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# IMPLEMENTATION OF TOTAL QUALITY MANAGEMENT (TQM) IN IMPROVING DIGITAL LITERACY AND INNOVATIVE ATTITUDE OF SENIOR HIGH SCHOOL TEACHERS

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## ABSTRAK

Perkembangan teknologi informasi menuntut guru memiliki kompetensi literasi digital dan sikap inovatif untuk mendukung pembelajaran yang efektif di era digital. Salah satu pendekatan yang dapat digunakan untuk mendukung peningkatan kompetensi tersebut adalah Manajemen Mutu Terpadu *(Total Quality Management/TQM)*. Penelitian ini bertujuan menganalisis hubungan implementasi TQM dengan literasi digital dan sikap inovatif guru Sekolah Menengah Atas (SMA). Penelitian menggunakan pendekatan kuantitatif dengan desain deskriptif-korelasional. Populasi penelitian terdiri atas 40 guru SMA YP IPPI Petojo yang seluruhnya dijadikan sampel melalui teknik total sampling. Data dikumpulkan menggunakan kuesioner skala Likert dan dianalisis dengan statistik deskriptif serta inferensial menggunakan SPSS versi 26. Hasil penelitian menunjukkan bahwa data literasi digital dan sikap inovatif berdistribusi normal dengan nilai signifikansi masing-masing sebesar 0,528 dan 0,468 (>0,05). Literasi digital memiliki nilai rata-rata 45,21 dengan standar deviasi 9,484, sedangkan sikap inovatif memiliki nilai rata-rata 46,15 dengan standar deviasi 8,732. Distribusi sikap inovatif didominasi interval skor 46–51 sebesar 35,0%, yang menunjukkan kategori sedang. Temuan ini mengindikasikan bahwa literasi digital dan sikap inovatif guru masih perlu dikembangkan melalui penerapan prinsip TQM, seperti perbaikan berkelanjutan, keterlibatan seluruh anggota organisasi, dan kepemimpinan mutu.

**Kata Kunci:** *Total Quality Management (TQM), Literasi Digital, Sikap Inovatif, Guru SMA, Manajemen Mutu Pendidikan.*

## ABSTRACT

The rapid development of information technology requires teachers to possess digital literacy competencies and innovative attitudes to support effective learning in the digital era. One approach that can support the improvement of these competencies is Total Quality Management (TQM). This study aims to analyze the relationship between TQM implementation and the digital literacy and innovative attitudes of senior high school teachers. The study employed a quantitative approach with a descriptive-correlational design. The population consisted of 40 teachers at SMA YP IPPI Petojo, all of whom were selected as the sample through a total sampling technique. Data were collected using a Likert-scale questionnaire and analyzed using descriptive and inferential statistics with SPSS version 26. The results showed that the digital literacy and innovative attitude data were normally distributed, with significance values of 0.528 and 0.468 (>0.05), respectively. Digital literacy had a mean score of 45.21 with a standard deviation of 9.484, while innovative attitude had a mean score of 46.15 with a standard deviation of 8.732. The distribution of innovative attitudes was dominated by the score interval of 46–51 (35.0%), indicating a moderate category. These findings suggest that teachers' digital literacy and innovative attitudes still need further development through the application of TQM


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principles, including continuous improvement, total involvement of organizational members, and quality-oriented leadership.

**Keywords**: *Total Quality Management (TQM), Digital Literacy, Innovative Attitude, Senior High School Teachers, Educational Quality Management.*

## INTRODUCTION

In the context of educational quality improvement, teacher productivity is closely related to teachers' competencies and professional attitudes. Among the factors that are increasingly recognized as determinants of teacher productivity are digital literacy and innovative attitudes. Teachers who possess adequate digital literacy are better able to integrate technology effectively into teaching and learning, improve instructional quality, and respond to the demands of digital transformation in education. At the same time, innovative attitudes encourage teachers to develop creative instructional strategies, adopt new pedagogical approaches, and continuously improve their professional practices. Therefore, efforts to improve teacher productivity cannot be separated from strengthening digital literacy and fostering innovative attitudes as essential competencies for educators in 21st century education (Nguyen & Habók, 2024; Wohlfart & Wagner, 2023).

