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Digital Leadership and Professional Commitment to Enhance Teacher Innovativeness as a Priority Strategy

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Abstract. This research aimed to determine priority strategies for increasing teacher innovativeness in the digital era from digital leadership and professional commitment perspectives. The research employed a mixed methods research approach with four stages: theme exploration, model design, data collection, and analysis/product creation. The study population was teachers in Indonesia, and the sample comprised 623 teachers. The study results show that the priority strategy to increase the innovativeness of teachers is divided into two perspectives: digital leadership and professional commitment. Priority strategies from a digital leadership perspective are as follows: digital competitive and intelligent capabilities, digital communication skills, strengthening digital resilience, the ability of educational innovativeness, and monitoring school performance digitally. Priority strategies from a professional commitment perspective are as follows: involvement in the decision-making process, abilities in evaluation and reflection, improving self-competence, ability to prepare to overcome educational challenges, and teacher discipline in their duties. The results imply that academic institutions need to strengthen digital leadership and professional commitment to promote the innovativeness of teachers in the digital era.

Keywords: digital leadership; Rasch model; SmartPLS; teacher innovativeness; teacher profession

1. Introduction

Increasing the innovativeness of teachers in the digital era is the key to ensuring that education results remain relevant to the development of society, science, and

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technology. Improving teacher innovativeness in the digital era requires a convincing strategy and priority. The primary key to advancing education is teachers' ability to innovate in schools (Dedering & Pietsch, 2023). Implementing education requires transformation by innovative teachers (Hidayat & Patras, 2024a). Innovative teachers are always looking for new and better teaching methods and are not afraid to try new things (López-Pérez et al., 2019; Žydžiūnaitė & Arce, 2021). They always look for ways to improve student learning outcomes, making teaching and learning more engaging and meaningful (Nguyen et al., 2019; Phuong et al., 2021).

Teacher innovativeness is crucial in ensuring that students receive the best education possible (Hosseini & Haghighi Shirazi, 2021). Innovative teachers can improve student learning outcomes, prepare students for the future, increase student motivation and engagement, and support change and innovation in society (Hosseini & Haghighi Shirazi, 2021; Huang & Zhang, 2024; Pandey et al., 2019). Increasing the innovativeness of teachers in the digital era is crucial in aligning graduates and the quality of education with the development of science and technology in the digital century (Middleton & Hall, 2021).

Teacher innovativeness refers to the tendency of teachers to generate new and creative ideas and apply those ideas in teaching practice (Cai & Tang, 2021; Dedering & Pietsch, 2023; Klaeijsen et al., 2018). Innovative teachers are always looking for new ways to improve student learning and are not afraid to try new approaches and ways (Lambriex-Schmitz et al., 2020). There are several challenges in realizing teacher innovativeness in the digital era (Hidayat & Patras, 2024b). Some are related to traditions and habits in the school, such as traditional and rigid school culture (Schipper et al., 2020; Suparno et al., 2022). There has not been an optimal sense of appreciation in schools for creative ideas and experimentation with new things, and there is minimal collaboration and communication between teachers (Kang et al., 2016). Other challenges are related to high teacher workload (teaching, administration, and assessment), making teachers feel that they do not have enough time and energy to be innovative in the classroom (Bloem & Salimi, 2022; Luksyte et al., 2018; Montani et al., 2021). Related to professional development, challenges include participation in training that focuses on learning innovation; access to mentors or coaches to develop their innovativeness; and poor incentives or rewards for teachers who behave innovatively (Liu, 2017; Luksyte et al., 2018; Morad et al., 2021; Pilav-Velić et al., 2021). Finally, in terms of teachers' confidence amid a rapidly changing environment, challenges include new technologies, new curricula, and new standards developing rapidly, making teachers feel overwhelmed and unsure of the best way to innovate in learning (Cai & Tang, 2021; Klaeijsen et al., 2018; Luksyte et al., 2018; Ratnaningsih et al., 2016).

