

# Integrating Technological Innovations in Teacher Professional Development: A Case Study on Enhancing Learning Outcomes

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## Abstract

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### Keywords:

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Learning Quality;  
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The integration of technology in teacher training has been widely promoted to enhance learning quality, yet its effectiveness remains debated. This study investigates whether technology-assisted teacher training can significantly improve learning outcomes at SMP Negeri 1 Sukodono. Using a quasi-experimental design with a quantitative approach, the study analyzed education report scores from 2023 (pre-training) and 2024 (post-training) through paired t-tests, normality tests, homogeneity tests, and Pearson correlation analysis. Findings revealed no statistically significant improvement in average education report scores ( $p = 0.199$ ), despite a 4.76% increase across five of six learning quality indicators. Strong correlations between pre- and post-training scores ( $r = 0.955$ ,  $p = 0.003$ ) suggest that while technology-based training has potential, its impact may require extended implementation and optimized integration for measurable improvements.

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### Kata kunci:

teknologi pendidikan;  
pembinaan guru; mutu  
pembelajaran; rapor  
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## Abstrak

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Integrasi teknologi dalam pelatihan guru telah banyak dipromosikan untuk meningkatkan kualitas pembelajaran, namun efektivitasnya masih menjadi perdebatan. Penelitian ini menyelidiki apakah pelatihan guru berbasis teknologi dapat secara signifikan meningkatkan hasil belajar di SMP Negeri 1 Sukodono. Dengan menggunakan desain kuasi-eksperimental dan pendekatan kuantitatif, penelitian ini menganalisis skor rapor pendidikan tahun 2023 (sebelum pelatihan) dan 2024 (setelah pelatihan) melalui uji t berpasangan, uji normalitas, uji homogenitas, dan analisis korelasi Pearson. Hasil penelitian menunjukkan tidak ada peningkatan yang signifikan secara statistik dalam rata-rata skor rapor pendidikan ( $p = 0,199$ ), meskipun terdapat peningkatan sebesar 4,76% pada lima dari enam indikator kualitas pembelajaran. Korelasi yang kuat antara skor sebelum dan sesudah pelatihan ( $r = 0,955$ ,  $p = 0,003$ ) mengindikasikan bahwa meskipun pelatihan berbasis teknologi memiliki potensi, dampaknya masih memerlukan penerapan yang lebih lama serta integrasi yang lebih optimal untuk mencapai peningkatan yang terukur.

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## INTRODUCTION

Education plays a fundamental role in human development by fostering intellectual, social, emotional, and physical growth. It serves as a means of equipping individuals with the knowledge, skills, and values necessary to navigate daily life and contribute to society (Wijayanto, 2022). Education is not only crucial for personal development but also serves as the backbone of a nation's social and economic progress (Subijanto et al., 2021). To optimize its impact, education can take multiple forms: formal

(schools, universities), non-formal (courses, training programs), and informal (daily learning experiences) (Bestari, 2023). Each of these educational modalities should integrate cognitive, affective, and psychomotor aspects to ensure a comprehensive learning experience (Purba, 2023).

One of the key measures of educational success is the quality of learning, which is influenced by several factors such as teaching quality, curriculum relevance, learning resources, teaching methods, evaluation and feedback, learning environment, teacher development, and the integration of technology (Mustafa & Zulhafizh, 2021). Among these, teacher development and technology utilization have gained prominence in contemporary discussions on education reform (Yustian, 2021). The use of technology in education has evolved significantly, with various digital tools enhancing learning outcomes. These tools include interactive learning technologies such as gamification, online learning platforms, simulations, automated assessments, and collaborative digital environments (Damayanti, 2023). Technology has been recognized as an effective medium for improving education, making learning more accessible and engaging (Tiara, 2022).

