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A Combined Path-SITOREM Analysis to Investigate Effective Islamic Instructional Strategies through Transformational Leaderships, Motivation, and Cooperative Learning Method

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Abstract: This study will develop strategies for increasing the effectiveness of teaching in Islamic Religious Education (IRE) in private vocational schools in Bogor Regency through an analysis of the influence of transformational leadership, models of cooperative learning, and motivation to learn. A quantitative approach was used whereby questionnaires were distributed to a sample of 168 from a total population of 289 teachers as calculated through Slovin's formula. The data analyses include the use of path analysis for testing relationships among variables and the SITOREM method for establishing indicators prioritization for intervention. Results indicated that transformational leadership, cooperative learning models, and learning motivation contributed significantly to effective learning. Cooperative learning, motivation, and leadership show the strongest direct effect in decreasing order. Learning motivation also served as the mediator of leadership and cooperative learning influences towards learning results. Based on the performed SITOREM analyses, indicative categories such as promotive interaction and inspirational motivation that appeared to still require further improvement required priority and serious attention, but those, like individual accountability and task orientation, that have been high should just be preserved. These findings make possible a strategic view of developing the quality of IRE instruction with regard to weaknesses and strengths, based on leadership, cooperative learning, and motivational practices. In conclusion, the study points to the significance of integrating transformational leadership, cooperative learning strategy, and intrinsic-extrinsic motivation in driving effective IRE teaching outcomes. The results give recommendations that are useful for educators, school administrators, and policymakers in the improvement of the quality of education.

Keywords: transformational leadership, cooperative learning, motivation, path analysis, SITOREM analysis.

▪ INTRODUCTION

The paraphrased content is as follows: Education is a very critical aspect in the development of an individual and society. It transforms an individual through intellectual, social, and emotional development, imparting skills, knowledge, and values that are needed to live a productive and fulfilling life. According to Glewwe & Kremer (2006) and UNESCO (2019), the main purpose of education is to develop human potential such that learners can navigate and contribute effectively toward changing global conditions. In this perspective, IRE assumes an important place in the life of believers, especially in multicultural contexts, as it aids in the inculcation of moral and ethical values that underpin the harmony of the society at large. As such, despite its importance, effective learning outcomes in IRE remain elusive to date, especially in vocational high schools where diverse learner needs and contextual constraints often limit the effectiveness of traditional pedagogical approaches. This study addresses such challenges in understanding the interaction of transformational leadership, cooperative learning, and

motivation of students in enhancing effectiveness, integrating SITOREM analysis to find and prioritize strategies of improvement.

Effective learning is identified as the coordination of educational objectives, instruction methods, and learner approach. As Hattie says, effective teaching ensures creating such an environment where learners want and can achieve more. Because the motivation-intrinsic and extrinsic-predicts students' will to learn and remain persisting even when activities challenge them (Deci & Ryan, 1985; Pintrich, 2003). Transformational leadership is described as one of the cornerstones of contemporary approaches to effective educational leadership by Bass and Avolio (1994). It is a broad concept that involves inspiration and intellectual stimulation of educators and students by creating a social environment characterized by trust, innovation, and commitment. According to Leithwood and Jantzi (2000) and Robinson et al. (2008), leaders manifesting transformational qualities through idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration create an environment that is supportive of learning and continuous improvement.

As an instructional strategy, cooperative learning provides a fitting match for such leadership because of its focus on collaboration and collective problem-solving among students. Johnson and Johnson (1999) indicate that the cooperative learning method enhances interpersonal relationships and social cohesion in addition to improving academic performance. According to Slavin (1995) and Kagan (1994), the major elements of cooperative learning include promotive interaction, group accountability, and structured group processing, all contributing to deeper learning experiences.

Analysis through SITOREM provides a structured focus on strengths and weaknesses in educational practice. SITOREM therefore highlights opportunities for improvement by targeting areas that are most needed, feasible, and effective, making the instrument quite helpful in realising a strategic approach to improving learning processes.

Gap Analysis

Despite extensive researches related to transformational leadership, cooperative learning, and motivation, little research explores the combined effect of all such factors on learning effectiveness within an IRE setting. Very few studies have been published that outline these factors individually and hardly any take into account their synergy. For example, even as transformational leadership has been identified with higher teacher performance and improvement in student outcomes, its interactive use with cooperative learning strategies is largely unexplored. Furthermore, much research into cooperative learning has focused on cognitive gains rather than its potential as a motivational tool to promote approach and engagement within religious education (Johnson & Johnson, 1999; Slavin, 1995). Other areas that require further examination include the aspect of motivation especially concerning vocational education. For instance, vocational students face many motivational issues, which are unique and often needs particular strategies to sustain interest and persistence for a more extended period were noted (Eccles & Wigfield, 2002; Ryan & Deci, 2020).

Adding SITOREM analysis into this frame adds another layer of intricacy. While SITOREM has been applied in a broader educational context to identify and prioritize improvement strategies, the breadth of its application is still limited in IRE. This research tries to fill these gaps and investigates the combined impact of transformational leadership, cooperative learning, and motivation on learning effectiveness in vocational high schools, applying SITOREM analysis to develop actionable recommendations.

The research questions are:

1. To what degree does transformational leadership and cooperative learning and motivation individually or in combination influence learning effectiveness on Islamic Religious Education?
2. What certain indicators, identified by SITOREM analysis, may be prioritized in an effort to optimize learning effectiveness within vocational high schools?
3. How does motivation mediate the relationship between transformational leadership, cooperative learning, and learning effectiveness?

