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Integrating Educational Technology to Increase Teacher Creativity Through Servant Leadership

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ABSTRACT

Objective: This study aims to analyze the effect of educational technology integration on improving teacher creativity through the application of servant leadership. The focus is to understand how servant leadership can create an environment that supports teachers' use of technology and enhances their creativity in teaching. **Methods:** A quantitative approach was used with a survey method. Data were collected through questionnaires distributed to 200 teachers in Indonesian schools. The variables studied included the application of servant leadership, the use of technology in learning, and teacher creativity. Data were analyzed using regression to measure the relationship between variables. **Results:** The results show that servant leadership has a positive and significant effect on the use of technology in learning, which in turn enhances teacher creativity. Leaders who provide active support and adequate resources create an environment that supports technology-based learning innovation, which positively impacts teaching quality. **Novelty:** This study contributes new insights by combining servant leadership and educational technology as mutually supportive factors in enhancing teacher creativity. The findings enrich the literature on educational leadership and provide practical insights for school principals to enhance teacher creativity through technology.

INTRODUCTION

The development of technology in the world of education today cannot be separated from efforts to improve the quality of learning. Educational technology, which includes software, applications, and digital-based learning systems, has revolutionized the way we teach and learn. In this context, the use of technology not only facilitates the learning process but also opens opportunities for teachers to enhance their creativity in delivering lesson material. However, to maximize the benefits of technology in education, the role of teachers as the main drivers of change is crucial. Therefore, enhancing teachers' creativity in using technology is of utmost importance in today's educational landscape (Antonopoulou et al., 2025).

According to Spector (Lukman & Yune, 2024), educational technology has immense potential to improve the quality of learning when applied wisely and in alignment with the specific needs of each educational setting. Effective technology integration will create a more interactive and data-driven learning process, which not only increases student engagement but also enriches their learning experience. Additionally, (Adeoye, 2025) highlights that technology serves not only as a tool but also as a catalyst for change in teaching and learning methods. With technology, learning can be conducted in a more efficient manner aligned with current developments.

However, to utilize technology optimally, creativity from teachers is required. Creativity refers to a teacher's ability to create new solutions in the learning process, one of which is through the use of technology (Lindawati et al., 2024a) explains that creativity in teaching has a significant impact on student learning outcomes, especially when technology is used to enrich learning materials and increase student engagement. In this

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case, the ability of teachers to innovate and use technology in creative ways will have a positive impact on the quality of learning provided. This approach, as explained by (Lasrin et al., 2025), allows teachers to make optimal use of technology while still paying attention to direct interaction between teachers and students. Blended learning can increase student engagement and enrich their learning experience.

In addition to teacher creativity, supportive leadership also plays an important role in enhancing teacher creativity in using technology. Servant leadership is one leadership model that can have a positive impact on teacher potential development (Lindawati et al., 2024a), who first proposed this concept, emphasized that a good leader is one who serves and pays more attention to the needs of their members. In the context of education, school principals or madrasah leaders who apply servant leadership will focus on empowering teachers, providing the necessary support, and creating an environment that encourages creativity and the maximum use of technology.

A study by (Yatno, 2025) shows that school principals who apply servant leadership can create a positive school culture, where teachers feel valued and encouraged to innovate. Servant leadership facilitates teacher development by providing space for experimentation and new learning and encouraging them to utilize technology as an effective teaching tool. This approach supports teachers in improving the quality of their teaching in more creative and technology-based ways.

Recent research by (Liu, 2025a) also shows that servant leadership can increase teacher creativity, which in turn can improve the quality of learning in the classroom. In their study, it was found that when educational leaders provide appropriate support and pay attention to teachers' needs, teachers will be more motivated to use technology in teaching and create an innovative learning environment.

In addition to servant leadership, transformational leadership also plays an important role in encouraging teacher creativity (Adhinugraha, 2024) explain that transformational leadership, which focuses on inspiring and empowering followers, can increase teacher motivation and innovation in the use of technology. School principals who adopt this leadership style will encourage teachers to innovate and improve their skills in using technology for learning.