In today's digital era, school principals' digital leadership is a determining variable in encouraging teacher innovation (Mihardjo et al., 2019). Principal digital leadership refers to the principal's ability to use technology, managerial skills, and the skills of individuals who rely on digital technology (Karakose et al., 2021). School principals' digital leadership is essential in transforming teachers' innovative behavior (Hidayat & Patras, 2024c), which impacts the quality of

learning and student learning outcomes (Navaridas-Nalda et al., 2020). The critical role of school principals' digital leadership in shaping teachers' innovative behavior can be seen in their role to create a culture of innovation in schools, including building a vision to integrate digital technology for creative and innovative learning (Susilawati et al., 2021; Umah et al., 2023). It can also be seen in how they create a safe and supportive environment for teachers to experiment with new technologies and try innovative learning approaches (Espina-Romero et al., 2023; Yusof et al., 2019), and in how they facilitate collaboration and knowledge sharing between teachers (Saputra et al., 2021; Zupancic et al., 2017). When teachers feel empowered, supported, and inspired, they are more likely to develop and implement new practices that enhance student learning and drive educational progress (Abbu et al., 2020; Jagadisen et al., 2022; Mihardjo et al., 2019; Wasono & Furinto, 2018).

A behavior is born from external and internal impulses (Zainal & Matore, 2019). If the principal is determined to encourage teachers' innovative behavior from the outside, then professional commitment will drive the teachers' internal behavior. Professional commitment refers to the teacher's emotional attachment to work and the institution. It is characterized by a strong psychological attachment to teaching, a continuous commitment to improve competence, and a commitment to maintain themself and not consider alternative employment (AL Jadidi, 2022; Nesje, 2023). Teachers who are highly committed to their work show dedication, loyalty, and a strong sense of responsibility (Alzoraiki et al., 2023; Wang et al., 2021; Woldearegay, 2021). They believe that teaching is an essential and meaningful profession (Ramli & Rasul, 2024) and strive to provide the best for their students (Yan et al., 2023; Ying, 2023). Teachers who have professional commitment are encouraged to read scholarly journals, attend workshops and conferences to learn about new teaching strategies, share ideas and resources with other teachers, and collaborate to develop them (AL Jadidi, 2022; Arifani et al., 2019; Khasanah et al., 2019).

Previous research on teacher innovativeness was only qualitative or quantitative. Meanwhile, this research used a mixed methods approach with four novel research steps. These were: 1) the exploration stage, where the theme was explored using VOSviewer software and focus group discussion (FGD); 2) the design stage, where constellations or structural research models were designed based on assessments from three experts in education management; 3) the implementation stage; and, finally, 4) the product creation or analysis stage using SmartPLS software and item measure with the Rasch model.

The study tested the following hypotheses:

1) The digital leadership of school principals can be used as a strategy to increase the innovation of teachers in the digital era.
2) The digital leadership of school principals can be used as a strategy to increase teacher professional commitment.
3) Teacher professional commitment can be used as a strategy to increase teacher innovation in the digital era.

2. Method

This research aimed to identify strategies to increase teacher innovativeness in the digital era. To this end, the study used a mixed methods research approach (Malo-Juvera et al., 2018; Melendez et al., 2022; Zohrabi, 2013). The first step involved investigating the direct and indirect dominant and non-dominant variables that influence teacher innovation using an FGD (Ismail et al., 2021; Noor et al., 2020). An FGD is an organized discussion conducted with a small group with a focused conversation on one topic that is moderated in a relaxed and comfortable manner (Hintermann et al., 2021; Kigozi, 2020; Yaakop et al., 2023). The FGD was carried out with teachers in Indonesia, particularly in Bogor, West Java. Theme exploration was continued by searching for topics connected to the central theme (Cheng et al., 2021; Huang et al., 2022). Furthermore, mapping of words or phrases was done around the concept of "teacher innovativeness", based on articles published in Scopus.

Next, alternative theoretical models for research were designed, and three experts were consulted to determine the chosen model (Buitrago et al., 2023). The indicator of success at this stage is the discovery of theoretical and structural models or research constellations. The constellations were examined, and three experts commented on the sheet provided to them. Several constellations were then selected for the next stage. This expert review provided added value for the validity of the rationale and content (Husni et al., 2020; Mohajan, 2017; Prasetya et al., 2020).

The next step involved devising the required research instruments and testing them for validity and reliability (Ahmady et al., 2018; Baharuddin et al., 2020). The respective teacher innovativeness (IN), digital leadership (DL), and professional commitment (PC) instruments had 12, 12, and 10 indicators/statements, respectively. The instrument testing involved administering a readability test to 10 teachers as respondents. Corrections were made to sentences or words that the respondents did not understand. The respondents indicated that all research instruments could be understood well.