▪ LITERATURE REVIEW

The Influence of Transformational Leadership on Learning Effectiveness

Transformational leadership has been identified as one of the most impactful leadership styles for enhancing educational outcomes. As defined by Bass and Avolio (1994), it motivates individuals by presenting a compelling vision, fostering shared goals, and promoting intellectual stimulation and creativity. In educational settings, this style has been shown to enhance teacher motivation, facilitate professional growth, and improve student learning outcomes (Leithwood & Jantzi, 2000; Robinson et al., 2008).

The four core dimensions of transformational leadership—idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration—play a pivotal role in shaping educational environments. Idealized influence positions leaders as role models, inspiring admiration and respect. Inspirational motivation involves articulating an optimistic vision that drives collective objectives. Intellectual stimulation challenges conventional assumptions to encourage creativity and problem-solving, while individualized consideration focuses on personalized support for professional and personal development (Bass, 1990; Avolio & Bass, 2002).

Empirical evidence underscores the effectiveness of transformational leadership in fostering collaboration and innovation among educators, enhancing instructional practices, and increasing student engagement (Leithwood et al., 2004; Robinson et al., 2008). This leadership style also promotes teacher self-efficacy and professional commitment, both critical for achieving sustained improvements in educational outcomes.

In vocational education, where teachers often face unique challenges like diverse student populations and resource limitations, transformational leadership has demonstrated particular efficacy. Such leaders inspire teams to overcome challenges, adapt to changes, and pursue shared goals (Day et al., 2016; Sun & Leithwood, 2018). However, to implement this style effectively, leaders need targeted training to develop the requisite skills and competencies.

Motivation as a Mediator of Learning Effectiveness

Motivation is a critical determinant of learning behaviors and outcomes. Self-Determination Theory (SDT), proposed by Deci and Ryan (1985), differentiates between intrinsic motivation arising from the inherent satisfaction of an activity and extrinsic motivation, driven by external rewards such as grades or recognition. Both types of motivation significantly influence student engagement and persistence (Ryan & Deci, 2020).

Motivation directly enhances learning effectiveness by affecting students' effort, attention, and perseverance. Schunk et al. (2008) observed that motivated students are more likely to employ deep learning strategies, such as critical thinking and problem-

solving, essential for academic success. Similarly, Pintrich (2003) highlighted the role of motivational beliefs in promoting self-regulated learning, enabling students to set goals, monitor progress, and adjust strategies.

Transformational leadership influences learning outcomes indirectly by fostering motivation. Leaders inspire intrinsic motivation by creating a sense of purpose and belonging, while cooperative learning environments provide the external support needed to sustain engagement (Leithwood & Jantzi, 2005; Bass et al., 2003). For instance, Lazarides et al. (2019) found that transformational teachers significantly enhanced students' intrinsic motivation and academic performance.

In vocational education, maintaining motivation presents unique challenges due to external pressures like financial constraints and societal expectations. Contextualized learning experiences and career-oriented goals have proven effective in sustaining motivation in these environments (Wigfield et al., 2015; Eccles & Wigfield, 2002).

The Role of Cooperative Learning in Enhancing Learning Effectiveness

Cooperative learning is an instructional strategy that emphasizes collaboration among students to achieve shared objectives. Defined by Johnson and Johnson (1999), it involves structured group interactions that promote interdependence, accountability, and active engagement. Research consistently identifies cooperative learning as a powerful method for improving both academic and social outcomes (Slavin, 1995; Gillies, 2007).

Key elements of cooperative learning include promotive interaction, individual accountability, and group processing. Promotive interaction fosters mutual support, enabling students to share ideas, clarify concepts, and provide feedback. Individual accountability ensures that every group member contributes meaningfully, while group processing involves reflecting on group dynamics and outcomes to improve performance (Kagan, 1994; Slavin, 2015).

Studies highlight the significant impact of cooperative learning on educational outcomes. Slavin (1995) demonstrated its effectiveness in improving knowledge retention, critical thinking, and problem-solving skills. Gillies (2007) noted that cooperative learning also reduces achievement gaps by providing equitable participation opportunities, particularly for marginalized students.

Transformational leadership and cooperative learning complement each other. Leaders who advocate for cooperative learning foster environments where collaboration and innovation thrive, facilitating the development of 21st-century skills (Johnson et al., 2014; Kagan, 1994). However, effective implementation requires teacher training and careful management of classroom dynamics to mitigate challenges like social loafing or dominance by certain members.

SITOREM Analysis for Strategic Improvement

SITOREM (Scientific Identification Theory to Conduct Operations Research in Education Management) is a structured approach for identifying and prioritizing factors influencing educational outcomes. Developed by Hardhienata (2017), SITOREM combines statistical analysis with expert judgment to evaluate system strengths and weaknesses, guiding targeted interventions.

The SITOREM process includes three steps: Identifying Indicators: Collecting data to assess factors such as leadership, motivation, and instructional methods. Prioritizing Indicators: Ranking these factors based on impact and feasibility to identify areas

requiring immediate attention. Developing Strategies: Formulating actionable plans to address weaknesses and sustain strengths based on prioritized indicators.

In this study, SITOREM is applied to examine the relationships between transformational leadership, motivation, cooperative learning, and learning effectiveness. It identifies critical indicators and provides a roadmap for optimizing educational practices. For example, Sugiyono (2015) demonstrated that SITOREM effectively improves teacher performance by prioritizing professional development and instructional strategies.

