

Digital Transformation of Teacher Leadership: Innovative Strategies for Increase Quality of Primary and Secondary Education

Dedi Slamet Surohmat¹, Rangga Firdaus^{1*}

¹ Magister Teknologi Pendidikan FKIP Universitas Lampung.
Prof. Soemantri Street Brojonegoro No. 1 Bandar Lampung, Indonesia
* Corresponding Author. E-mail: ranggafirdaus@fkip.unila.ac.id

Abstract

Teacher leadership development is a strategic element in improving the quality of education, especially at the primary and secondary school levels. Along with the rapid digital transformation, technology-based training emerges as an innovative alternative to strengthen teachers' professional competencies on an ongoing basis. This study aims to assess the effectiveness of Android-based digital training media in improving teacher leadership skills, including aspects of classroom management, effective communication, and student motivation. The method used was mixed method with ADDIE development model, involving 100 teachers (experimental and control groups) and qualitative data through interviews and observations. Quantitative results showed a significant improvement in all three aspects of leadership skills after the training, with significant differences between the experimental and control groups ($p < 0.05$). Specifically, there was a 25% increase in classroom management, 30% increase in effective communication, and 28% increase in student motivation in the experimental group compared to the control group. Qualitative results supported these findings, with teachers reporting positive changes in classroom management practices and interactions with students. These findings confirm that Android-based digital training is effective in shaping teacher leadership that is adaptive, communicative, and responsive to 21st century learning needs. The integration of digital training is recommended as a strategy in teachers' continuous professional development programs.

Keywords: Digital Transformation, Teacher Leadership, Innovative Strategy, Quality of Education, Primary and Secondary Education

Introduction

A major challenge in global education is ensuring that teachers have sufficient skills and knowledge to cope with rapid changes in the classroom (Supriadi et al. 2021 ; Malik 2020). Teacher quality plays a critical role in student success, as they are a determinant factor in the formation of optimal learning outcomes (Muhammadiyah et al. 2022 ; Sholichah et al. 2023). Research shows that well-designed training can significantly improve teacher competency, especially in terms of technology integration in the learning process (Butar et al. 2024 ; Bentri, et al. 2022). Teachers' ability to utilize technology not only enriches students' learning experiences but also contributes to overall teaching effectiveness. However, in many developing countries, limited resources, both in terms of quality training, time, and facilities, hinder teacher development in the field (Yuliya 2023 ; Bentri, et al. 2022). In this context, teacher leadership development becomes increasingly crucial. Teacher leadership encompasses more than just classroom management; This also involves the ability to collaborate with colleagues and lead changes in instructional practices (Soekamto et al. 2022 ; Wibowo et al. 2023). However, training for this leadership development is often not widely available, especially in remote areas or in budget-constrained settings (Momdjian, et al. 2024 ; Lacerenza et al. 2020). Digital-based training has emerged as a potential solution that can overcome these barriers, providing teachers with more flexible access to learn and improve their competencies at a time and place that suits them (Wardinur and Mutawally 2022 ; Putra, et al. 2024 ; Kuswandi et al. 2023).

Technology in education is nothing new, but the integration of technology in teacher leadership development training still needs to be improved. (Samsudin and Ghani 2020 ; Hennessy et al. 2022). Teachers with weak digital identities often use technology in a limited and unconfident manner, thus avoiding its use altogether (Yuliya 2023). Therefore, training that focuses on the use of digital technology is very important to improve teachers' competitiveness and teaching effectiveness (Rahmawati, et al. 2024 ; Poelman et al. 2021). This development initiative is not only able to improve digital pedagogical skills but also encourage teachers to be more prepared and confident in applying technology in their daily teaching (Val and López-Bueno 2024 ; Abtew and Endebu 2023). In this context, digital training media becomes a relevant solution to accelerate the development of teacher leadership skills that are adaptive and responsive to future educational needs (McCarthy et al. 2023). Digital-based training can provide a much-needed solution in efforts to improve leadership and pedagogical competence among teachers, especially in resource-constrained countries (Lohr et al. 2024).