Despite extensive research on the role of technology in education, there remains a gap in understanding its effectiveness in specific applications, particularly in teacher development and the quality of learning assessments. Previous studies have emphasized the benefits of technology in general learning contexts but have not sufficiently examined its impact on education report cards as an assessment and improvement tool (Zam, 2021). The education report card, introduced within the independent curriculum framework, is a platform that evaluates education quality across six dimensions: literacy skills, numeracy skills, character development, security climate, diversity climate, and overall learning quality (Hulwani et al., 2021). However, the effectiveness of technology in utilizing education report cards for learning quality improvement has not been extensively analyzed.

This study aims to fill this gap by investigating the effectiveness of technology in teacher development and its role in improving the quality of learning through education report cards. The novelty of this research lies in its specific focus on how digital tools enhance the assessment and feedback mechanisms provided by education report cards. By analyzing their impact, this study contributes to the existing body of research by providing insights into how technology can be leveraged to optimize teacher performance and learning quality evaluations. Furthermore, this study seeks to offer practical recommendations for policymakers and educators on the strategic use of technology to enhance the assessment and improvement of educational outcomes (Nugraha & Nugraha, 2023).

## RESEARCH METHODS

This study employed a quasi-experimental design with a quantitative approach, following Creswell's (2014) guidelines on research methodology. The research aimed to evaluate the impact of teacher coaching using technological aids on the quality of

education. The study took place at SMP Negeri 1 Sukodono, a junior high school known for its openness to teacher development programs. Conducted over two academic years, the research compared data from 2023 (before coaching) and 2024 (after coaching). The school was selected based on its diverse student population, which includes various academic, social, and demographic backgrounds. The supportive environment at this institution was considered conducive to implementing technology-based learning improvements.

Data collection in this study involved a combination of interviews, observations, and documentation. The primary instrument used was the educational report card value published by the Ministry of Education, Culture, Research, and Technology of Indonesia. The report card includes six key indicators: student literacy skills, numeracy ability, character development, school safety conditions, school diversity conditions, and quality of learning. Interviews were conducted with teachers and school administrators to understand their perspectives on the implementation of technology in learning. Observations were carried out in classrooms to assess how technology was integrated into teaching practices. Documentation of the educational report card scores from both years provided measurable data for analysis.

The data analysis process involved several stages. First, a normality test was conducted using the Kolmogorov-Smirnov test to ensure the data distribution met statistical assumptions. A homogeneity test using Levene's test followed, confirming the consistency of variance across the two datasets. To determine whether significant differences existed between pre-coaching and post-coaching report card scores, a paired sample t-test was applied. Additionally, correlation analysis was performed using the Pearson correlation test to measure the strength of the relationship between the two sets of scores. The hypothesis tested whether teacher coaching using technology resulted in a significant improvement in education quality. The findings of this study are expected to provide insights into the effectiveness of technology-enhanced teacher coaching in improving learning outcomes at the junior high school level

## RESEARCH RESULTS AND DISCUSSION

### Results

#### **Test of Differences in Educational Report Card Values Before and After Teacher Coaching with Technology**

To assess the effectiveness of the use of technology as a tool in teacher training to improve the quality of learning, a statistical analysis was conducted in the form of a paired t-test on the results of the pretest and posttest. This paired t-test aims to identify whether there is a significant difference in the educational report card scores between before and after training.

Table 1 and Table 2 show the results of normality and homogeneity tests as prerequisites before conducting further analysis. Based on the results of the Kolmogorov-Smirnov test with a significance value of 0.973 ( $> 0.05$ ), the data has a

normal distribution. The homogeneity test with the Levene test produces a significance value of 0.482 ( $> 0.05$ ), indicating that the data is homogeneous.