Education is a fundamental aspect of national development because it plays a vital role in improving the quality of human resources in a sustainable manner. Teachers hold a strategic role as the primary agents of the learning process, directly influencing the quality of educational outcomes. Teacher productivity is an important indicator in determining the effectiveness of learning and the achievement of educational goals. Productive teachers are not only capable of facilitating students' academic achievement but also play a crucial role in fostering students' character through the integration of moral values, discipline, responsibility, and positive learning behaviors in classroom practices (Maulana, 2022; Kapoh et al., 2022).

The problem of low teacher productivity remains a serious concern in the field of education. This condition is reflected in the suboptimal implementation of teachers' core responsibilities, limited instructional innovation, and low contributions to school development. Previous studies have shown that teacher productivity is influenced by several factors, including work motivation, professional competence, work discipline, and a supportive work environment. In addition, inadequate reward systems, excessive workload, and limited opportunities for professional development may reduce teachers' performance and commitment to improving the quality of learning (Andhayany & Mulyanti, 2022; Hidayat et al., 20).

Teachers as professionals require specialized expertise and continuously developing competencies to meet the evolving demands of education. Teacher professionalism is reflected in their ability to design and implement high quality learning while demonstrating a strong work ethic and commitment to continuous improvement. Teacher productivity is not only measured by the quantity of work accomplished but also by the quality of instructional performance, innovation in teaching practices, and the effective implementation of educational responsibilities. As emphasized by Kuswibowo (2021), continuous professional competence development is a key factor in enhancing teachers' productivity and instructional performance. Similarly, empirical findings indicate that supportive working conditions and ongoing professional development significantly contribute to improving teacher productivity and the overall quality of education (Hestianingtias et al., 2022).

The development of information technology requires teachers to have digital literacy skills as part of 21st-century skills. Digital literacy includes the ability to access, understand, evaluate, and utilize technology-based information effectively. Teachers with good digital


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literacy are able to create interactive, innovative, and relevant learning according to student needs. Research results show that digital literacy contributes to increasing student understanding and engagement in the learning process (Falloon, 2020; Sadaf & Gezer, 2020). This ability also enables teachers to create technology enhanced learning environments that promote more meaningful interaction and higher levels of student engagement through the effective use of digital technologies (Nkomo et al., 2021).

An innovative attitude is an essential characteristic that teachers need to possess in responding to the rapid advancement of science and technology. It reflects teachers' ability to think creatively, adapt to educational changes, and remain open to new ideas and pedagogical approaches. According to Wohlfart and Wagner (2023), teachers are expected to continuously innovate in their instructional practices to respond to the challenges of digital transformation in education. Consistent with this view, Listrianti et al. (2024) found that the integration of digital literacy into innovative learning practices contributes to more effective and meaningful learning experiences. An innovative attitude also encourages teachers to continuously improve their performance and avoid becoming complacent with their existing achievements. Teachers who demonstrate innovative behavior are more likely to engage in continuous improvement, seek new instructional approaches, and enhance the quality of teaching practices (Murwaningsih & Fauziah, 2023).

Effective interpersonal communication also plays an important role in enhancing teacher productivity. Harmonious relationships between teachers and students, as well as collaborative interactions among colleagues, contribute to the creation of a positive and supportive school environment. Effective communication, both within instructional activities and professional collaboration, facilitates knowledge sharing, strengthens teamwork, and improves the overall performance of educational organizations. As explained by Xie and Derakhshan (2021), positive teacher interpersonal communication promotes meaningful interactions that support effective teaching and learning processes. Likewise, effective communication and teacher competence have been shown to contribute significantly to improving educational quality and student learning outcomes (Yusuf et al., 2020).

A systematic and sustainable management approach is needed to improve the quality of education comprehensively. Total Quality Management (TQM) is one approach that emphasizes continuous improvement, the involvement of all members of the organization, and an orientation towards quality. The application of TQM through the Plan-Do-Check-Act (PDCA) cycle can encourage the strengthening of a quality culture and the structured improvement of teacher competencies.