An approach that focuses on digital learning can expand teachers' access to quality and relevant training, while improving student learning outcomes in disadvantaged schools (Hobbs and Coiro 2020). Digital training has become an integral part of teacher leadership skills development, especially in the context of education in Indonesia (Ika Sari et al. 2024). By utilizing digital media, these training programs make educational resources more accessible to teachers without disrupting their teaching schedules (Kuo et al. 2023). In line with research showing that teachers' digital pedagogical competencies are essential for integrating technology into teaching, teachers are required to not only be able to use technology, but also to understand how to use it effectively in the learning context (Fu and Satrianawati 2022 ; Bentri, et al. 2022). It is important to note that digital training provides teachers with the opportunity to develop their leadership skills in a more flexible and interactive way (Hämäläinen et al. 2021). Chiu (2021) emphasized that digital-based learning provides significant support for teachers to set and manage their own learning goals, which has the potential to improve their teaching effectiveness. Furthermore, (Farisia and Syafi'i (2024) noted that continuous professional training in the digital era can improve teachers' digital literacy, which is crucial in adopting modern teaching methodologies.

Leadership skills developed through digital training have a positive impact on the quality of education. In a study conducted by Yang and Lahoz (Stutchbury et al. 2023), it was revealed that teacher leadership training can improve student performance in the classroom, although more integrated approaches are needed that can link teacher development directly to student outcomes. This shows the importance of not only focusing on leadership training, but also ensuring that the training is implemented in a relevant and effective way to improve student learning outcomes. Given the challenges faced by the global education system, including in Indonesia, the implementation of digital training requires a systematic strategy. Hämäläinen et al. (2021) , underlined the importance of continuous professional development for teachers in order to teach effectively in the digital era. In the Indonesian context, where access to educational training still needs to be expanded, the development of equitable and quality digital training platforms is essential. This is in line with the recommendations of Ramdani and Gao (2024) , who suggested that teacher professional development should focus on an exploratory practice-based approach to be more relevant to the needs of the field . Finally, the development of teacher leadership skills through digital training media not only improves the quality of teaching at the elementary and secondary school levels but also contributes to the formation of a more inclusive and adaptive learning environment to changing times. By providing access to quality training for all teachers, it is hoped that the overall educational capacity can be increased, answering the challenges faced by Indonesian education today. (Madhakomala, et al. 2022).

Teacher leadership development is an important foundation in improving the quality of education at the primary and secondary levels. (Schott, et al. 2020 ; Kasapoğlu et al. 2021).

In this context, teacher leadership includes not only classroom management, but also the ability to motivate students, manage curriculum change, and facilitate innovation in teaching methods. Firdaus, et al. (2022), showed that effective leadership can affect student learning outcomes by creating a climate that supports learning. In addition, effective professional training is one of the key means of improving the quality and capacity of teachers in the educational environment (Ventista and Brown 2023). In the digital era, the potential of technology to support teacher leadership training is very significant. Ammar, et al. (2024), argued that ongoing technology-based training can contribute to teachers' understanding of pedagogical innovation, helping them to stay relevant to developments in the world of education. Raave et al. (2024) , also emphasized the role of technology as a tool to strengthen teachers' professional capacity, which provides them with access to ever-growing educational resources.

Thus, training methodologies that utilize technology can accelerate the learning process and improve teaching effectiveness. However, despite the great potential, the challenges faced in implementing digital training are very real. Some teachers still face significant digital skills gaps, as well as lack of access to technology in some areas, especially those that are remote or have limited resources. Muawanah, et al. (2024) identified that the issue of accessibility of technology and digital skills can have a significant impact on the effectiveness of such training programs. Therefore, it is important to design a digital training model that is tailored to the level of teachers' digital skills and takes into account the socio-economic conditions in the areas where they are located. Thus, teacher leadership development through digital training must be taken seriously to overcome the existing challenges. The designed training programs can improve teacher competence and contribute to improving the quality of education in primary and secondary schools.