**Table 1.** Results of the Normality Test - Kolmogorov-Smirnov

<i>Statistics</i>	<i>Mark</i>
<i>N</i>	6
<i>Mean</i>	0.000000
<i>Std. Dev.</i>	4,113008
<i>Kolmogorov-Smirnov Z</i>	0.485
<i>Sig. (2-tailed)</i>	0.973

**Table 2.** Results of Homogeneity Test - Levene Test

<b>Levene Statistics</b>	<b>Mark</b>	<b>df1</b>	<b>df2</b>	<b>Sig.</b>
Levene Statistics	0.533	1	10	0.482

### Increase in Education Report Card Values Between 2023 and 2024

Table 3 and Table 4 show the results of the paired t-test analysis, which produced an average report card score of 72.7467 in 2023 and 76.2133 in 2024. Although there was an increase of 4.76%, the results of the paired t-test showed a significance value of 0.199 ( $> 0.05$ ), which indicated that there was no significant difference between the report card scores before and after coaching.

**Table 3.** Paired Sample Statistics - 2023 and 2024 Education Report Card Grades

<b>Year</b>	<b>Mean</b>	<b>N</b>	<b>Std. Dev.</b>	<b>Std. Error Mean</b>
2023	72,7467	6	13.88612	5.66899
2024	76,2133	6	17.26284	7,04752

**Table 4.** Paired t-Test Results - 2023 and 2024 Education Report Card Grades

<b>Difference Between Couples</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Std. Error Mean</b>	<b>95% interval</b>	<b>t</b>	<b>df</b>	<b>Sig. (2-tailed)</b>
2023 - 2024	-3.46667	5,73720	2,34220	(-9.48749; 2.55415)	-1,480	5	0.199

### Correlation Test between 2023 and 2024 Education Report Card Grades

To assess the relationship between educational report card grades in 2023 and 2024, a correlation analysis was conducted using the Pearson correlation test. Table 5 shows the results of the correlation analysis, with a correlation value of 0.955 and a significance of 0.003 ( $< 0.05$ ), indicating a very strong relationship between report card grades in the two years.

**Table 5. Results of Paired Sample Correlation Analysis**

Partner	N	Correlation	Sig.
2023 & 2024 Education Report Card Grades	6	0.955	0.003

The results of this significant correlation indicate that there is a strong relationship between educational report card scores before and after teacher coaching using technology.

### Overall Educational Report Card Value Difference Test

Table 6 shows the overall results of the paired t-test on the differences in educational report card scores in 2023 and 2024. The results of this analysis produce a Sig. (2-tailed) value of 0.199 ( $> 0.05$ ), which means that  $H_0$  fails to be rejected. Thus, it can be concluded that there is no significant difference in educational report card scores between before and after teacher coaching in the use of technological aids to improve the quality of learning.

**Table 6. Paired t-Test Results for Differences in Educational Report Card Grades**

Difference Between Couples	Mean	Std. Dev.	Std. Error Mean	95% interval	t	df	Sig. (2-tailed)
2023 - 2024	-3.46667	5,73720	2,34220	(-9.48749; 2.55415)	-1,480	5	0.199

Based on the results of the paired sample test above, it shows that the Sig. (2-tailed) value is 0.199. Because the value is more than 0.05,  $H_0$  fails to be rejected. So it can be concluded that there is no significant difference in the value of the education report card between before and after teacher coaching in the use of technological aids to improve the quality of learning. However, there was an increase in the value of 5 of the 6 assessment indicators, namely student literacy skills, student numeracy skills, school security conditions, school diversity conditions, and learning quality. This result may be due to several factors, including the duration of the training which may be too short to have a significant impact because the distance of the education report card analyzed was only 1 year. In addition, some young teachers may already have a high level of competence so that the training does not provide significant additions, and some senior teachers may not be accustomed to using technology and applying what they learned during training to daily teaching practices. This is in line with the results of research by Novitasari and Fauziddin (2022) which shows that information technology training for teachers is not evenly distributed to all teachers and that teachers have not been optimal in utilizing existing technology-based media Novitasari & Fauziddin (2022). These obstacles are caused by factors such as teacher age, teacher motivation and attitude, availability of information technology-based media, school geographic conditions, and opportunities to participate in training. This is reinforced by the results of research by

Siregar (2023) which shows that teachers have difficulty in using technology, including designing and operating technology-based media, as well as the lack of complete facilities and infrastructure.

