoring, and a culture of appreciation for teachers.

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