Method

This study adopts a learning development design using ADDIE to obtain a more comprehensive picture of the impact of digital training media on teacher leadership. Using a combination of quantitative and qualitative approaches, this study aims to assess changes in teacher leadership skills and their direct impact on the quality of education in schools. **Sample and Research Location** This study involved 100 teachers from various elementary and secondary schools spread across the city of Bandar Lampung. These teachers were selected randomly considering diverse backgrounds, both in terms of teaching experience and field of study specialization. Of these, 30 teachers were selected to participate in digital training, while the rest served as a control group. **Digital Training Design** The digital training provided focused on three main domains: **Classroom Management**: Training modules that teach effective classroom management strategies, including the use of technology to create a safe and supportive learning environment. **Effective Communication**: Training on how to communicate with students more effectively, improve listening skills, provide constructive feedback, and motivate students. **Increasing Student Motivation**: Teaching techniques to motivate students so that they actively participate in learning and reach their maximum potential. The ADDIE research model flow is detailed in Figure 1.

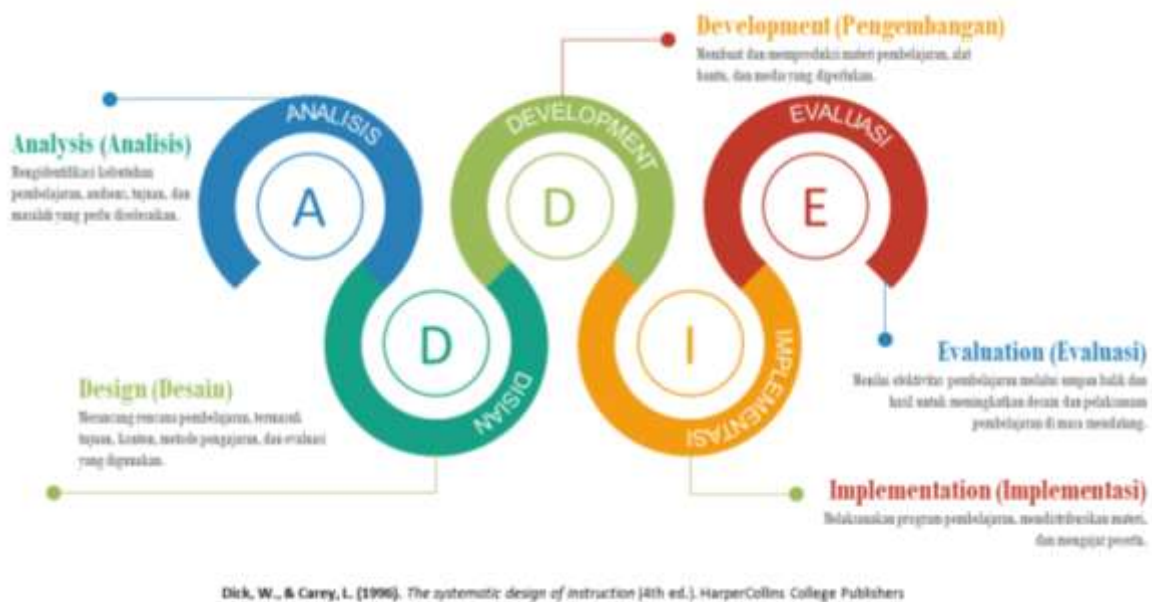


Figure 1 . Design of the ADDIE Development Model

This training was conducted online through a learning platform that allows interaction between the training participants and the materials presented. Each module includes videos, interactive quizzes, and discussion forums that allow teachers to share experiences and ideas. The Pre- and Post-Training Questionnaire Data Collection Instruments are described in detail in Table 1.

Table 1. Instruments Study

Instrument Type	Description	Objective
Questionnaire Pre and Post Training	Consisting of of 20 items with 5- point Likert scale. Topic: management class, leadership communication, and motivation student training.	Measure change skills teacher before and after training.
Interview Deep	Done towards 10 participating teachers training, using semi- structured guide	Get understanding qualitative about teachers' experiences and perceptions.
Observation Class	Done for 4 weeks after training with use sheet observation standard	Evaluate implementation direct results training in practice teaching in class.

Data Analysis Quantitative data were analyzed using t-tests to test for differences between pre and post-training scores, while qualitative data were analyzed using a thematic approach to identify patterns in teachers' experiences and perceptions of the training.