## Discussion

### **Analysis of the Difference Test of Educational Report Card Values Before and After Teacher Coaching with Technology**

The analysis of the test of differences in educational report card scores before and after teacher coaching with technology showed interesting results. The results of the paired t-test analysis showed that the educational report card score data in 2023 (before coaching) and 2024 (after coaching) had a normal and homogeneous distribution. This is supported by the significance value of the Kolmogorov-Smirnov normality test and Levene's homogeneity test, which indicate that the data meets the assumptions of normality and homogeneity. This finding is in line with previous studies that show the importance of normality and homogeneity tests in educational data analysis to ensure the validity of the results (Feliyawati & Widodo, 2022; Putri, 2023).

Although the data showed normality and homogeneity, the results of the paired t-test showed that there was no significant difference in report card scores before and after coaching. The significance value of 0.199 ( $> 0.05$ ) indicates that although there was a change in scores, the increase was not statistically significant enough. This is in line with the findings reported by Yusanti, who also found that although there was an increase in knowledge and skills after training, the results were not always significant (Yusanti, 2023). Other studies have also shown that short training duration can affect outcomes, where participants may not have fully applied their new knowledge (Achyana, 2016; Yufita et al., 2021).

Factors that may influence these results include short training duration and suboptimal implementation. Research by Feliyawati and Widodo shows that the implementation of appropriate learning methods and sufficient time for implementation can have a significant impact on learning outcomes (Feliyawati & Widodo, 2022). In addition, research by Akbar et al. emphasizes the importance of an integrated learning technology system to improve the quality of education, which may not have been fully implemented in this coaching context (Akbar et al., 2023).

Another obstacle that may be faced is the lack of support from the school environment and community in implementing technology. Research by Kusumanegara shows that motivation and work discipline greatly influence performance, which can also be applied in the context of education (Kusumanegara, 2023). If the environment is not supportive, then even though teachers have been trained, the expected results may not be achieved.

In addition, it is important to consider that teacher coaching with technology is not an instant solution. Research by Putri shows that the application of technology in education requires time and a continuous process to achieve the desired results (Putri,

2023). Therefore, continuous evaluation and adjustment of learning methods may be needed to ensure that the coaching carried out is truly effective.

In this context, it is important to develop more comprehensive and sustainable training modules. Research by Nugroho et al. shows that a more structured approach to training can improve learning outcomes (Mayasari et al., 2021). Thus, the development of better training programs and stronger support from schools and the government can help improve the effectiveness of teacher coaching.

Finally, although the results of the analysis show that there is no significant difference, it is important to continue to conduct further research to understand the factors that influence educational outcomes. More in-depth research can help identify more effective strategies in coaching teachers with technology, thereby improving the overall quality of education (Yufita et al., 2021; Susanti, 2013).

#### **Assessing the Increase in Education Report Card Values Between 2023 and 2024**

The increase in average report card scores of 4.76% between 2023 and 2024 indicates a trend of improvement in the education system, although the results are not statistically significant. The average report card score increased from 72.7467 to 76.2133, reflecting the positive impact of teacher coaching using technology. Research shows that the use of technology in education can improve the quality of learning, albeit on a small scale (Putri et al., 2019; , Gusriana, 2022). This is in line with the finding that effective teacher training can contribute to improving student learning outcomes (Syafi'i et al., 2023).

One factor that may contribute to the increase in report card scores is the implementation of technology that supports better accessibility of materials and evaluation methods. In this context, a website-based report card processing information system can simplify the assessment process and provide faster feedback to students and parents (Putri et al., 2019). In addition, the use of companion modules in training can also improve teachers' understanding and skills in managing learning (Wilis & Rahmad, 2018). Thus, the integration of technology in education can be an effective tool to improve the quality of teaching and learning outcomes.

However, despite the improvement, statistical analysis showed that the differences were not significant. This indicates the need for further evaluation of the training methods applied. Previous studies have shown that good educational management, including principal leadership and communication patterns between teachers and students, have a significant influence on learning outcomes (Syafi'i et al., 2023). Therefore, it is important to evaluate the duration and methods of training used so that the results achieved are more optimal and statistically significant in the future.