At the State Senior High School (MAN) in Bogor Regency, the application of technology in learning must involve all parties, especially creative and innovative teachers. With the support of servant and transformational leadership, it is hoped that teachers can be empowered to fully integrate technology into learning. This study aims to analyze how servant leadership can enhance teacher creativity in using technology at the State Senior High School in Bogor Regency. Path analysis will be used to identify the relationship between servant leadership, teacher creativity, and the use of technology in learning.

With this approach, it is hoped that this research can make an important contribution to the development of education at the State Senior High School in Bogor Regency, as well as provide strategic recommendations to improve the quality of education through the empowerment of creative and technology-based teachers.

RESEARCH METHOD

The research approach is the main foundation underlying every step in the research process, from the formulation of basic assumptions to the collection, analysis, and

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interpretation of the data obtained. According to (Creswell & Creswell, 2018), the research approach is a plan that guides researchers in developing and conducting research, including choosing the appropriate methods for data collection and analysis. In this study, the approach used was designed systematically to obtain relevant and reliable results.

This study uses a descriptive approach that aims to describe the characteristics of the variables being studied. The descriptive approach does not aim to find cause-and-effect relationships, but rather to provide a clear and detailed picture of the state or condition of the phenomenon being studied. With this approach, the research focuses on a deep understanding of the existing variables without any attempt to manipulate or intervene in the object being analyzed. For example, this research will systematically describe the characteristics of relevant variables, from measurement to data analysis, to provide a more complete picture of the phenomenon. As explained by (Setyaningsih & Hardhienata, 2019), the descriptive approach provides an understanding of "what is" in a situation without testing the cause-and-effect relationship between variables.

On the other hand, this research also focuses on verifiable or causal research, which aims to explore the cause-and-effect relationship between the variables being studied. Causal research seeks to verify whether a variable has a significant influence on another variable. In this study, the causal approach is used to explore and test whether the relationships found between the variables are indeed causal. For example, this study will test whether changes in one variable can influence changes in another variable and how significant that influence is on the results obtained. According to (Sugiyono, 2021), causal research not only identifies the existence of relationships between variables but also seeks to prove these causal relationships through appropriate statistical analysis.

By combining descriptive and causal approaches, this research aims to provide a comprehensive picture of the phenomenon being studied while verifying the relationships between the variables (Jiang & Tong, 2025). This approach allows researchers to delve deeper into the characteristics of a phenomenon while providing empirical evidence of how the variables influence each other, which ultimately contributes significantly to theoretical development or practical application in the field.

Path Analysis is a statistical technique used to analyze cause-and-effect relationships between variables in a structural model (Syah et al., 2024). This method allows researchers to identify and measure direct and indirect effects between variables, as well as understand complex structures in data. In recent years, the application of Path Analysis has grown, particularly in the fields of education, economics, and social sciences.

According to (Benitez et al., 2021), Path Analysis is effective for testing the direct and indirect effects between socioeconomic conditions, learning motivation, and student academic achievement. Their research shows that learning motivation has a significant effect on student academic achievement, and socioeconomic conditions directly influence learning motivation. This finding aligns with (Cepeda-Carrion et al., 2022)research, which identified protective and risk factors in academic stress among students through a Path Analysis model.

Based on these studies (Setiady, 2019), it can be concluded that Path Analysis is an effective tool for understanding relationships between variables across various disciplines. This method not only provides an overview of the direct relationships

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between variables but also allows for the identification of indirect influences through specific pathways within the model (Susanti, 2023). Therefore, this study aims to apply Path Analysis in the context of specify the specific context of your research to provide deeper insights into the dynamics of the relationships between the variables involved(Sulistiyani & Haris, 2024). The determination of the model for the inter-variable relationships being studied namely, teacher innovation, creativity, organizational support, emotional intelligence, and information and communication technology (ICT) literacy is based on Colquitt's Grand Theory of Organizational Behavior (Su et al., 2022).