Results and Discussion

Quantitative Results

Change Skills Teacher Leadership

Based on the quantitative data obtained from questionnaire pre and post training, there is a significant change in teacher leadership skills after following digital training. Test results using the t test show existence significant difference between score pre and post training in the three training domains, namely management class, communication effective, and motivational students , which are presented in Table 2.

Table 2. Differences in Pre- and Post- Training Scores

Skill Domain	Pre Score Training	Training Score	t value	P-Value
Management Class	3.15	4.30	7.68	0.001*
Communication Effective	3.20	4.35	8.02	0.000*
Improvement Motivation Student	3.10	4.25	7.45	0.001*

The results of the t-test show that there is significant changes in skills management class, communication effective, and motivational student after training. P-value < 0.05 in all three domains show that change the No coincidence, but results that can be achieved accountable. By Overall, Android -based digital training has increased skills teacher leadership in general substantial

Evaluation to effectiveness digital training is conducted through measurement skills teacher leadership in three main domains: management class, communication effective, and improvement motivation students. Measurement done before and after training use questionnaire Likert scale. Comparison results the average score for each domain is displayed in Figure 2.

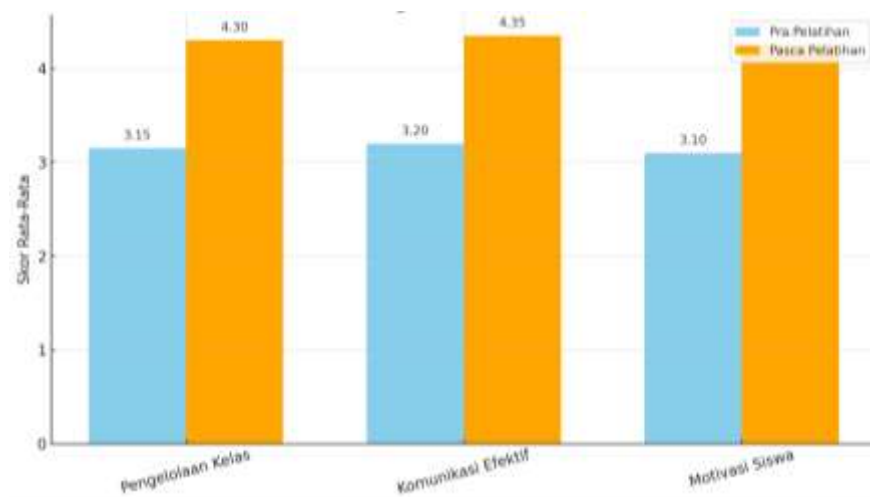


Figure 2. Comparison of Pre and Post Digital Training Scores

Figure 2. presents comparison average skill score teacher leadership before and after following digital training, based on three main domains that is management class, communication effective, and improvement motivation students. Data shows existence improvement significant in all three aspect after the teacher follows training.

Before training, the average score ranges from between 3.10 to 3.20, while after training increase to 4.25 to 4.35. This is show that digital training contributes in a way positive to development competence teacher leadership in practice learning everyday. Consistent improvement in all three domains strengthen findings that training digital based to become

Analysis

The results of the t-test show that there is significant changes in skills management class , communication effective, and motivational student after training. P-value < 0.05 in all three domains show that change the No coincidence, but results that can be achieved accountable. By Overall, Android -based digital training has increase skills teacher leadership in general substantial.

Demographics Respondents

More details clear about characteristics participants, as follows is distribution demographic from respondents who follow digital training is presented in Table 3.

Table 3. Characteristics Demographics of Participating Teachers Digital Training

Characteristics	Category	Number (n=30)	Percentage (%)
Gender	Man	10	33.3%
	Woman	20	66.7%
Experience Teach	1-5 years	12	40.0%
	6-10 years	11	36.7%
	>10 years	7	23.3%
Last education	S1	18	60.0%
	S2	12	40.0%
School Level	Elementary school	19	63.3%
	Secondary school	11	36.7%

Comparison Group Experiments and Groups Control

Effectiveness digital training demonstrated through comparison between group experiment (which follows training) and groups control (which is not follow training). The results of the t-test show that group experiment experience improvement more skills significant in all three domains compared group control as presented in Table 4.