The last step involved the collection of research data, followed by data analysis using SmartPLS and item measure with the Rasch model. Data collection using the fit/relevant instruments was aimed at as many as 623 teachers from Indonesia. The following demographic details were recorded: region in Indonesia (west = 76%, central = 14%, east = 10%); geographical location (rural = 45%, urban = 55%); sex (male = 36%, female = 64%); school (public = 59%, private = 41%); level (pre-school = 24%, elementary = 66%, senior = 10%);

age (<30 = 16%, 31–45 = 53%, 46–55 = 26%, >55 = 5%), and employee status (civil servant = 46%, private = 51%). This study used purposive sampling, where we determined the sample criteria. Based on the analysis using structural equation modeling based on partial least squares (SEM-PLS) (Arham et al., 2023; Hair et al., 2017) in the final stage, the Rasch model was used to recommend strategies to improve teacher innovativeness in the digital era. The flow diagram of the research method is presented in Figure 1.

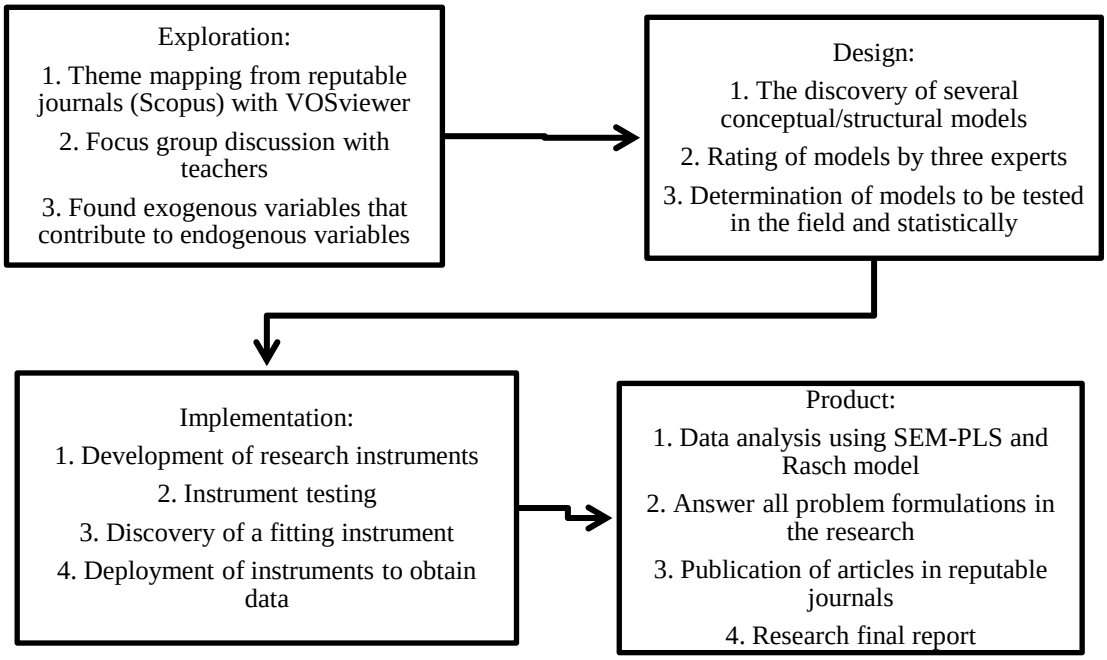

Figure 1: Research flow diagram

3. Results and Discussion

3.1 Results

3.1.1 Exploration stage using focus group discussion and VOSviewer

The results of the data analysis based on the FGD with 20 teachers in July 2024 show that the digital leadership of school principals and the professional commitment of teachers are external and internal exogenous variables, respectively, that affect the innovativeness of teachers. The FGD activities identified variables influencing teacher innovation, including quality culture, self-efficacy, and work motivation. From these activities, we chose variables suspected to be of significant influence, namely digital leadership and professional commitment.

VOSviewer software was used to create a visualization from the textual data of 46 articles on "teacher innovativeness" from Scopus. Analysis of this map showed that 1440 terms were connected to teacher innovativeness. However, when limited to a minimum of 10 occurrences, 41 terms were connected to teacher innovativeness (see Figure 2). Based on these results, leadership, in general, has been widely associated with teacher innovativeness. However, the analysis did not show the digital leadership of school principals and teacher professional

commitment as factors related to teacher innovativeness. Therefore, these two variables are relatively new and deserve to be studied for their influence on teacher innovativeness.