Integrating SITOREM with transformational leadership and cooperative learning forms a comprehensive framework for enhancing learning effectiveness. Transformational leaders set the vision, cooperative learning promotes collaboration, and SITOREM ensures efficient resource allocation to achieve these goals (Hardhienata, 2017; Robinson et al., 2008). The literature review generated five research hypotheses, namely:

- H1: Transformational Leadership has a significant positive effect on Motivation
- H2: Transformational Leadership has a significant positive effect on Learning Effectiveness
- H3: Cooperative Learning has a significant positive effect on Motivation
- H4: Cooperative Learning has a significant positive effect on Learning Effectiveness
- H5: Motivation has a significant positive effect on Learning Effectiveness

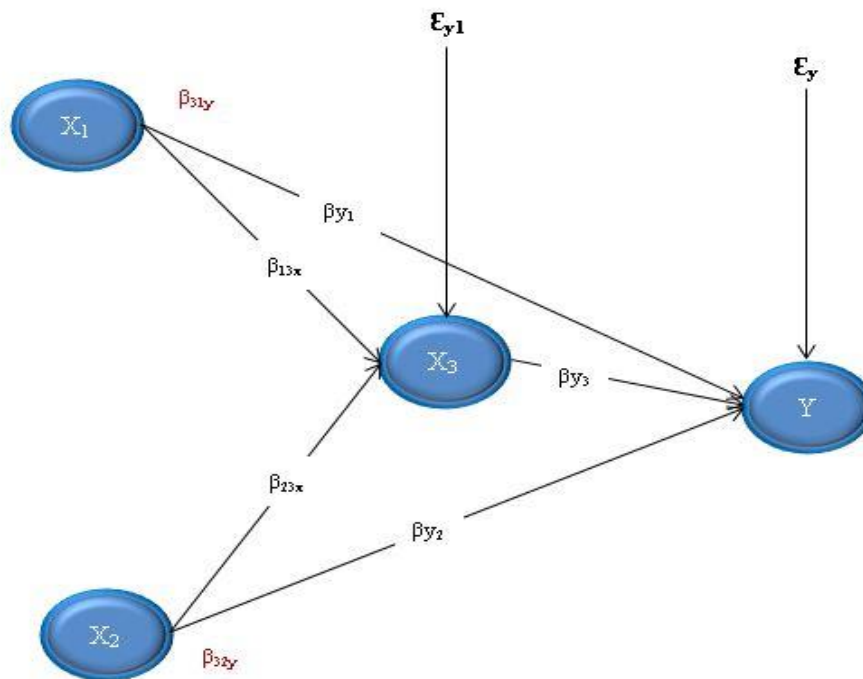


Figure 1. Structural hypothetical model

▪ **METHOD**

Participants

The study targeted vocational high school teachers from private schools in Bogor Regency, Indonesia, as its population. These educators play a vital role in applying curricula and instructional strategies to improve student outcomes. The population

comprised 289 teachers employed as permanent foundation educators (GTY). From this population, a sample size of 168 teachers was calculated using Slovin's formula, ensuring a representative sample with a 95% confidence level and a 5% margin of error. This approach is a standard in educational research for determining sample size when the population is known (Taherdoost, 2016; Creswell, 2014).

Proportional random sampling was employed to ensure the sample represented the diverse school contexts within the region. This technique selected participants in proportion to their distribution in the population, minimizing sampling bias (Fowler, 2014; Etikan et al., 2016). Priority was given to teachers actively engaged in implementing the instructional strategies under study and available during the research timeline. This approach enabled a comprehensive analysis by involving educators with direct experience in teaching and leadership practices.

Research Design and Procedures

The study used a quantitative correlational design, combining Structural Equation Modeling (SEM) with Scientific Identification Theory to Conduct Operations Research in Education Management (SITOREM) analysis. SEM analyzed the relationships among transformational leadership, cooperative learning, motivation, and learning effectiveness, while SITOREM identified and prioritized key indicators for improvement (Hair et al., 2010; Hardhienata, 2017). The research spanned nine months. In the initial phase, objectives and hypotheses were defined, and instruments were adapted from internationally validated scales. Pilot testing was conducted to ensure clarity, relevance, and reliability. Ethical approval was obtained, ensuring compliance with ethical standards and securing informed consent from participants. Teachers were informed about the study's purpose, confidentiality measures, and their right to withdraw at any time without penalty.

Data collection occurred over two months using a hybrid approach of online and printed surveys, improving accessibility and response rates. Teachers were provided with detailed instructions and sufficient time to complete the surveys. Data were reviewed for completeness and consistency upon collection. In the analysis phase, SEM tested hypothesized relationships between variables, and SITOREM prioritized actionable indicators for improvement. The process concluded with strategic recommendations and result dissemination.

Instruments

The study utilized three primary instruments to measure transformational leadership, cooperative learning, motivation, and learning effectiveness. Each instrument was adapted from internationally validated models to ensure its relevance and reliability within the context of the research.