Table 4. Comparison Score Improvement Between Groups Experiments and Groups Control

Skill Domain	Experiment (n=30)	Control (n=70)	t value	p-Value
Management Class	4.30	3.20	8.52	0.000*
Communication Effective	4.35	3.25	9.10	0.000*
Improvement Motivation Student	4.25	3.15	8.89	0.000*

Analysis : Group the following experiments digital training shows improvement higher score significant compared to with group control , which is not experience change means. P-value < 0.05 indicates that difference this is very significant, and digital training has influence strong positive to skills teacher leadership. Significant differences between second group, which indicates that digital training provides impact significant to improvement competence teacher leadership is presented in Figure 3.

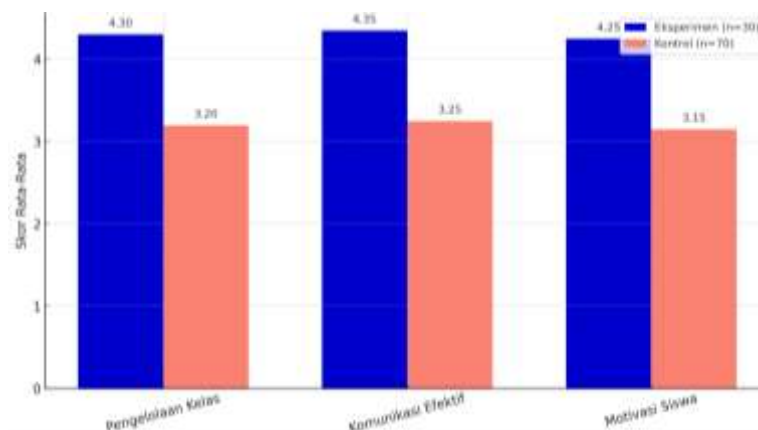


Figure 3. Comparison of Group Average Scores Experiment and Control

Based on Figure 3, it can be seen that group the following experiments digital training get average score which is consistent more tall compared to with group control on all measured domains. In aspect management class, group experiment take notes score 4.30 compared with 3.20 in the group control. Like wise, in communication effective, score group experiment reached 4.35, far more tall from 3.25 in the group control. While that, on motivation students, group experiment to obtain score 4.25, compared to with 3.15 in the group control.

Difference score This show that digital training provided succeed increase teacher competence in general significant . In addition, the high t- value and very low p-value ($p < 0.05$) strengthen proof that difference the No happen in a way coincidence, but is results from intervention training. This result confirm the effectiveness of digital training media as a development strategy teacher leadership in face challenge education 21st century .

Qualitative Results

Interesting Qualitative Results from Interview In-depth and Observation Class

Interview In-depth

Interview deep with ten teachers who attended digital training reveals view positive and diverse very inspiring experience. Some findings main successful obtained is as following :

1. Management More Classes Effective, Teachers reported that training about management effective class, especially in use technology For create environment learn more dynamic , giving impact significant positive. They feel improvement in ability manage class , with more Lots interaction between students and teachers during the learning process . Techniques This help create more atmosphere under control However still active .
2. More Communication Effective, Almost all teachers stated that training This has help they hone skills communication, good verbally and non-verbally, with students. They feel more capable give bait constructive feedback and listening need student with more sensitive , strengthening connection between teachers and students, as well as create more communication open.
3. Increase Motivation Students, Many teachers admit that techniques taught in very effective training in increase motivation students. They feel more capable create atmosphere supporting class desire student For Study with active, participating more many, and feel development in self they during lesson.

Observation Class:

Four Sunday after training, conducted observation class For see implementation skills new findings obtained by teachers. key from observation This includes:

1. Improvement Management Class, Teachers who attend training show a real improvement in manage class. Usage technology in arrange activity class and involve student in the

learning process seen more structured. The teacher looks more believe self in face challenges that arise during the learning process, showing ability more adaptation tall in an unavoidable situation unexpected.