From a theoretical perspective, TQM can enhance teachers' digital literacy and innovative attitudes through several mechanisms. The principle of continuous improvement encourages schools to provide regular professional development programs, including digital skills training and technology integration in teaching. Total involvement promotes active participation of teachers in collaborative learning communities, enabling the exchange of ideas and innovative practices. Furthermore, leadership commitment and data-driven decision making create a supportive environment for experimentation, reflection, and adoption of educational innovations. Consequently, TQM is conceptually expected to support the development of teachers' digital competencies and innovative attitudes in educational practice.

Several studies reported that teacher productivity experienced challenges after the COVID-19 pandemic due to limitations in digital competencies, difficulties in adapting to technology-based learning, and reduced innovation in instructional practices. Although previous studies have examined TQM implementation in educational institutions and other


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studies have separately investigated digital literacy and innovative attitudes among teachers, studies describing the conditions of teachers' digital literacy and innovative attitudes within the context of TQM implementation at the senior high school level remain limited. Therefore, further research is needed to provide an empirical description of these variables as a basis for improving educational quality in the post-pandemic era.

Several studies reported that teacher productivity experienced challenges after the COVID-19 pandemic due to limited digital literacy, reduced learning innovation, and difficulties in adapting to technology-based learning environments. This condition shows the importance of directed and sustainable efforts to improve educational management. Based on this description, this study aims to describe the level of digital literacy and innovative attitudes of senior high school (SMA) teachers within the context of Total Quality Management (TQM) implementation as an effort to support educational quality improvement. Specifically, this study aims to: (1) describe the level of teachers' digital literacy; (2) describe the level of teachers' innovative attitudes; and (3) provide an overview of these variables within the context of TQM implementation at SMA YP IPPI. The findings are expected to contribute to the development of quality-oriented educational management strategies that support digital transformation and innovation among teachers.

## METHODS

This study employed a quantitative correlational research design to examine the relationships between Total Quality Management (TQM) implementation, teachers' digital literacy, and innovative attitudes. A correlational approach was selected because it enables researchers to determine the strength and direction of relationships among variables without establishing causal inferences. The study involved one independent variable, namely TQM implementation (X), and two dependent variables, namely teachers' digital literacy ($Y_1$) and innovative attitude ($Y_2$). Figure 1 illustrates the conceptual framework of the research variables and the relationships examined in this study.

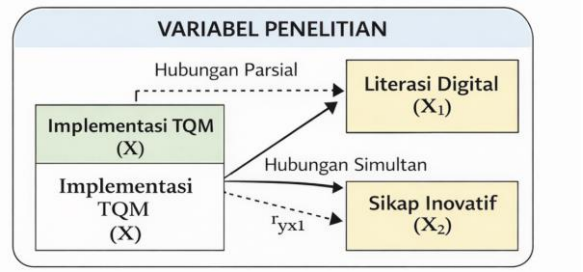


**Figure 1. Research Variables**

The research was conducted at SMA IT YP IPPI Petojo during the even semester of the 2025/2026 academic year over approximately one month. The research activities included the preparation of research instruments, administrative procedures, questionnaire distribution, data collection, and statistical analysis. The population consisted of all 40 teachers employed at SMA IT YP IPPI Petojo. Because the population was relatively small, a total sampling (census) technique was adopted, allowing every teacher to participate in the study. Consequently, the final sample comprised 40 teachers, representing the entire population.

Primary data were collected using a structured questionnaire developed based on theoretical indicators for each research variable. All questionnaire items were measured using a five point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The TQM


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implementation variable was measured through indicators of customer focus, continuous improvement, employee involvement, and process oriented management. Teachers' digital literacy was assessed through their ability to access, evaluate, understand, and utilize digital information effectively in educational settings, whereas innovative attitude was measured using indicators of idea generation, idea promotion, and idea implementation in teaching practices. Before the questionnaires were administered, the instrument was reviewed to ensure that each item adequately represented the intended constructs.