Transformational Leadership Questionnaire

The transformational leadership questionnaire was adapted from the Multifactor Leadership Questionnaire (MLQ) developed by Bass and Avolio (1994). This instrument assesses four dimensions of transformational leadership: idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration. The idealized influence dimension measures a leader's ability to serve as a role model, inspiring trust and respect among followers. It includes items such as "My leader instills pride in being associated with them." The inspirational motivation dimension evaluates the leader's

capacity to articulate a clear and compelling vision. For example, items include "My leader provides a clear vision of the future." The intellectual stimulation dimension examines how leaders encourage innovation and critical thinking, with items like "My leader challenges me to think critically about problems." The individualized consideration dimension assesses the leader's efforts to provide personalized support and mentorship. Example items include "My leader considers my personal development needs."

The questionnaire consisted of 16 items, with four items per dimension. The reliability of the instrument was established through Cronbach's alpha, which yielded a value of 0.89, indicating excellent internal consistency. Validity was confirmed through Confirmatory Factor Analysis (CFA), with Average Variance Extracted (AVE) values exceeding 0.5 for all constructs, demonstrating good convergent validity (Hair et al., 2010).

Cooperative Learning Survey

The cooperative learning survey was adapted from the Cooperative Learning Model developed by Johnson and Johnson (1999). This instrument assessed three dimensions: promotive interaction, individual accountability, and group processing. Promotive interaction measured the degree of mutual support among students, with items such as "Students in my class help each other understand the material." Individual accountability evaluated the sense of personal responsibility within groups, including items like "Each group member is accountable for the group's success." Group processing assessed how effectively the group reflected on and improved their performance, with items such as "Our group discusses ways to improve our work regularly." The survey included nine items, with three items per dimension. The reliability of the instrument was high, with a Cronbach's alpha of 0.85. The instrument's validity was verified through CFA, with all dimensions meeting the thresholds for construct validity.

Motivation Scale

The motivation scale was based on Deci and Ryan's (1985) Self-Determination Theory (SDT) and measured two dimensions: intrinsic motivation and extrinsic motivation. Intrinsic motivation focused on internal drivers, such as enjoyment and personal growth. It included items like "I study because I enjoy learning new things." Extrinsic motivation assessed external influences, such as rewards or recognition, with items like "I work hard to earn high grades." This scale consisted of ten items, with five items per dimension. The instrument demonstrated strong reliability, with a Cronbach's alpha of 0.87. Convergent validity was established through AVE values greater than 0.5, and discriminant validity was confirmed using the Fornell-Larcker criterion. All instruments were piloted with a subset of participants before full-scale deployment. Feedback from the pilot phase was incorporated to refine the wording and clarity of the items, ensuring their appropriateness for the target population.

Data Analysis

Data analysis was conducted using SEM and SITOREM analysis, providing a robust framework for hypothesis testing and strategic prioritization of indicators. The SEM analysis began with the evaluation of the measurement model to ensure the validity and reliability of the constructs. Convergent validity was assessed by examining factor loadings, composite reliability, and AVE values, all of which met or exceeded the recommended thresholds (Hair et al., 2010). Discriminant validity was verified using the

Fornell-Larcker criterion, ensuring that each construct was distinct from the others. Reliability was measured through Cronbach's alpha and composite reliability, both of which indicated strong internal consistency.

Once the measurement model was confirmed, the structural model was analyzed to test the hypothesized relationships. Path coefficients were examined to determine the strength and significance of each relationship, with a significance threshold of $p < 0.05$. Model fit was evaluated using indices such as the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA). All indices indicated an acceptable model fit.

SITOREM analysis was then applied to prioritize the indicators identified through SEM. The process involved calculating the mean scores for each indicator and categorizing them based on their performance and importance. Indicators with high importance but low performance were prioritized for improvement, while those with high performance were flagged for maintenance (Hardhienata, 2017). This dual analytical approach ensured that the study provided both theoretical insights into the relationships among variables and practical recommendations for improving learning effectiveness.

▪ **RESULT AND DISCUSSION**

Validity and Reliability of the Structural Model

The structural model's validity and reliability were confirmed using several key statistical measures. Confirmatory Factor Analysis (CFA) validated the measurement model, ensuring that the constructs were adequately represented. Factor loadings for all items exceeded the recommended threshold of 0.70, confirming item reliability. Additionally, the Average Variance Extracted (AVE) values surpassed the threshold of 0.50 for all constructs, signifying strong convergent validity (Hair et al., 2010; Kline, 2015). Reliability was assessed through Cronbach's alpha and composite reliability. Cronbach's alpha values ranged from 0.85 to 0.91, while composite reliability scores exceeded 0.85, indicating robust internal consistency (Taber, 2018). To ensure discriminant validity, the Fornell-Larcker criterion was applied, confirming that each construct was distinct. AVE values for each construct were greater than the squared correlations among constructs, further supporting discriminant validity (Fornell & Larcker, 1981).

Moreover, The R^2 value for motivation was 0.255, indicating that 25.5% of the variance in motivation is explained by the independent variables, transformational leadership (X1) and cooperative learning (X2). Similarly, the R^2 value for learning effectiveness was 0.438, demonstrating that 43.8% of the variance in learning effectiveness is accounted for by the predictors, including motivation as a mediating variable. The adjusted R^2 values for both variables, 0.248 and 0.430 respectively, indicate minor adjustments for model complexity and confirm the stability of the model.

These R^2 values suggest that while the predictors significantly contribute to explaining the variance in the dependent variables, additional factors not included in the model may also influence motivation and learning effectiveness. For instance, external factors such as institutional support, teaching resources, and student socio-economic backgrounds could play a role in shaping these outcomes (Deci & Ryan, 1985; Hattie, 2008). The relatively higher R^2 value for learning effectiveness compared to motivation suggests that the combined effects of transformational leadership, cooperative learning, and motivation more strongly influence learning outcomes. This finding aligns with prior

research emphasizing the cumulative impact of leadership and instructional strategies on educational effectiveness (Leithwood & Jantzi, 2000; Robinson et al., 2008).