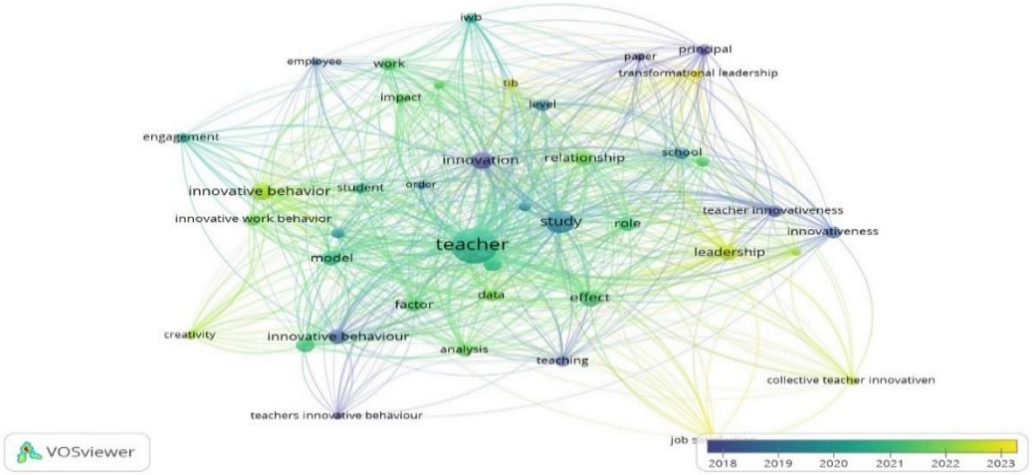

Figure 2: Results of the map-based analysis of textual data

3.1.2 Design stage involving determination of structural models by three experts in education management

The expert assessment results show that although many variables affect teacher innovativeness, only two essential variables must be studied. These two variables affect teacher innovativeness externally, namely the principal's digital leadership, and internally, namely professional commitment. Based on the experts' input, we tested the research constellation, as shown in Figure 3.

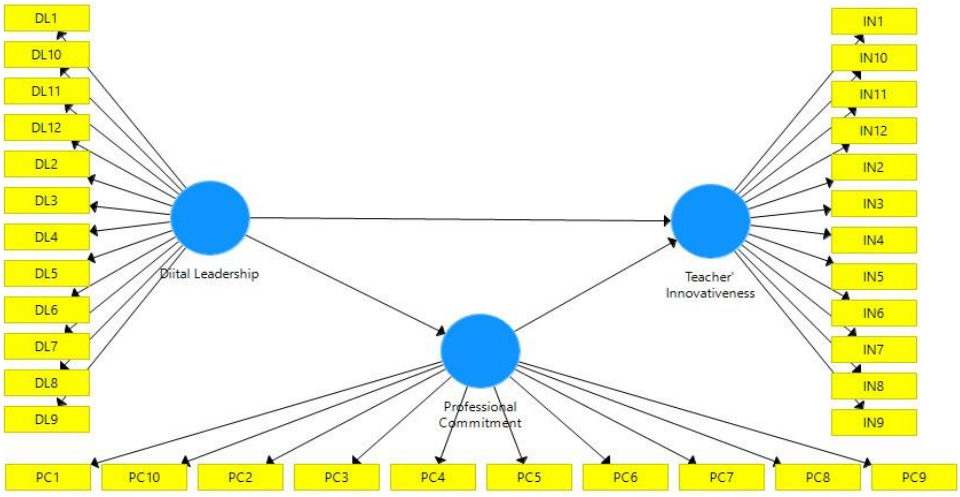

Figure 3: Constellation/structural model of teacher innovativeness research

3.1.3 Implementation stage through data collection using the three instruments and analyzing the data to obtain valid and reliable instruments

The results of the test using SmartPLS on indicators to measure the validity and reliability of data for the variables of teacher innovation (IN), digital leadership (DL), and teacher professional commitment (PC) show that all indicators were valid and reliable. All values were above the requirements, that is, the composite reliability (CR) value (>0.7), the Cronbach alpha value (>0.6), and average variance extracted (AVE) (>0.5) (Hair et al., 2017; Rivera, 2015; Suhayat et al., 2023). Results of the validity and reliability of the research variables are presented in Table 1.