Data analysis was performed using IBM SPSS Statistics version 26 and consisted of descriptive and inferential statistical techniques. Descriptive statistics were employed to summarize respondents' characteristics and the distribution of each research variable by calculating the minimum score, maximum score, mean, standard deviation, and frequency distribution, with class intervals determined using the Sturges formula. Before conducting inferential analysis, the normality of the data was examined using the One Sample Kolmogorov Smirnov test at a significance level of $\alpha = 0.05$, where data were considered normally distributed when the significance value (Asymp. Sig.) exceeded 0.05. Since the data satisfied the normality assumption, Pearson Product Moment correlation analysis was employed to determine the strength and direction of the relationships between TQM implementation, teachers' digital literacy, and innovative attitudes. Participation in the study was voluntary, and all respondents were informed about the purpose of the research. Furthermore, all responses were kept confidential and used exclusively for academic purposes.

## RESULTS AND DISCUSSION

### Results

The survey in this study involved SMA YP IPPI teachers as research respondents. The characteristics of the respondents were analyzed based on several demographic aspects, namely age, gender, length of service, and education level. These four aspects were used to provide a general overview of the respondents' profiles, although they were not used as variables in the analysis of the relationship between research variables. The distribution of respondents by gender showed that the number of male teachers was greater than that of female teachers. This demographic data serves as supporting information in describing the research subjects, especially in the study of the implementation of Total Quality Management (TQM) in improving the digital literacy and innovative attitudes of SMA teachers at SMA YP IPPI. Based on the results of descriptive statistical analysis in Table 1, a general description of the level of digital literacy of SMA teachers as one of the variables in this study was obtained.

**Table 1. Descriptive Statistics of Digital Literacy**

| No. | Descriptive Statistics | Value |
|---|---|---|
| 1. | Minimum Score | 20 |
| 2. | Maximum Score | 70 |
| 3. | Mean | 45.21 |
| 4. | Variance | 89.955 |
| 5. | Standard Deviation | 9.484 |


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| No. | Descriptive Statistics | Value |
|---|---|---|
| 6. | Mode | 48 |
| 7. | Median | 46.00 |

The data in Table 1 show that the mean of the digital literacy variable of SMA teachers is 45.21 with a median of 46.00. This indicates that the mean and median values are relatively close, so the data distribution tends to be symmetrical. This condition shows that most respondents have a level of digital literacy that is around the average value. The level of data spread can be seen from the standard deviation value of 9.484, which indicates that the data variation is in the moderate category. The minimum value obtained was 20, while the maximum value reached 70, so the data range is quite wide and reflects differences in the level of digital literacy among teachers. In the research on the Implementation of Total Quality Management (TQM) in Improving Digital Literacy and Innovative Attitudes of SMA Teachers, this data shows that teachers' digital literacy is at a varied level, so the implementation of TQM is expected to play a role in improving the quality of this digital literacy.

Next, the research data is also presented in the form of a frequency distribution to provide a more detailed picture of the data distribution. The determination of the number of class intervals uses the Sturges formula ($k = 1 + 3.3 \log n$). Based on the number of respondents, five class intervals were obtained which were used to compile the digital literacy frequency distribution table. The results of descriptive statistical analysis in Table 2 show that the level of innovative attitude of SMA teachers has a mean value of 46.15 with a median of 45.80. The closeness between the mean and median values indicates that the data distribution is relatively balanced and does not show significant deviation. This indicates that most respondents have an innovative attitude level that is around the middle value. The magnitude of data variation is indicated by the standard deviation value of 8.732, which indicates that the data spread is in the moderate category. The minimum value of 22 and the maximum value of 68 show a fairly wide range of scores, so there are differences in the level of innovative attitude among teachers.