The population is a generalization area consisting of objects and subjects that have certain qualities or characteristics determined by a researcher to be studied and then conclusions are drawn (Sugiyono, 2013). The population of this study is 164 civil servant teachers at the State Islamic High School (MAN) in Bogor Regency. The sample size for this quantitative study was determined using random sampling based on the Taro Yamane formula. A sample is a portion of the population that represents and possesses the characteristics of the population. In this study, the error rate and confidence level used were 5%. The following is Taro Yamane's formula (Arikunto, 1998). Based on this formula, the sample size for this study is:

$$n = \frac{N}{1 + Ne^2} = \frac{202}{1 + 202(0.05)^2} \approx 135$$

Therefore, the sample size used in this study is 135 civil servant teachers at the State Senior High School (MAN) in Bogor Regency. The research data presented in this section were obtained from measurements of teacher creativity, servant leadership, knowledge management, emotional intelligence, work motivation, and information and communication technology (ICT) literacy based on respondents' responses to the instrument variables. Data were collected from 135 respondents. Before conducting path analysis, the data must meet several statistical test requirements, namely: Normality of Error Test, Homogeneity of Variance Test, and Linearity Test, as follows:

1. Normality Test

The normality of the standard error of the estimate was tested using the Liliefors test. The Ltable value for n = 135 with α = 0.05 is 0.06, at a significance level of 0.05. The requirement that the standard error of the estimate comes from a normally distributed population is Lcount < Ltable. The hypothesis for the normality test in this study is as follows:

Table 1. Summary of Normality Test of Standard Error of Estimation

Nu	Estimation Error	n	L_Calculate	L_label α=0,05	L_label α=0,01	Decision
1	$z - \hat{y}_1$	135	0.034	0.076	0.089	Normal
2	$z - \hat{y}_2$	135	0.033	0.076	0.089	Normal
3	$z - \hat{y}_3$	135	0.033	0.076	0.089	Normal
4	$y - \hat{y}_4$	135	0.033	0.076	0.089	Normal
5	$z - \hat{y}_5$	135	0.032	0.076	0.089	Normal
6	$y_1 - x_1$	135	0.032	0.076	0.089	Normal
7	$y_1 - x_2$	135	0.033	0.076	0.089	Normal
8	$y_2 - x_2$	135	0.031	0.076	0.089	Normal
9	$y_2 - x_3$	135	0.031	0.076	0.089	Normal

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2. Homogeneity Test

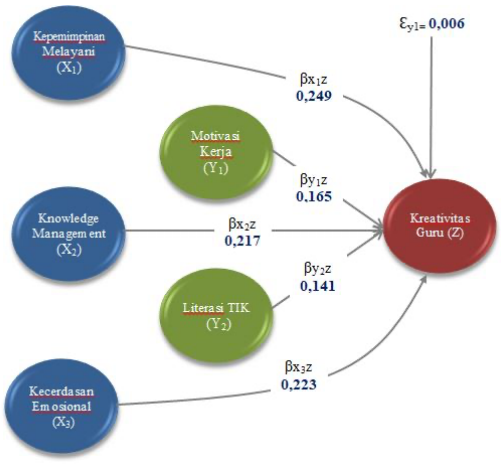
Homogeneity testing was conducted to determine whether the population variance was homogeneous or heterogeneous. The homogeneity test of variable data in this study was performed using Bartlett's test with a chi-square table. The data was considered homogeneous if $\chi 2count < \chi 2table$, and the table was tested at a significance level of 0.05.

Table 2. Summary of Linearity Test Results

No	Linearity Test	F_observed	F_table	Sig.	Conclusion	Decision
1	Teacher Creativity (Z) → Servant Leadership (X1)	1,576	2,67	0,330	Linear	Normal
2	Teacher Creativity (Z) → Knowledge Management (X2)	1,058	2,67	0,402	Linear	Normal
3	Teacher Creativity (Z) → Emotional Intelligence (X3)	0,674	2,67	0,930	Linear	Normal
4	Teacher Creativity (Z) → Work Motivation (Y1)	1,072	2,67	0,385	Linear	Normal
5	Teacher Creativity (Z) → ICT Literacy (Y2)	1,230	2,67	0,271	Linear	Normal
6	Work Motivation (Y1) → Servant Leadership (X1)	1,379	2,67	0,097	Linear	Normal
7	Work Motivation (Y1) → Knowledge Management (X2)	1,483	2,67	0,060	Linear	Normal
8	ICT Literacy (Y1) → Knowledge Management (X2)	0,808	2,67	0,778	Linear	Normal
9	ICT Literacy (Y1) → Emotional Intelligence	0,632	2,67	0,957	Linear	Normal