Table 1: Validity and reliability of the research variables

	Cronbach alpha	rho_A	CR	AVE
Digital leadership (DL)	0.970	0.971	0.974	0.755
Professional commitment (PC)	0.967	0.967	0.971	0.769
Teacher innovativeness (IN)	0.974	0.974	0.977	0.779

The test results use SmartPLS to ensure that the model built is according to the observed data, showing that the model meets the requirements. The determination of the model was declared appropriate because the standardized root mean square residual (SRMR) value was below 0.08, the normed fit index (NFI) value was above 0.90, and the root mean square (RMS) theta value was close to zero (Hair et al., 2017; Rivera, 2015). Based on these criteria, the model built in this study fitted well with the data. The data from the model test results are presented in Table 2.

Table 2: Model test results

	Saturated model	Estimated model
SRMR	0.026	0.026
d_ULS	0.407	0.407
d_G	0.522	0.522
Chi-square	1.795.912	1.795.912
NFI	0.929	0.929
RMS theta	0.094	

3.1.4 Product creation stage with data analysis using SmartPLS and item measure with the Rasch model

The path analysis test using SmartPLS was done to determine the direct effects of the digital leadership (DL) variable as an exogenous variable on the endogenous latent variable, namely teacher innovativeness (IN). The results are presented in Table 3.

Table 3: Results of the path analysis test

	Digital leadership	Professional commitment	Teacher innovativeness
Digital leadership		0.682	0.255
Professional commitment			0.489

Digital leadership -> professional commitment -> teacher innovativeness = 0.333

The results show that digital leadership positively affected teacher innovativeness, with a value of 0.255. In addition, the digital leadership variable positively affected professional commitment, with a value of 0.682. When compared using the digital leadership correlation values for the two endogenous latent variables above, the influence of digital leadership was more significant on the increase in professional commitment. Furthermore, the value for the direct effect of the variable professional commitment on teacher innovativeness was 0.489. Conversely, regarding indirect effects, namely the indirect effect of digital leadership on teacher innovativeness through professional commitment, the value obtained was 0.333. Indirect effects are more significant than the direct effects of digital leadership on teacher innovativeness and can be interpreted as a perfect intervening variable.

An overview of the results of the path analysis of exogenous, endogenous, and intervening variables is depicted in Figure 4. Based on the data in the figure, it is evident that DL and PC can be used to increase IN. From Figure 4, it is statistically proven that the effect of DL on PC is 0.682, and the effect of PC on IN is 0.489. However, it is still necessary to confirm whether the contribution of DL to IN is significant and whether the contribution of PC to IN is significant. In addition, details are still needed from each DL and PC indicator, which is a priority for improvement. Efforts to answer these two needs require a significance test analysis using the effect size or *f*-square test on the SmartPLS and item measure using the Rasch model.

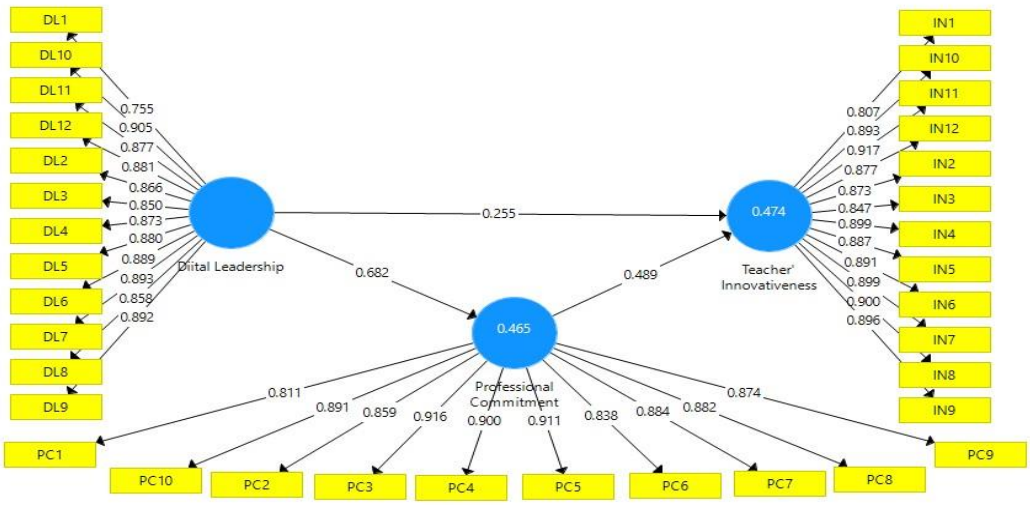

Figure 4: Results of path analysis

The effect size or *f*-square value was used to determine the value of direct influence between variables (Table 4) (Hair et al., 2017; Rivera, 2015).