**Table 2. Descriptive Statistics of Innovative Attitude**

| No. | Descriptive Statistics | Value |
|---|---|---|
| 1. | Minimum Score | 22 |
| 2. | Maximum Score | 68 |
| 3. | Mean | 46.15 |
| 4. | Standard Deviation | 8.732 |
| 5. | Median | 45.80 |

In the research on the Implementation of Total Quality Management (TQM) in Improving Digital Literacy and Innovative Attitudes of SMA Teachers, this condition shows that teachers' innovative attitudes are not yet optimally uniform. Therefore, the application of


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TQM principles is expected to be a strategy to improve teachers' innovative attitudes in a sustainable manner. In analyzing the pattern of data distribution, the next research results are presented in the form of a frequency distribution. The determination of the number of class intervals was carried out using the Sturges formula (k = 1 + 3.3 log n). Based on the number of respondents, several class intervals were obtained which were used in compiling the frequency distribution table for the innovative attitude variable.

**Table 3. Frequency Distribution of Innovative Attitude**

| No. | Class Interval | Number of Respondents | Percentage (%) |
|---|---|---|---|
| 1 | 22–27 | 1 | 2.5 |
| 2 | 28–33 | 1 | 2.5 |
| 3 | 34–39 | 3 | 7.5 |
| 4 | 40–45 | 10 | 25.0 |
| 5 | 46–51 | 14 | 35.0 |
| 6 | 52–57 | 7 | 17.5 |
| 7 | 58–63 | 3 | 7.5 |
| 8 | 64–69 | 1 | 2.5 |
| | Total | 40 | 100 |

The data distribution in Table 3 shows that most respondents are in the score interval of 46–51 with a total of 14 respondents or 35.0%. This shows that the level of teachers' innovative attitude tends to be in the moderate category. The distribution of respondents in other intervals shows a distribution pattern that is relatively centered on the middle value, with the number of respondents decreasing in lower and higher score intervals. This condition shows that the variation in teachers' innovative attitudes is still within reasonable limits and does not show extreme deviations. In the context of research on the implementation of Total Quality Management (TQM), this finding indicates that the improvement of teachers' innovative attitudes still has room for development. Therefore, the application of TQM principles is expected to be a supporting factor in encouraging the improvement of innovative attitudes more optimally and sustainably.

**Normality Test**

The normality test was conducted to assess whether the research data for each variable has a distribution that is close to normal. This test used a significance level of α = 0.05 (5%) with the help of SPSS version 26 software through the One-Sample Kolmogorov-Smirnov Test method. The basis for decision making in this test is the significance value (Asymp. Sig.). If the significance value is less than 0.05, then the data is declared not normally distributed. Conversely, if the significance value is greater than or equal to 0.05, then the data can be said


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to be normally distributed. The results of the normality test for the research variables are presented in the following table:

**Table 4. Normality Test Results of the Research Variables**

| Description | Digital Literacy | Innovative Attitude |
|---|---|---|
| N | 40 | 40 |
| Mean | 45.36 | 44.82 |
| Std. Deviation | 9.512 | 9.876 |
| Absolute | 0.044 | 0.047 |
| Positive | 0.038 | 0.045 |
| Negative | -0.044 | -0.034 |
| Kolmogorov-Smirnov Z | 0.815 | 0.856 |
| Asymp. Sig. (2-tailed) | 0.528 | 0.468 |

Based on the table above, all variables have a significance value greater than 0.05. Thus, it can be concluded that the data on digital literacy and innovative attitudes are normally distributed. The research model shows that the implementation of Total Quality Management (TQM) acts as an independent variable that influences digital literacy ($X_1$) and innovative attitude ($X_2$), both partially and simultaneously. This relationship pattern indicates that improving the quality of education not only impacts one aspect of teacher competence but also on broader dimensions of professional behavior. The results of statistical analysis show that all variable data are normally distributed, with significance values above 0.05. This condition provides a strong basis that the relationship between variables can be analyzed validly and reliably. The frequency distribution of the innovative attitude variable, which is dominated by the moderate category (35.0%), shows that teachers' innovation capacity is still in the developing stage, thus requiring strengthening through a systematic quality management approach.