The results of predictive relevance (Q^2) using the Stone-Geisser criterion. For motivation (X_3), the Q^2 value was 0.141, indicating that the predictive relevance of the model for motivation is moderate. In comparison, the Q^2 value for learning effectiveness (Y) was 0.270, reflecting a higher predictive relevance for this construct. The Q^2 values suggest that the model has a good predictive ability for learning effectiveness and a moderate predictive ability for motivation. A Q^2 value greater than zero indicates that the model has predictive power, meaning it can accurately predict unseen data (Hair et al., 2019; Sarstedt et al., 2017). The higher Q^2 value for learning effectiveness further underscores the robustness of the model in capturing the dynamics influencing educational outcomes.

Table 1. Convergent validity

Variable	Indicators	Loading Factors	AVE	CR	Cronbach α
Learning Effectiveness (Y)	Clarity	0.781	0.637	0.898	0.858
	Variety	0.829			
	Task Orientation	0.792			
	Engagement in learning	0.841			
	Student success rates	0.745			
Transformational Leaderships(X_1)	Idealized influence	0.748	0.646	0.879	0.817
	Inspirational motivation	0.863			
	Intellectual simulation	0.834			
	Individual consideration	0.763			
Cooperative Learning Model (X_2)	Promotive interaction	0.707	0.595	0.843	0.754
	Personal accountability	0.748			
	Interpersonal skills and small group	0.843			
	Group processing	0.728			
Motivation (X_3)	<i>Intrinsic Dimension</i>		0.565	0.890	0.890
	Achievement	0.838			
	Confession	0.81			
	Responsibility	0.855			
	Progress	0.799			
	Compensation	0.804			
	<i>Extrinsic Dimension</i>				
	Studying Condition	0.851			
Status	0.805				
Learning Procedure	0.771				

Table 2. Discriminant validity

Indicators	Transformational Leadership	Cooperative Learning	Motivation		Learning Effectiveness
			Intrinsic	Extrinsic	
X1.1	0.748				
X1.2	0.863				

Indicators	Transformational Leadership	Cooperative Learning	Motivation		Learning Effectiveness
			Intrinsic	Extrinsic	
X1.3	0.834				
X1.4	0.763				
X2.1		0.707			
X2.2		0.748			
X2.3		0.843			
X2.4		0.728			
X3.1.1			0.838		
X3.1.2			0.81		
X3.1.3			0.855		
X3.1.4			0.799		
X3.2.1				0.804	
X3.2.2				0.851	
X3.2.3				0.805	
X3.2.4				0.771	
Y.1					0.781
Y.2					0.829
Y.3					0.792
Y.4					0.841
Y.5					0.745

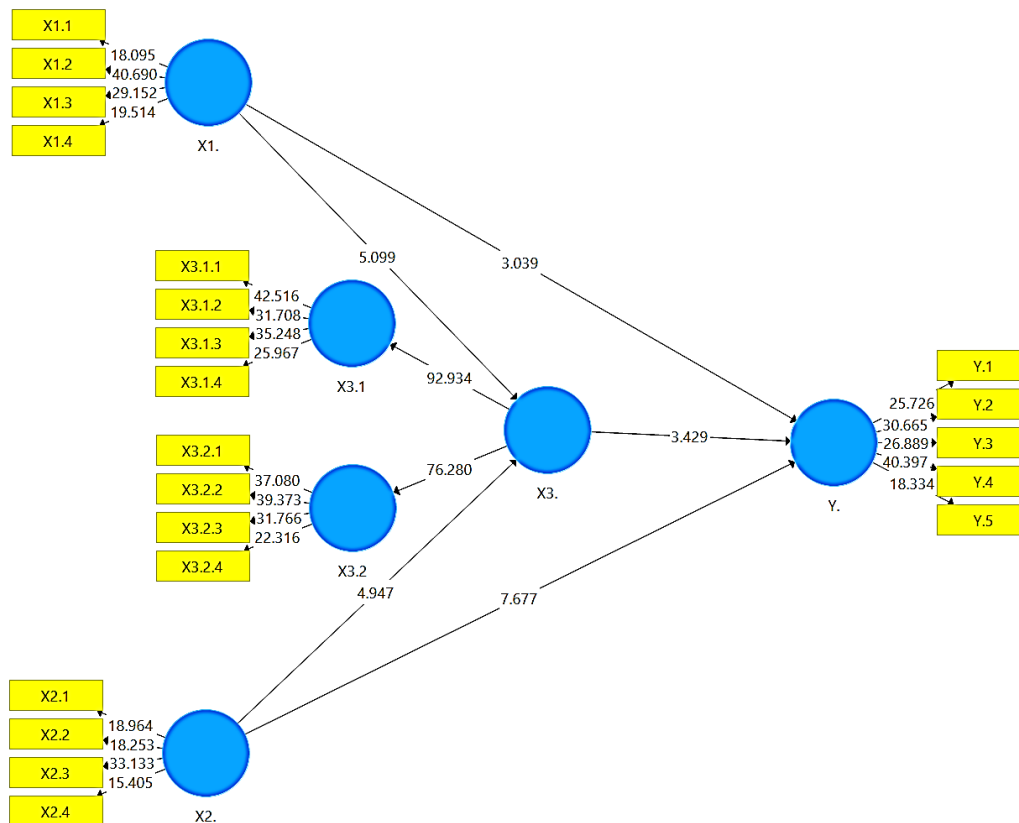
The dimensionality of the instruments was examined to ensure alignment with theoretical constructs. The transformational leadership instrument revealed a multidimensional structure, capturing the dimensions of idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration. Similarly, cooperative learning was multidimensional, consisting of promotive interaction, individual accountability, and group processing. In contrast, learning effectiveness was determined to be a unidimensional construct. These results are consistent with theoretical frameworks and affirm the appropriateness of the instruments for this study (Bass & Avolio, 1994; Johnson & Johnson, 1999).