Table 4: Effect size or *f*-square value

	Digital leadership	Professional commitment	Teacher innovativeness
Digital leadership		0.870	0.066
Professional commitment			0.243

The criteria for the value of *f*-square are as follows: 0.02 is small, 0.15 is medium, and a value of 0.35 is significant. A value of less than 0.02 can be ignored or considered to have no effect. Based on the test with SmartPLS on the *f*-square, the impact of DL on IN obtained a small value (0.066), the impact of DL on PC obtained a significant value (0.870), and the impact of PC on IN obtained a medium value (0.489). Based on these findings, improving the DL variable must be directed more toward improving PC, as a high PC will significantly affect IN. Table 5 displays the study results on the direct and indirect influences between the variables studied.

Table 5: The direct effects of the variables

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	*t*-value (|O/STDEV|)	*p*-value
Digital leadership -> Professional commitment	0.682	0.684	0.049	14.000	0.000
Digital leadership -> Teacher innovativeness	0.255	0.259	0.059	4.331	0.000
Professional commitment -> Teacher innovativeness	0.489	0.485	0.057	8.611	0.000

The results show that the direct effects of DL on PC are statistically significant or significant. This can be interpreted to mean that the higher the DL value, the more PC will increase. Increasing one DL unit will increase PC by 68.2%. Based on calculations using bootstrapping or sampling, the value of the DL estimation coefficient test result against the PC bootstrap test result is 0.682, with a *t*-value of 14,000 and a standard deviation of 0.049. Therefore, the *p*-value is <0.05, so the hypothesis that DL affects PC is accepted and has statistical significance.

Furthermore, the results show that the direct effects of DL on IN are statistically significant or significant. This can be interpreted to mean that the higher the DL value, the higher the IN will increase. Increasing one DL unit will increase PC by 2.5%. Based on calculations using bootstrapping or sampling, the value of the DL estimation coefficient test result against the IN bootstrap test result is 0.255, with a *t*-value of 4.331 and a standard deviation of 0.059. Therefore, the *p*-value is <0.05, so the hypothesis that DL affects IN is accepted and statistically significant.

In addition, the results show that the direct effects of PC on IN are statistically significant or significant. This can be interpreted to mean that the higher the PC value, the higher the IN will increase. An increase of one PC unit will increase IN

by 48.9%. Based on calculations using bootstrapping or sampling, the value of the PC estimation coefficient test result against the IN bootstrap test results is 0.489, with a *t*-value of 8.611 and a standard deviation of 0.057. Therefore, the *p*-value is <0.05, so the hypothesis that PC affects IN is accepted and statistically significant.

Furthermore, efforts were made to determine which indicators need improvement and maintenance. The results of these findings will help to determine strategies for increasing endogenous variables, namely teacher innovativeness in the digital era (IN). Based on these objectives, the results of analyzing variable data on the digital leadership of school principals using item measure with the Rasch model are subsequently discussed (Andrich, 2010; van Zile-Tamsen, 2017; Villalonga-Olives et al., 2021). Based on the results of the analysis, five priority rankings of DL indicators must be improved: (1) digital competitive intelligence, (2) digital communication, (3) digital resilience, (4) educational innovation, and (5) digital performance monitoring. Table 6 displays the ranking of priority DL indicators that need to be improved.