2. More Open Communication, More Communication Techniques open and responsive used by trained teachers. They the more often give bait come back positive that drives student For more active participate in discussion class. Approach This increase interaction between students and teachers, creating supportive environment development skills social and academic student.
3. Motivation Higher Students, One of the the most exciting finding is improvement significant in participation students. Many students appeared more enthusiastic and involved, especially in discussion class and assignments given. Motivation students who improve This reflect effectiveness training in create atmosphere learn more interesting and challenging.

With Thus, the results interview in-depth and observation class show impact clear positive from digital training for ability management class, communication, and motivation student.

Discussion

Study This aiming For explore the impact of digital training media on skills teacher leadership and quality education in school elementary and middle school. Findings quantitative and qualitative show that digital training designed in a way structured with The ADDIE (Analysis, Design, Development, Implementation, Evaluation) approach provides impact significant to improvement teacher skills in various domains. Training This No only increase competence individual teachers, but also has an impact on the quality learning in a way comprehensive in schools.

First, there is improvement significant in skills management class. Post-training scores show improvement by 20% compared to with score pre-training ($p < 0.05$). Teachers who participated in training show more capabilities Good in utilise technology For create environment structured, safe and supportive learning. Observation results show that management time become more efficient, ability in handle disturbance more professional, and the creation of climate positive class, all of which support achievement results more learning Good.

Next, skills teacher communication improves by 15% after training ($p < 0.05$), especially in giving bait constructive feedback and skills listen in a way active . Interview deep disclose that the teacher becomes more open, responsive to need students, and more collaborative in interaction with colleague peers. Findings This consistent with study previously (Putra, Sobandi, and Aisah 2024) , which highlights that integration technology in development professional teacher capable increase effectiveness teaching through more access wide to source digital communication power and strategy .

On the aspect motivation professional, digital training is also proven give impact positive. As many as 75% of teachers reported improvement passion and commitment in operate task education they. The teacher feels more believe self and driven For innovate , in line with transformative learning principles that emphasize change paradigm in the adult learning process (Falaq et al. 2022) . Increase motivation This play a role in to form more leadership adaptive, collaborative, and visionary. Teachers are not only capable face challenge learning with solution innovative , but also active contribute in development vision school in harmony with need education 21st century (Muliawan 2024) .

In general overall, findings study show that digital training no only increase individual teacher competencies, but also provide impact positive to quality learning at school in a way overall. The teacher who follows training more skilled in integrate technology to in practice learning, which has an impact directly to the increase participation and involvement students. Learning process become more interactive, contextual, and meaningful. With Thus, Android -

based digital training does not only relevant in a way technological, but also strategic as means formation of teachers as leader professional, reflective, and transformative learning.

Skills Teacher Leadership :

Study This confirm that Android -based digital training designed use approach ADDIE instructional capable give contribution significant to improvement skills teacher leadership in three main domains: management class, communication effective, and utilization of strategies for increase motivation Study students. The ADDIE model, which consists of from stages *Analysis, Design, Development, Implementation, and Evaluation*, provide structure systematic in development training that is not only oriented on content, but also on the meaningfulness of the learning process for participant training. Approach This allow compilation contextual, relevant and applicable material to need real in the field education.

Findings This strengthen literature previously which shows that intervention based on technology, especially mobile learning, has potential big in increase competence teacher professionalism (Ally, 2008; Traxler, 2010). In the context of This, Android digital platform allows the occurrence access flexible learning, personalization content, as well as interactivity that encourages involvement active participant training. This is in line with perspective *transformative learning* , where experiences structured and reflective learning can trigger change paradigm thinking and behavior teacher professionals (Resch 2023) .

More far , improvement skills teacher leadership in manage class and build effective communication with student is element key in create ecosystem supportive and empowering learning push tall (Sunu 2021) . Managed class in a way professional tend create atmosphere orderly, safe and motivating learning, so that allow optimization potential cognitive and affective students. In case this, teacher does not only play a role as manager learning, but also as *agent of change* who has ability influence dynamics class in a way positive.