Descriptive statistics provided additional insights into the sample characteristics. The mean age of the participants was 39.4 years ($SD = 7.8$), with a nearly equal gender distribution (51% female, 49% male). Most respondents had more than five years of teaching experience, reflecting significant professional expertise. These demographic characteristics support the generalizability of the findings to similar educational settings.

H1: The Effect of Transformational Leadership on Motivation

Hypothesis 1 proposed that transformational leadership positively impacts motivation. The analysis confirmed this hypothesis, revealing a significant relationship ($\beta = 0.292$, $T = 5.099$, $p < 0.001$). These findings highlight the effectiveness of transformational leadership practices, such as articulating a compelling vision and providing individualized support, in enhancing both intrinsic and extrinsic motivation among teachers.

The positive influence of transformational leadership on motivation is primarily due to its ability to inspire commitment and cultivate a supportive environment. Leaders who



demonstrate idealized influence and inspirational motivation instill a sense of purpose and alignment with organizational goals, which are essential for maintaining high levels of motivation (Bass & Avolio, 1994; Robinson et al., 2008). Additionally, intellectual stimulation and individualized consideration contribute to this effect by fostering innovation and addressing individual needs (Leithwood & Jantzi, 2000; Sun & Leithwood, 2018).

These results are consistent with Deci and Ryan’s (1985) Self-Determination Theory, which emphasizes the role of autonomy-supportive behaviors in promoting intrinsic motivation. Similar findings were reported by Lazarides et al. (2019), who observed that transformational leadership significantly enhanced teacher motivation across various educational contexts. This study builds on these insights by demonstrating the applicability of these principles in vocational high schools, underlining the pivotal role of leadership in motivating educators within these specialized settings.

H2: The Effect of Transformational Leadership on Learning Effectiveness

The second hypothesis explored the direct impact of transformational leadership on learning effectiveness. The analysis revealed a significant positive relationship ($\beta = 0.176$, $T = 3.039$, $p = 0.002$), indicating that transformational leadership behaviors significantly enhance conditions for effective teaching and learning.

Transformational leaders contribute to learning effectiveness by fostering collaboration, encouraging innovation, and supporting professional growth. Through the articulation of a shared vision and empowerment of educators, these leaders establish an environment conducive to improved instructional practices and enhanced student outcomes (Robinson et al., 2008; Sun & Leithwood, 2018). These findings align with

Leithwood et al. (2004), who demonstrated that transformational leadership positively influences teacher efficacy and student achievement.

The relatively modest path coefficient suggests that transformational leadership's influence on learning effectiveness may be partially mediated by other variables, such as motivation and instructional methods. This observation is consistent with Bass et al. (2003), who emphasized the interplay of complementary factors in amplifying the effects of leadership behaviors on organizational and educational outcomes. This highlights the importance of integrating leadership practices with other strategies to optimize learning effectiveness.

H3: The Effect of Cooperative Learning on Motivation

The third hypothesis examined the relationship between cooperative learning and motivation. The analysis showed a significant positive effect ($\beta = 0.315$, $T = 4.947$, $p < 0.001$), indicating that cooperative learning practices, including promotive interaction and individual accountability, play a vital role in enhancing both students' and teachers' motivation.

These findings align with theoretical frameworks that underscore the motivational benefits of collaborative learning environments. Cooperative learning fosters a sense of belonging and shared purpose, which are crucial for maintaining motivation (Johnson & Johnson, 1999; Slavin, 1995). Additionally, its emphasis on mutual support and group accountability enhances intrinsic motivation by providing opportunities for meaningful participation and personal growth (Gillies, 2007; Kagan, 1994).

This study's results are consistent with those of Wigfield et al. (2015), who demonstrated the positive effects of cooperative learning on motivational constructs in various educational settings. Furthermore, the current research extends these findings by emphasizing the relevance of cooperative learning in vocational education. This is particularly significant given the unique challenges in such contexts, which require innovative instructional strategies to sustain motivation and engagement.

H4: The Effect of Cooperative Learning on Learning Effectiveness

Hypothesis 4 posited that cooperative learning directly influences learning effectiveness. The results supported this hypothesis, with a significant positive effect observed ($\beta = 0.441$, $T = 7.677$, $p < 0.001$). These findings underscore the critical role of collaborative instructional strategies in enhancing educational outcomes.

The success of cooperative learning in improving learning effectiveness can be attributed to its emphasis on active engagement and collaborative problem-solving. By facilitating peer-to-peer interaction and reflective group processes, cooperative learning enhances critical thinking, knowledge retention, and social skills (Slavin, 1995; Johnson & Johnson, 1999). These benefits are particularly relevant in vocational education, where hands-on learning and teamwork are integral to student success.