The description of the research data obtained from each variable teacher creativity (Z), servant leadership (X1), knowledge management (X2), emotional intelligence (X3), work motivation (X4), and ICT literacy (X5) was derived from the research sample's responses and then processed using descriptive statistical calculations. The data used as the basis for the description of the research results are the instrument item scores referring to the four research variables, namely teacher creativity (Y) as the endogenous variable, servant leadership (X1), knowledge management (X2), emotional intelligence (X3), work motivation (Y1), and ICT literacy (Y2) as the intervening variables.

a. Model of Path Effects Between Variables in Substructure-1



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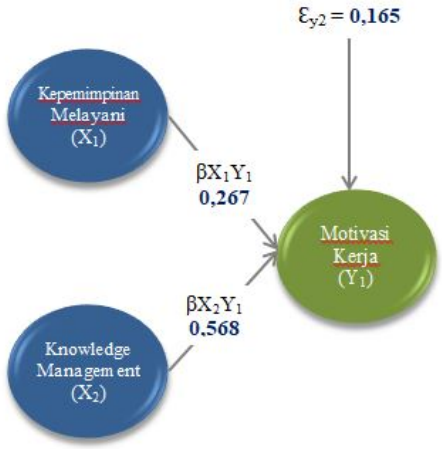
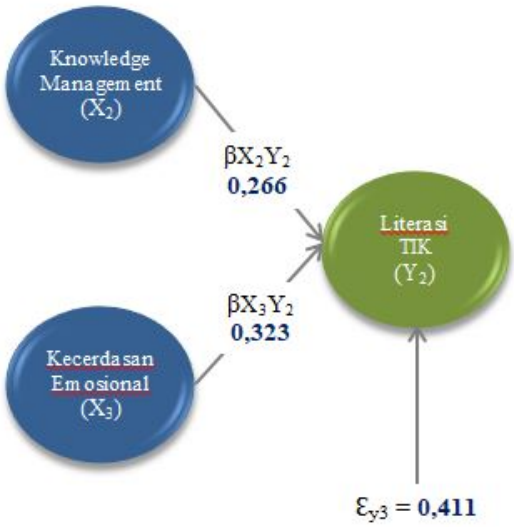
The model of the influence between variables in substructure-1 consists of one variable, namely teacher creativity (Z), and five variables, namely servant leadership (X1), knowledge management (X2), emotional intelligence (X3), work motivation (Y1), and ICT literacy (Y2), as well as one residual variable, namely Ɛy1. Based on these influences, the path model for Substructure-1 is as follows: $\hat{y} = \beta z1x1 + \beta z2x2 + \beta z3x3 + \beta y1x4 + \beta y2x5 + \varepsilon y$.

b. Model of Path Effects Between Variables in Substructure-2



The model of the influence between variables in substructure-2 consists of one dependent variable, namely work motivation (Y1), and two independent variables, namely servant leadership (X1) and knowledge management (X2), as well as one residual variable, namely Ɛy4. Based on this influence, the path model in substructure-2 is as follows: $\hat{y} = \beta x1y1 + \beta x2y1 + \varepsilon y2$.

c. Model of Path Effects Between Variables in Substructure-3



The model of the influence between variables in substructure-3 consists of one dependent variable, namely ICT literacy (Y2), and two independent variables, namely organizational culture (X2) and knowledge management (X3), as well as one residual variable, namely Ɛy4. Based on this influence, the path model in substructure-2 is as follows $\hat{y} = \beta x2y2 + \beta x3y2 + \varepsilon y3$.