## Discussion

### The Effect of TQM Implementation on Teachers' Digital Literacy ($X_1$)

From a theoretical perspective, the implementation of Total Quality Management (TQM) is expected to support the improvement of teachers' digital literacy through continuous improvement and professional development programs. The principle of continuous improvement, which is the core of TQM, encourages schools to consistently improve the digital competencies of teaching staff through systematic quality management. These efforts are reflected in technology training programs, the integration of digital media into classroom instruction, and the strengthening of school information systems. Suaeb (2022) explains that the principle of *continuous improvement* in TQM encourages educational institutions to


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continuously improve organizational quality, including the development of teachers' competencies to respond to changes in the educational environment.

The normal distribution of the digital literacy variable indicates that the data are evenly distributed among respondents and do not show extreme deviations. However, these findings do not directly indicate the effect of TQM implementation but rather provide a descriptive overview of teachers' digital literacy levels. The finding that teachers' digital literacy remains at a moderate level suggests that the utilization of technology has not yet been fully optimized to support innovative learning practices. This finding is consistent with Sari et al. (2025), who argue that strengthening teachers' digital literacy requires systematic educational management, continuous training, supportive policies, and adequate technological infrastructure.

From the TQM perspective, continuous quality improvement emphasizes total employee involvement and sustainable human resource development. In this context, the principal, as a quality leader, plays an important role in ensuring that every teacher has equal opportunities to improve digital competencies through continuous professional development programs. Leadership commitment, collaborative participation, and ongoing evaluation are essential components of successful TQM implementation in schools. Likewise, effective top down and bottom up strategies are needed to ensure that digital transformation is implemented not only for administrative purposes but also to improve learning quality and pedagogical innovation (Diana & Faslah, 2025).

**The Effect of TQM Implementation on Teachers' Innovative Attitude ($X_2$)**

Conceptually, the principles of Total Quality Management (TQM) are considered relevant to fostering teachers' innovative attitudes through continuous improvement, participation, and collaboration. The philosophy of continuous improvement encourages teachers to continuously evaluate their instructional practices, develop new ideas, and actively participate in quality enhancement initiatives within the school. The distribution value concentrated in the moderate category indicates that teachers have demonstrated a tendency toward innovation; however, innovation has not yet become a deeply embedded organizational culture. Sari et al. (2025) explain that the successful implementation of TQM in educational institutions depends on sustained participation, organizational commitment, and continuous quality improvement, all of which support the development of innovative professional behavior.

The TQM principle emphasizing quality culture and continuous improvement encourages teachers to critically reflect on their instructional practices and continuously seek more effective teaching strategies. A work environment that supports experimentation, collaboration, and creativity is an important prerequisite for strengthening innovative attitudes among teachers. In addition, school principals play a strategic role in establishing policies that provide opportunities for teachers to develop new ideas, improve professional competence, and adopt adaptive instructional methods. This finding is supported by Parejo et al. (2022), who found that leadership, collaboration, trust, professional development, and organizational support are key elements in building a sustainable culture of educational innovation.

The relationship between TQM implementation and teachers' innovative attitudes can also be explained through the perspective of organizational culture. A strong quality culture encourages teachers to become more adaptive to change, accept new ideas, and regard innovation as an integral part of their professional responsibilities rather than an additional burden. Likewise, Sofiyan et al. (2022) demonstrated that organizational culture significantly influences innovative work behavior and subsequently improves employee performance, indicating that supportive organizational environments play a crucial role in promoting


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innovation. Furthermore, a collaborative organizational culture supported by effective leadership has been shown to strengthen innovative work behavior through greater organizational commitment and positive work behavior (Baety & Rojuaniah, 2022). Therefore, strengthening organizational quality culture through the consistent implementation of TQM principles is expected to cultivate sustainable innovative attitudes among teachers and ultimately improve educational quality.

**Simultaneous Effect of TQM Implementation on Digital Literacy and Innovative Attitude**

Digital literacy and innovative attitude are two important competencies required by teachers in the digital era. The descriptive findings indicate that both variables are at a moderate level, suggesting that there is still room for improvement in teachers' digital competencies and innovative behaviors. This condition reflects that the integration of digital skills and innovative pedagogical practices has not yet been fully optimized in school settings. Similar findings are reported by Falloon (2020), who emphasizes that digital literacy in education requires continuous development through structured pedagogical support and sustained professional learning environments.