Table 6: Ranking priorities for improving the digital leadership of school principals

Rank	Statement	Indicator	Total score
1	The principal can calculate well about digital risks in the school	Digital competitiveness	2580
2	Principals communicate through digital platforms to increase school participation and transparency	Digital communication	2606
3	The principal has high resilience in fighting for the school to become a digital-based school	Digital resilience	2623
4	Principals create innovative environments based on digital technology that support new experiments and discoveries in schools	Educational innovation	2652
5	School principals use technology to monitor and evaluate the performance of schools, teachers, and students	Digital performance monitoring	2653
6	The principal facilitates collaboration between teachers, students, and parents using digital technology	Digital collaboration	2656
7	The principal has an excellent digital vision, including integrating digital technology into school management and curriculum	Digital vision	2660
8	The principal has digital literacy skills that support school progress, especially school digitalization	Digital literacy	2663
9	The principal establishes digital security policies to protect student data and school organizations	Digital security	2664
10	The principal facilitates various digital technology training that supports digital-based learning	Digital technology training	2669
11	School principals have high adaptability and openness to technological changes in education	Flexible and adaptive	2685
12	The principal ensures that digital resources such as Internet access can function optimally	Digital resource management	2725

Results from the analysis of the PC variable data using item measure with the Rasch model (Andrich, 2010; van Zile-Tamsen, 2017; Villalonga-Olives et al., 2021) indicate five priority ranking indicators that must be improved: (1) involvement in the decision-making process; (2) evaluation and reflection; (3) increasing self-competence; (4) readiness to overcome challenges; and (5) discipline in obligations. Table 7 displays the ranking of priority PC indicators that need improvement.

Table 7: Ranking of priorities for improving teacher professional commitment

Rank	Statement	Indicator	Total score
1	I actively participate in decision-making in schools, such as curriculum, school programs, and learning strategies	Involvement in the decision-making process	2663
2	I regularly evaluate and reflect on what has worked and what needs to be improved in the educational process	Habituation of evaluation and reflection	2672
3	I constantly improve my knowledge and skills by attending relevant trainings, seminars, and workshops	Increasing self-competence	2708
4	I am willing to face various challenges, including student behavior issues, individual differences, and curriculum changes	Readiness to overcome challenges	2716
5	I attend school regularly, arrive on time, and fulfill all obligations, such as teaching on schedule	Discipline towards duty	2746
6	I am dedicated to and passionate about achieving the best outcomes for students and the school	Dedication to the profession	2747
7	I care about and support the individual potential and needs of students optimally	Concern for students	2750
8	I strive for students to reach their maximum potential, measure their progress, and provide the necessary guidance	Exploring student potential	2754
9	I listen well, give constructive feedback, and establish positive relationships with students, teachers, and parents	Effective communication	2762
10	I abide by the code of ethics and professional standards of teachers and behave as the best example	Adherence to the code of conduct	2777

Results from the analysis of the IN variable using item measure with the Rasch model (Andrich, 2010; van Zile-Tamsen, 2017; Villalonga-Olives et al., 2021) indicate five priority ranking indicators that need improvement: (1) project-based learning, (2) digital learning, (3) digital problem-solving, (4) adaptation to change, and (5) collaborative learning. Table 8 displays the ranking of priority IN indicators that need to be improved.

Table 8: Ranking of priorities for improving teacher innovativeness in the digital era

Rank	Statement	Indicator	Total score
1	I use project-based learning (PJBL), where students create creative projects using technology	Project-based learning	2486
2	I ensure that access to digital learning resources and technology devices is available to all learners	Digital-based learning	2520
3	I measure students' creativity and innovation in using technology to solve problems and create new solutions	Digital problem-solving	2529
4	I ensure learners have the digital skills to participate in an increasingly digitized world	Adaptation to change	2546
5	I encourage student collaboration and communication through online platforms, forums, or other collaboration tools	Collaborative learning	2549
6	I provide flexibility in access to learning outside of the classroom and outside of school hours	Flexible learning	2555
7	I collect feedback from learners about their digital learning experience to continuously improve the learning process	Digital data-based feedback	2559
8	I use digital learning resources such as videos, simulations, e-books, and interactive learning materials to improve students' understanding	Digital learning resources	2572
9	I use technology to monitor student progress, provide feedback, and design more effective learning	Digitally evaluate	2572
10	I use technology to enable learning tailored to the needs and level of individual learners (personalization of learning)	Personalized learning	2582
11	I always evaluate and reflect on my readiness to use technology in learning and follow the necessary training	Ongoing professional development	2585
12	I learn using hardware (computers, tablets, smartphones) and software (apps, e-learning platforms)	Utilization of learning technology	2619

The results of the path analysis estimate with SmartPLS show that improvements in digital leadership and professional commitment can significantly increase the innovativeness of teachers in the digital era. In addition, the calculation results from the item measure using the Rasch Model show that the priority of improvement in the digital leadership of school principals and professional commitment can be done by referring to priority indicators to be improved. These improvement priorities can then be used to increase teacher innovation in the digital era.