These findings are consistent with prior research by Gillies (2007) and Slavin (2015), who emphasized the universal applicability of cooperative learning across educational contexts. The study contributes to this body of evidence by demonstrating its efficacy in vocational high schools, providing a practical framework for addressing the unique challenges of these institutions.

H5: The Effect of Motivation on Learning Effectiveness

The fifth hypothesis examined the direct impact of motivation on learning effectiveness. Results revealed a significant positive relationship ($\beta = 0.209$, $T = 3.429$, $p = 0.001$), indicating that motivated teachers and students are more likely to achieve favorable educational outcomes.

Motivation influences learning effectiveness by driving engagement, persistence, and goal-directed behavior. Intrinsically motivated individuals are more likely to embrace challenges and adopt deep learning strategies, while extrinsic motivation provides additional reinforcement through rewards and recognition (Deci & Ryan, 1985; Pintrich, 2003). These findings align with studies by Eccles and Wigfield (2002), who highlighted the critical role of motivation in shaping educational outcomes.

Comparatively, the study’s results are consistent with those of Ryan and Deci (2020), who found that motivation significantly enhances learning outcomes across diverse contexts. The present research adds to this evidence by emphasizing its role in mediating the effects of leadership and cooperative learning on learning effectiveness.

Indirect Effects: Mediation Analysis

The mediation analysis revealed significant indirect effects for both transformational leadership and cooperative learning on learning effectiveness through motivation. Transformational leadership demonstrated an indirect effect of $\beta = 0.061$ ($T = 2.518$, $p = 0.012$), while cooperative learning exhibited an indirect effect of $\beta = 0.066$ ($T = 2.943$, $p = 0.003$). These findings suggest that motivation serves as a critical pathway through which leadership and instructional strategies influence learning effectiveness. These results highlight the interconnectedness of the study variables, emphasizing the importance of an integrated approach to improving educational outcomes. By fostering motivation through leadership and cooperative learning, educators can create a synergistic effect that maximizes learning effectiveness (Bass et al., 2003; Leithwood et al., 2004).

Table 3. Hypothesis test results

No	Variables	Coefficients	t-statistics	p-values
1	Transformational Leadership (X ₁) -> Motivation (X ₃)	0.292	5.099	0.000
2	Transformational Leadership (X ₁) -> Learning Effectiveness (Y)	0.176	3.039	0.002
3	Cooperative Learning (X ₂) -> Motivation (X ₃)	0.315	4.947	0.000
4	Cooperative Learning (X ₂) -> Learning Effectiveness (Y)	0.441	7.677	0.000
5	Motivation (X ₃) -> Learning Effectiveness (Y)	0.209	3.429	0.001

Optimal Solutions for Improving Learning Effectiveness: SITOREM Analysis

SITOREM analysis provided a systematic framework for identifying and prioritizing indicators critical to improving learning effectiveness. The results of this analysis revealed three major components—transformational leadership, cooperative learning, and motivation—as pivotal to enhancing educational outcomes. Each component was assessed in terms of its individual indicators, which were then weighted by experts to establish priority areas for improvement.

For transformational leadership ($\beta_1 = 0.176$), the most critical indicator identified was inspirational motivation, followed by individual consideration, intellectual stimulation, and idealized influence. This prioritization underscores the importance of a leader's ability to inspire and individually support teachers in fostering an effective learning environment. Studies by Bass and Avolio (1994) and Leithwood and Jantzi (2000) have similarly emphasized that inspirational motivation and individual consideration are foundational to transformational leadership's impact on organizational performance. Inspirational motivation, specifically, encourages a shared vision and commitment among educators, directly influencing their engagement and productivity.

For cooperative learning ($\beta_2 = 0.441$), the results highlighted promotive interaction as the top priority, followed by individual accountability, interpersonal and small group skills, and group processing. These findings align with research by Johnson and Johnson (1999) and Slavin (1995), which indicate that promotive interaction and accountability significantly enhance collaborative learning outcomes. Promotive interaction creates a supportive environment where students actively engage with one another, fostering deeper understanding and knowledge retention.

In terms of motivation ($\beta_3 = 0.209$), progress and compensation emerged as the most critical indicators, followed by study conditions and responsibility. This suggests that recognizing achievements and providing tangible rewards are key to sustaining motivation among learners. Deci and Ryan's (1985) Self-Determination Theory posits that progress, as a form of competence-building, intrinsically motivates individuals, while external rewards, such as compensation, provide additional reinforcement.

Finally, for learning effectiveness, task orientation and student success rates were identified as the most impactful indicators, emphasizing the need for structured learning environments and measurable outcomes. Task orientation ensures clarity and focus in instructional strategies, while success rates reflect the tangible achievements of students. These findings resonate with Hattie's (2008) research on visible learning, which highlights clarity and success as critical drivers of effective pedagogy.

The findings of this study are largely consistent with prior research but also provide unique insights into the vocational education context. For instance, the prioritization of inspirational motivation and promotive interaction aligns with Leithwood and Jantzi's (2000) and Slavin's (1995) findings, respectively, highlighting their universal applicability across educational settings. However, this study extends these concepts by emphasizing their specific relevance in vocational high schools, where contextual challenges require tailored interventions.