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RESULTS AND DISCUSSION

Results

A. Model of Inter-Variable Relationships in Substructure-1

Table 3. Inter-Variable Relationships in Substructure-1

Variable	B	Std. Error	Beta	t	Sig.
(Constant)	2.839	8.697		0.326	0.745
Servant Leadership_X1	0.238	0.065	0.249	3.676	0
Knowledge Management_X2	0.262	0.098	0.217	2.67	0.009
Emotional Intelligence_X3	0.227	0.077	0.223	2.944	0.004
Work Motivation_Y1	0.182	0.081	0.165	2.241	0.027
ICT Literacy_Y2	0.568	0.242	0.141	2.349	0.02

Table 4. Anova

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	20746.204	5	4149.241	53.071	0
Residual	10085.53	129	78.182		
Total	30831.733	134			

The probability value (sig.) is 0.000 < 0.05, thus the regression equation $\hat{y}$ = 0.249x1+ 0.217x2 + 0.223x3 + 0.165x4 + 0.141x5 + εy is significant. The results of this test confirm that the equation can be used to predict teacher creativity (Y) based on scores for servant leadership (X1), knowledge management (X2), emotional intelligence (X3), work motivation (Y1), and ICT literacy (Y2), as well as one residual variable, Ɛy1. Results of the linear regression model test on the substructure -1

Table 5. Model Summery

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	0.82	0.673	0.66	8.842	0.673	53.071	5	129	0

B. Model of Inter-Variable Relationships in Substructure-2

Table 6. Inter-Variable Relationships in Substructure-2

Model	B	Std. Error	Beta	t	Sig.
(Constant)	15.048	9.428	–	1.596	0.113
Servant Leadership (X1)	0.246	0.064	0.267	3.837	0
Knowledge Management (X2)	0.661	0.081	0.568	8.175	0

Table 7. Anova

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	16131.370	2	8065.685	85.297	0
Residual	12481.964	132	94.560		
Total	28613.333	134			

It can be shown that the path coefficients in substructure-1 obtained are the path coefficient of X1 to Y1 is βX1y1 = 0.267, and X2 to Y1 is βX2y1 = 0.568. Each sig value is < 0.05, so H0 is rejected, meaning it is significant.

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Table 8. Model Summery

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.751	.564	.557	9.724	.564	85.297	2	132	0

C. Model of Path Effects Between Variables in Substructure-3

Table 9. Model of Path Effects Between Variables in Substructure-3

Variable	B	Std. Error	Beta	t	Sig.
(Constant)	3.669	3.116		1.117	0.241
Knowledge Management_X2	0.81	0.30	0.266	2.668	0.009
Emotional Intelligence_X3	0.83	0.26	0.323	3.232	0.002

Table 9. Anova

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	573.563	2	286.782	27.297	0
Residual	1394.762	132	10.566		
Total	1968.326	134			

The probability value (sig.) is 0.000 < 0.05, thus the regression equation $\hat{y} = 0.266x2 + 0.323x3 + \varepsilon y3$ is significant. The results of this test confirm that the equation can be used to predict ICT literacy (Y2) based on knowledge management scores (X2) and emotional intelligence (X3).

Table 10. Model Summery

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.540	.291	.281	3.251	.291	27.141	2	132	0

Discussion

Amid rapid technological advances, the application of technology in education has become extremely important. One key factor influencing the effectiveness of technology use in the classroom is teachers' creativity in adapting and implementing technology to improve the quality of learning. Servant leadership plays a central role in supporting the development of teachers' creativity. This leadership style emphasizes service, empowerment, and the development of the potential of those being led, which in an educational context means providing maximum support for teachers to innovate and use technology effectively. Research conducted by (Liu, 2025b) in the Journal of Humanities and Social Studies reveals that a supportive school climate, shaped by the implementation of servant leadership, can enhance teachers' creativity. School principals who implement a servant leadership style create an environment where teachers feel valued, empowered, and given opportunities to innovate, including in the use of technology. These findings align with research conducted by (Lindawati et al., 2024b) in the Edusci Journal, which shows that servant leadership not only enhances teacher creativity but also helps create a learning culture that supports technology integration in the classroom.