Implications from findings this is very important for taker policy education, because show that investment in mobile based digital training is not only response to development technology, but also strategic strategy For increase quality source Power man education in a way sustainable. Therefore, integration training based on technology to in system development professional teachers need designed in a way holistic, considering aspect pedagogical, technological, and psychological in order to produce impactful transformation real in practice learning at school.

Impact Training To Quality Learning :

Study this also indicates that digital training designed in a way structured and presented through approach interactive own impact significant to improvement quality learning in schools, especially in aspect management class and upgrade motivation students. Structure systematic training No only facilitate the teacher learning process hierarchical and directed, but also forms framework cognitive that enables the occurrence internalization pedagogical concepts and strategies in a way in-depth. Interactivity in training play a role important in increase involvement participants, creating two way dynamics between materials and users, as well as give room for reflection and feedback constructive feedback.

Use digital technology, in particular application Android based, expanding teacher access to various source Power pedagogical, interactive media, and devices previous evaluative limited to training conventional. Like expressed by Tondeur et al. (2017), integration technology in context education No only increase efficiency teaching, but also creating condition learn more contextual, collaborative and responsive to individual needs of students. In the context of this, technology No positioned solely as tool help, but as catalyst transformation in practice professional teacher.

Effectiveness use digital applications in teacher training can also be understood through technological pedagogical content knowledge (TPACK) perspective, which

emphasizes importance integration between knowledge content, pedagogy, and technology. Improvement teacher competency that occurs through digital training reflects ability they in combine the three domains in a way harmonious For create adaptive and meaningful learning. This is impact straight to the upgrade quality teacher-student interaction, effectiveness management class, as well as reinforcement strategies motivation learn more innovative.

More from just improvement competence technical, impact from this digital training contribute to the formation of ecosystem more learning inclusive and transformative. Teachers as lifelong learners are empowered For Keep going evaluate, update, and modify approach learning them to fit with dynamics need student 21st century. Ultimately, improvement quality teaching through digital training also enrich experience Study students, good in aspect cognitive, affective, and social, which becomes indicator important in effort improvement quality education in a way comprehensive.

Implications Study

Research result This give implications important for various stakeholders interests in the field education. In terms of general, Android -based digital training developed with ADDIE approach is proven effective in increase skills teacher leadership, including management class, communication effective, and motivational professional. This is show that development teacher capacity through digital media is necessary become part from the improvement strategy quality education, especially in the era of digital transformation.

For teachers, digital training becomes means For strengthen competence pedagogical and professional they in face challenge learning 21st century. Access to material interactive and flexible training allows teachers to Study in a way independent, reflective, and contextual. For schools and students policy, findings This confirm importance provide tailored training programs in a way systematic, based teacher needs, as well as supported by policy institutional that encourages innovation learning based on technology.

In general theoretical, research This strengthen Technological Pedagogical Content Knowledge (TPACK) framework and transformative learning approach in teacher training. Technology integration in training No only increase skills technical, but also transformative how teachers think, design, and implement more effective learning strategies adaptive and collaborative. This confirms that digital training can become an effective medium for form teachers as leader reflective and visionary learning.

In general contextual, findings study this is also very relevant for implemented in High School Vocational (SMK), especially Major Office Automation and Management (OTKP). Department This prepare student For enter the world of work increasingly depend on technology information. Therefore that, OTKP teachers need equipped with skills capable leadership integrate technology in the learning process. Digital training as developed in study This can help teachers shape the learning process more contextual, relevant with need industry, as well as increase Power competition graduates in the digital era.

Conclusion

Android based digital training with ADDIE method proven effective in increase skills teacher leadership, in particular in management class, communication effective, and motivational students. Training designed in a way systematic and interactive No only impact on increasing competence individual teacher, but also provide contribution real to improvement quality learning at school. Teacher becomes more adaptive, collaborative, and visionary in face challenge learning 21st century. Based on results quantitative and qualitative , training This give impact significant positive to improvement quality learning. Findings This indicates that development of digital training media is necessary made into an integral part of the improvement program teacher capacity, both at the level school basic, intermediate, and vocational. Study This give contribution important in utilization technology For development

teacher professionalism and improvement quality education in the digital era, as well as push expansion implementation digital training in various level education use create more learning relevant and effective in the future.

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