Conversely, some results diverge from previous studies. For example, while Hattie (2008) emphasized task clarity as a key driver of learning outcomes, the current study highlights its role alongside student success rates, suggesting a dual focus on process and outcomes in vocational education. This divergence may reflect the unique demands of vocational curricula, which balance theoretical knowledge with practical skills.

The SITOREM analysis also provides a more granular understanding of these dynamics, prioritizing specific indicators such as progress and compensation within the broader construct of motivation. This level of detail complements existing research by offering actionable recommendations for addressing specific challenges in vocational education (Deci & Ryan, 1985; Johnson & Johnson, 1999).

Table 8. SITOREM analysis

Transformational Leadership ($\beta_1 = 0.176$) (3rd Rank)				
	Indicator in Initial State		Indicator after Weighting by Expert	Score
1	Idealized influence	1 st	Inspirational motivation (27.37)	3.88
2	Inspirational motivation	2 nd	Individual consideration (25.33)	4.10
3	Intellectual simulation	3 rd	Idealized influence (24.16)	4.00
4	Individual consideration	4 th	Intellectual simulation (23.14)	3.61
Implementasi Model Cooperative learning ($\beta_2 = 0.441$) (1st Rank)				
1	Promotive Interaction	1 st	Promotive Interaction (26.47)	3.57
2	Individual Accountability	2 nd	Group Processing (24.54)	4.02
3	Interpersonal and Small Group Skills	3 rd	Interpersonal and Small Group Skills (24.51)	3.68
4	Group Processing	4 th	Individual Accountability (24.48)	4.04
Motivation ($\beta_3 = 0.209$) (2nd Rank)				
1	Achievement	1 st	Progress (14.14)	3.82
2	Confession	2 nd	Compensation (14.02)	3.84
3	Responsibility	3 rd	Studying Condition (13.14)	3.78
4	Progress	4 th	Confession (13.10)	4.14
5	Compensation	5 th	Responsibility (12.06)	4.56
6	Studying Condition	6 th	Study Procedure (12.02)	4.56
7	Status	7 th	Achievement (11.12)	3.98
8	Study Procedure	8 th	Status (10.40)	4.02
Learning Effectiveness				
1	Clarity	1 st	Task Orientation (21.24)	3.78
2	Variety	2 nd	Variety (21.06)	3.65
3	Task Orientation	3 rd	Clarity (20.16)	4.15
4	Engagement in learning	4 th	Student success rates (19.12)	3.86
5	Student success rates	5 th	Engagement in learning (18.42)	4.16
SITOREM Analysis Result				
	Priority order of indicator to be Strengthened		Indicator remain to be maintained	
1 st	Promotive Interaction		1. Group processing	
2 nd	Interpersonal and small group skills		2. Individual accountability	
3 rd	<i>Progress</i>		3. Confession	
4 th	<i>Compensation</i>		4. Responsibility	
5 th	<i>Studying Condition</i>		5. Study Procedure	
6 th	Achievement		6. Status	
7 th	<i>Inspirational motivation</i>		7. Individual consideration	
8 th	<i>Intellectual simulation</i>		8. Idealized influence	
9 th	<i>Task Orientation</i>		9. Clarity	
10 th	<i>Variety</i>		10. Engagement in learning	
11 th	<i>Student success rates</i>			

▪ **CONCLUSION**

This study investigated the relationships between transformational leadership, cooperative learning, motivation, and learning effectiveness in vocational high schools, offering valuable insights into the dynamics of educational success in this context. The

findings confirm that transformational leadership, characterized by inspirational motivation, individualized consideration, intellectual stimulation, and idealized influence, has a direct and positive impact on both motivation and learning effectiveness. Similarly, cooperative learning strategies, particularly those emphasizing promotive interaction and individual accountability, were found to significantly enhance motivation and learning outcomes. Motivation also emerged as a critical mediating factor, linking the effects of leadership and cooperative learning to learning effectiveness and highlighting its central role in fostering engagement and achievement.

The SITOREM analysis provided a strategic framework for improving learning effectiveness by identifying and prioritizing actionable indicators. Inspirational motivation was highlighted as a key area for leadership development, while promotive interaction and progress recognition were identified as essential components of cooperative learning and motivation, respectively. These prioritized indicators offer a practical roadmap for educators and policymakers seeking to address specific challenges in vocational education. By strengthening leadership practices, fostering collaborative learning environments, and addressing motivational gaps, schools can create more effective educational settings that support both student success and teacher engagement. The study's findings align with international research while also offering unique insights tailored to the vocational education context, thereby contributing to both theoretical understanding and practical applications.

The implications of this research are significant for vocational high schools. The findings underscore the importance of targeted leadership development programs that cultivate inspirational motivation and provide individualized support for educators. The study also highlights the potential of incorporating cooperative learning strategies into the curriculum to enhance collaboration and accountability, which are particularly relevant to the applied nature of vocational education. Additionally, motivational frameworks that emphasize recognizing progress and offering tangible rewards are critical for maintaining sustained engagement among both students and teachers.

Despite these contributions, the study is not without limitations. The relatively moderate R^2 values for motivation suggest that other factors, such as institutional support and socio-economic influences, may also play a role in shaping learning outcomes. Future research should consider expanding the model to include these variables for a more comprehensive understanding of the dynamics at play. Moreover, the study relied on self-reported data, which introduces the potential for response bias. Future studies could address this limitation by incorporating observational methods or archival data to triangulate findings and enhance reliability. Despite these limitations, this research provides a robust foundation for improving educational practices in vocational settings and advancing the broader field of educational research.

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