The success of technology integration in education depends on the leader's ability to motivate and empower teachers. Leaders with a servant leadership style will focus more on providing support and training for teachers to improve their digital literacy. This is evident in the research conducted by (Hidayat & Patras, 2024), which highlights the

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importance of the principal's role in guiding teachers through technology-based training and providing them with access to the resources needed to enhance teaching innovation. Additionally, the leader's commitment to providing teachers with opportunities to explore new technologies is crucial in creating an environment that supports teacher creativity. In this context, school principals acting as servant leaders serve as facilitators who encourage teachers' professional development. Based on the findings of the study by (Budiyanto, 2025), principals who apply the principles of servant leadership not only focus on achieving learning outcomes but also on the emotional and professional well-being of teachers. Such leaders provide space for teachers to innovate by integrating technology into learning, which ultimately leads to improved teaching quality and more creative learning.

Educational technology, in many cases, functions as a tool that enables teachers to be more creative in designing and delivering learning materials. Research by (Supriatman, 2025) in Society states that leaders who provide support and remove barriers to technology use can accelerate the creative process of teachers. They note that effective use of technology allows teachers to design learning that is more engaging and relevant to students, which in turn can improve the overall quality of education. Additionally, the use of educational technology also aids in the development of collaborative skills among teachers. As suggested by Hidayat (2023), technology enables teachers to share knowledge and ideas through digital platforms, enhancing their innovation and creativity in designing more effective and engaging teaching strategies. Servant leadership facilitates this process by creating a collaborative environment that supports constructive idea exchange among teachers. Another study by (Damianus et al., 2024) also reinforces the argument that the implementation of servant leadership can shape an inclusive and creativity-supporting school culture. Good leadership creates space for teachers to share knowledge and experiences and allows them to access the technology needed to support innovative learning. Thus, servant leadership focuses not only on administrative management but also on developing teachers' technical and creative abilities.

Ultimately, teachers' creativity in using educational technology will be greatly influenced by the servant leadership they receive. Leaders who prioritize empowerment, emotional support, and training will encourage teachers to innovate and integrate technology more effectively. As shown in research by (Gustini, 2025), leaders who implement servant leadership give teachers the freedom to innovate, resulting in more creative and comprehensive use of educational technology. Thus, the relationship between servant leadership and teacher creativity in the integration of educational technology is very important(Hidayat & Patras, 2024). Effective leaders will ensure that teachers have access to the right technology, adequate training, and a supportive environment for innovation. This will enhance teachers' ability to design more engaging and effective learning experiences, as well as support their professional development in the digital age.

CONCLUSION

The integration of educational technology to enhance teacher creativity through servant leadership is a highly relevant approach in the context of contemporary education. The studies discussed indicate that servant leadership has a significant impact

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on the development of teacher creativity, particularly in the use of technology in teaching. Leaders who apply the principles of servant leadership not only focus on achieving learning objectives but also pay special attention to empowering and developing teachers professionally. Leadership that cares about teachers' well-being and needs, and supports them with adequate training and resources, has proven to create an environment that fosters creativity and innovation in integrating educational technology.

In this case, educational technology is not only a tool for delivering material, but also a means of encouraging teachers to be creative in creating more engaging and effective learning experiences. Servant leadership that supports teachers in adopting new technologies strengthens their ability to design and implement more innovative learning strategies. Thus, teachers' creativity in using technology can develop more optimally, which ultimately contributes to improving the overall quality of education.

The research findings described in this article also indicate that educational leaders who actively support the use of technology and provide space for teachers to innovate will achieve better results in improving the quality of learning. Conversely, without support from leaders, even if technology is available, teachers' creativity in utilizing it will be limited. Therefore, it is important to involve aspects of servant leadership in every effort to integrate educational technology in schools, so that a harmonious relationship between technology, teachers, and students can be created, and to achieve better educational goals.

Overall, the application of servant leadership in education has a significant impact on increasing teacher creativity, especially in the context of technology use. Leadership that prioritizes teacher empowerment and creates a supportive environment will result in teachers who are more creative and innovative in applying educational technology. Thus, the application of effective servant leadership is the key to optimizing the potential of technology to improve the quality of learning and student learning outcomes.

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