From a conceptual perspective, Total Quality Management (TQM) emphasizes both competency development and the strengthening of professional attitudes through continuous quality improvement. A systemic approach is the key to ensuring that every quality policy has a comprehensive impact. Likewise, Rada et al. (2024) argued that successful implementation of TQM in educational institutions depends on leadership commitment, continuous quality improvement, technology integration, and active participation of all stakeholders. Therefore, the synergy between improving digital competencies and strengthening innovative attitudes is expected to produce teachers who are adaptive to change and able to face educational challenges in the digital era.

**Implications of TQM Implementation in the Context of Senior High School Education**

The descriptive findings indicate that teachers' digital literacy and innovative attitudes remain at a moderate level. Therefore, the principles of Total Quality Management (TQM) may serve as a relevant framework for supporting continuous improvement in these areas. Strengthening digital literacy and innovative attitudes is essential in responding to the demands of digital transformation in education, which requires systematic quality improvement and continuous teacher development. This condition shows that schools still need structured strategies to optimize teacher competencies in integrating technology and innovation in learning. These findings are in line with Ridani and Sudadi (2024), who emphasize that digital transformation in education requires continuous improvement systems, although its implementation is still challenged by limited teacher competence and infrastructure readiness.

The role of the principal as a quality leader needs to be optimized through policies oriented toward continuous professional development. Effective leadership plays a crucial role in ensuring that TQM principles are implemented consistently and sustainably within the school environment. Principals are expected to create a quality culture that supports collaboration, innovation, and continuous improvement among teachers. According to Meirani et al. (2023), successful implementation of TQM in schools depends on strong leadership commitment, stakeholder involvement, and structured quality assurance systems to improve both teacher performance and educational outcomes.

The availability of technological facilities and infrastructure, a supportive organizational culture, and the commitment of all school members are determining factors for


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the success of TQM implementation. Schools that are able to integrate these elements effectively will have greater opportunities to develop adaptive and innovative learning environments. An integrated and sustainable approach enables continuous improvement in both teacher competence and school performance quality. The synergy between leadership, organizational readiness, and quality management systems is essential to ensure that TQM contributes significantly to educational transformation in the digital era. These conditions reinforce the importance of comprehensive implementation of TQM as stated by Meirani et al. (2023).

**The Role of the Principal in TQM Implementation on Improving Digital Literacy and Innovative Attitudes of SMA Teachers**

The role of the principal occupies a strategic position as the main driver of TQM implementation. Effective leadership is reflected in the ability to formulate a quality vision, direct teacher competency improvement programs, and conduct continuous monitoring and evaluation. This practice is in line with the TQM principle which emphasizes the importance of leadership commitment in creating a quality culture. Recent studies also indicate that principals' technology leadership, digital supervision, and the development of a positive digital culture significantly contribute to improving teachers' professional digital competence (Rasdiana et al., 2024).

The research results show that teachers' digital literacy data are normally distributed without extreme deviations. This finding indicates a relatively balanced distribution of digital literacy levels among respondents, although it does not directly reflect the effectiveness of specific school programs. The mean value, which is still in the moderate category, shows the need for program optimization, especially in the creative and innovative use of technology in learning. These findings suggest that continuous support from school leaders through structured professional development and technology-based supervision is essential to strengthen teachers' digital literacy (Rasdiana et al., 2024).

The strengthening of teachers' innovative attitudes may be supported by the principal's policies in creating a conducive work environment. A school culture that is open to change, support for learning experiments, and appreciation for creativity are important factors in encouraging innovation. Achievements in the moderate category show that innovation has not yet become a deeply rooted culture, so a more transformational leadership strategy is needed. This finding is consistent with previous research showing that principals' change leadership positively influences teachers' attitudes toward change and strengthens their commitment to implementing innovative learning practices (Suryaman et al., 2024).