In this context, more structured and ongoing training may be needed to ensure that teachers can make the most of technology in the learning process. Research shows that ongoing training can improve teacher competency and, in turn, improve student learning outcomes (Asmoro et al., 2018). Therefore, it is important to design training

programs that focus not only on the use of technology, but also on developing teachers' pedagogical skills.

In addition, it is important to involve parents in the educational process. Research shows that parental involvement in children's education can contribute to improved learning outcomes (Zubairi, 2022). By utilizing technology for communication between schools and parents, such as through the E-Rapor application, it is hoped that it can increase parental participation in supporting their children's education (Gusriana, 2022). This involvement can create synergy between school and home, which can ultimately contribute to improving students' report card grades.

Furthermore, despite the positive trend in increasing report card scores, it is important to consider other factors that may affect learning outcomes. Research shows that socioeconomic factors, such as family income and parental education level, also play an important role in determining students' academic success (Dewi & Suseno, 2020; , Rifai, 2023). Therefore, efforts to improve the quality of education must consider the social and economic context of students.

Finally, to achieve more significant results, a holistic approach is needed in education development. This includes the development of relevant curricula, effective teacher training, and the involvement of parents and the community in the education process. With a comprehensive approach, it is hoped that more sustainable and significant improvements in the quality of education can be achieved in the future.

### **Correlation Test Analysis between 2023 and 2024 Education Report Card Grades**

The correlation test analysis between the 2023 and 2024 educational report card scores showed a very strong relationship, with a Pearson correlation value of 0.955 and a significance of 0.003. This indicates that students' report card scores in the previous year have a significant influence on the results obtained after coaching. This finding is in line with research showing that previous assessment results are often strong predictors of future academic performance, reflecting stability in students' academic abilities (Rimfeld et al., 2019).

This high correlation also reflects the effectiveness of coaching carried out by teachers, especially in the context of using technology in teaching. Research shows that integrating technology in education can improve student engagement and their learning outcomes (Pattiasina, 2024). However, despite the strong relationship, statistically significant improvements have not been achieved. This suggests that although coaching has a positive impact, it is possible that the time and methods used in coaching need to be increased to achieve more significant results (Nguyen, 2024).

Furthermore, it is important to consider that other factors, such as differentiated approaches to instruction, may also impact student outcomes. Research shows that teachers' understanding of differentiated approaches to instruction is positively related to student achievement (Yessingeldinov et al., 2022). Therefore, professional development for teachers that includes training in differentiated approaches and the use of technology may be an effective strategy to improve student learning outcomes.

In this context, longer and more innovative training is needed to enhance the impact of coaching. Previous research has shown that longer training time can improve the effectiveness of learning and students' academic outcomes (Du, 2024). Thus, designing more comprehensive and sustainable training programs can help teachers implement more effective teaching strategies and adapt to students' needs.

In addition, it is important to evaluate how emotional factors, such as teachers' emotional intelligence, can influence the relationship between coaching and student learning outcomes. Research shows that teachers with high emotional intelligence can create a more supportive learning environment, which in turn can improve students' academic performance (Valente & Lourenço, 2022). Therefore, training in emotional intelligence should also be considered as part of teachers' professional development.

The correlation between 2023 and 2024 report card grades also shows that continuous evaluation of the learning process is very important. Research shows that regular formative evaluations can help students identify their strengths and weaknesses, and encourage them to improve their academic performance (Huang, 2022). Thus, implementing a more dynamic and responsive evaluation system can improve overall student learning outcomes.

Finally, to achieve more measurable and significant results, collaboration between teachers, students, and parents is also very important. Research shows that parental involvement in their children's education is positively related to students' academic achievement (Aubin et al., 2023). Therefore, creating effective communication channels between school and home can help support the learning process and improve students' academic outcomes.