**Factors Influencing TQM Implementation in Improving Digital Literacy and Innovative Attitudes of SMA Teachers**

The success of TQM implementation is influenced by various interrelated factors. Internal factors include teacher competence, organizational commitment, and readiness to adopt change. The not-yet-high mean value of the variables shows limitations in mastering technology and developing learning innovations. Previous studies have shown that teachers' digital competence and organizational commitment are important determinants of successful digital transformation and continuous quality improvement in schools (Rasdiana et al., 2024; Falloon, 2020).

The leadership factor of the principal is theoretically considered an important element in directing TQM implementation. Consistency in applying the principle of continuous


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improvement and data-based decision making is expected to support quality improvement. Normally distributed data provides a strong basis for designing more targeted improvement programs. Recent evidence suggests that principals who demonstrate technology leadership, instructional supervision, and strategic decision-making are more successful in improving teachers' professional digital competence and school quality (Rasdiana et al., 2024).

The organizational culture factor is also considered important in supporting TQM implementation. A collaborative work environment and openness to change may facilitate the development of teachers' digital literacy and innovative attitudes. Obstacles can arise if there is resistance to change or a lack of awareness of the importance of innovation. Research has indicated that a positive organizational culture and principals' change leadership foster teachers' commitment, encourage innovation, and strengthen positive attitudes toward educational change (Suryaman et al., 2024).

The factor of facilities and infrastructure is the main support in digital-based TQM implementation. The availability of adequate technology allows teachers to develop digital-based learning optimally. Limited facilities can be an obstacle in achieving the expected quality. Studies on digital education emphasize that adequate technological infrastructure and access to digital resources are prerequisites for enhancing teachers' digital literacy and integrating technology effectively into classroom practices (Falloon, 2020).

Based on the descriptive findings, teachers' digital literacy and innovative attitudes are still at a moderate level. Therefore, TQM may be considered a relevant management approach to support the continuous development of these competencies in schools. The synergy between the principal's leadership, human resource readiness, organizational culture, and infrastructure support is the key to achieving sustainable quality improvement in education. This finding reinforces previous research emphasizing that sustainable educational quality depends on the integration of effective leadership, digital competence development, organizational support, and a culture of continuous improvement (Rasdiana et al., 2024; Suryaman et al., 2024).

## CONCLUSION

Penelitian ini menunjukkan bahwa implementasi Total Quality Management (TQM) berperan dalam mendukung peningkatan digital literacy dan innovative attitude guru SMA. Temuan ini menegaskan bahwa TQM tidak hanya berfungsi sebagai pendekatan manajerial, tetapi juga sebagai sistem yang mendorong pengembangan kompetensi guru secara berkelanjutan. Dengan demikian, tujuan penelitian untuk menganalisis pengaruh TQM terhadap digital literacy dan innovative attitude telah tercapai melalui temuan yang menunjukkan adanya keterkaitan antarvariabel.

Secara substantif, hasil penelitian mengindikasikan bahwa digital literacy dan innovative attitude guru berada pada kategori sedang, sehingga masih diperlukan penguatan yang lebih sistematis. Implementasi TQM melalui prinsip continuous improvement, keterlibatan seluruh komponen sekolah, serta penguatan budaya mutu terbukti menjadi faktor penting dalam peningkatan kedua variabel tersebut. Selain itu, digital literacy dan innovative attitude memiliki hubungan yang saling mendukung dalam meningkatkan profesionalisme guru di era digital, meskipun penerapannya masih perlu dioptimalkan.

Implikasi penelitian ini menunjukkan bahwa keberhasilan TQM sangat ditentukan oleh kepemimpinan kepala sekolah, budaya organisasi, kesiapan sumber daya manusia, dan dukungan infrastruktur. Penelitian ini memberikan manfaat praktis bagi sekolah dalam merancang strategi peningkatan kompetensi guru yang lebih terarah dan berkelanjutan. Untuk penelitian selanjutnya, disarankan agar mengkaji variabel lain yang turut memengaruhi


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kompetensi guru serta menggunakan pendekatan yang lebih komprehensif agar hasil penelitian semakin mendalam.

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