Overall, the correlation analysis between the 2023 and 2024 education report card scores shows that although there is a strong relationship, there are many factors that need to be considered to improve learning outcomes. By implementing more innovative strategies, extending training time, and increasing collaboration between all parties involved, it is hoped that more significant results can be achieved in the future.

#### **Analysis of Overall Educational Report Card Value Difference Test**

Analysis of the differences in educational report card scores before and after coaching showed that there was no significant difference, with a significance value of 0.199. Although there was an increase in five of the six assessment indicators, these results were not enough to conclude that technology-based teacher coaching had a significant impact on the quality of learning. This is in line with research showing that although technology training can improve teacher knowledge, its impact on student learning outcomes still requires further evaluation (Hunaidah et al., 2022; Rahmayanti et al., 2022).

It is important to note that despite improvements in assessment indicators, the challenges faced in implementing technology for teacher development remain significant. Research shows that limited facilities, teacher readiness to use technology, and limited training time are major barriers to improving the quality of learning (Azzahra et al., 2021). For example, in a study conducted by Rahardjo et al., it was found

that many teachers were not ready to teach using technology, resulting in low learning effectiveness (Rahardjo et al., 2023).

Furthermore, research by Hunaidah et al. highlighted the importance of training in the use of technology-based applications in improving teachers' abilities in online learning. However, the results obtained showed that although there was an increase in knowledge, the practical application of this knowledge in the learning context still needed to be improved (Hunaidah et al., 2022). This suggests that the training provided should be more focused on practical applications and relevance to the daily needs of teachers in the field.

Obstacles faced in technology-based teacher coaching also include lack of support from the school and unsupportive policies. Research by Setiyadi et al. emphasized that the leadership of the principal greatly influences the success of teacher coaching, where the principal must be able to provide the support and resources needed for training (Setiyadi et al., 2021). Without adequate support, the coaching initiatives carried out will not achieve the expected results.

In this context, it is important to develop a more comprehensive strategy in teacher training. For example, training that integrates information and communication technology (ICT) with innovative learning approaches can increase teacher and student engagement in the learning process (Febriani et al., 2023; Rohman & Susilo, 2019). Research by Anita et al. shows that Higher Order Thinking Skills (HOTS)-based training can improve the quality of learning if balanced with a good understanding of technology (Anita et al., 2022).

In addition, research by Zaman shows that training that focuses on developing teachers' writing competencies can also contribute to improving the overall quality of learning (Zaman, 2023). Thus, a more holistic approach to teacher development, which includes various aspects of competency, can have a more significant impact on the quality of education.

Finally, to maximize the impact of technology-based teacher training, ongoing evaluation and adjustment of existing training programs is needed. Research by Nella emphasizes the importance of educational supervision in improving the learning process, where continuous evaluation can help identify areas for improvement (Nella, 2019). Thus, ongoing development in teacher training will be key to improving the quality of education in the future.

## CONCLUSION

This study revealed that teacher coaching using technology did not result in a statistically significant improvement in educational report card scores at SMP Negeri 1 Sukodono. However, it did contribute to a 4.76% increase in five indicators of learning quality between 2023 and 2024, highlighting the potential of technology as a supplementary learning tool. The Pearson correlation test showed a very strong relationship between the scores before and after coaching, with a correlation value of

0.955 ( $p < 0.05$ ), indicating consistency in educational assessment results despite the intervention.

A key limitation of this research is its scope, as it focused only on one school, limiting the generalizability of the findings. Additionally, the study did not account for variations in teacher experience, student demographics, or differences across multiple educational institutions. The relatively short duration of coaching and the lack of extensive infrastructure support may have also contributed to the modest improvements observed.

For future research, a broader study incorporating multiple schools, diverse educational levels, and longer intervention periods is recommended. Further studies should also explore different models of technology-based coaching, combining them with pedagogical mentoring and infrastructure enhancements. With a more extensive and in-depth approach, better insights can be gained to inform policies that optimize the use of technology in teacher development and improve overall learning outcomes.

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