3.2 Discussion

This study has three main findings. First, good digital leadership can improve teacher innovation; second, a high level of professional commitment by teachers can improve teacher innovativeness; and third, strategies can be prioritized to enhance teacher innovation by improving indicators that are still lacking, for both the principal's digital leadership and the teacher's professional commitment.

This study clarified that improving school principals' digital leadership can increase teacher innovativeness. In this study, digital leadership comprised 12 indicators, all of which meet the requirements for validity and reliability. The principal's digital leadership contribution to teacher innovativeness is 25.5%, with a *p*-value <0.05. This means that digital leadership has statistical significance on teacher innovativeness. This study is relevant to previous research indicating that leadership has a significant effect on teacher innovativeness (Afsar et al., 2019; Alheet et al., 2021; Chen et al., 2022; Dedering & Pietsch, 2023; Khaola & Oni, 2020). However, previous research did not mention improvement strategies or priorities to increase teacher innovation in the digital era. This study recommends strategies to increase the innovation of teachers in the digital era by showing the priority of improvement based on the digital leadership indicators according to ranking. The five indicators ranked highest were: (1) improving the digital competitive intelligence ability of school principals; (2) improving the digital communication skills of school principals; (3) strengthening the digital resilience of school principals; (4) strengthening the ability of school principals to innovate education; and (5) improving the ability to monitor school performance digitally.

This research strengthens the idea that improving professional commitment can increase teacher innovativeness in the digital era. In this study, the professional commitment variable consisted of 10 indicators, all of which meet the requirements for validity and reliability. The contribution of professional commitment to teacher innovativeness is 48.9%, with a *p*-value <0.05. This means that professional commitment has statistical significance on teacher innovativeness. This research aligns with previous research on teachers' professional commitment influencing teacher innovativeness (Asiyah et al., 2021; Cera et al., 2023; Wang & Hou, 2023). However, previous research did not mention improvement of the professional commitment indicator, which is a priority strategy to increase teacher innovativeness. This study recommends improving the priority indicator as a strategy to increase teacher innovativeness. The five indicators ranked highest were: (1) improving teacher involvement in the decision-making process; (2) improving teachers' abilities in evaluation and reflection; (3) involving teachers in improving their self-competence; (4) improving teachers' ability to overcome educational challenges; and (5) improving teachers' discipline in their duties.

The critical role of digital leadership has been proven theoretically and objectively. The research strengthens the notion that the digital leadership of school principals has a more significant direct positive effect on professional commitment than its lasting influence on teacher innovativeness. These findings show the central role of digital leadership in increasing teachers' professional

commitment and innovativeness. The digital leadership of school principals must receive attention in educational organizations because it is closely related to the development of the science and technology environment (Brunner et al., 2023; Budianto et al., 2023; Karakose et al., 2021; Wasono & Furinto, 2018). As seen in other research, leadership variables – whether transformational leadership (Firmansyah et al., 2022), servant leadership (Song et al., 2022; Swart et al., 2021), instructional leadership (Nurabadi et al., 2021), situational leadership (Hidayat et al., 2020; Zohair et al., 2021), and other leadership styles – play an essential role in the educational organization. Thus, leadership improvement, mainly digital leadership, can be the primary strategy for improving educational organizations, especially for increasing the variables of teacher innovation in the digital era and professional commitment.

Although the results of this study contribute to education, this study had several limitations. These limitations include the subjectivity of the researchers and the experts involved; the choice of variables studied, because many variables influence teacher innovativeness, such as the environment and school culture; unequal generalization areas; duration of the study; complexity of the relationship between the variables studied; limited data sources; and variations in complex leadership styles, such as transformational leadership, servant leadership, situational leadership, and many more. These limitations have implications for bias or deficiencies in this study, so further research is needed to correct any possible deficiencies.

4. Conclusion

This research aimed to determine priority strategies for increasing teacher innovativeness in the digital era from digital leadership and professional commitment perspectives. The study proved that the digital leadership of school principals and teacher professional commitment can be a strategic tool in increasing teacher innovativeness in the digital era. From the perspective of digital leadership, increasing teacher innovativeness can be achieved with the following priority strategies: digital competitive and intelligent capabilities, digital communication skills, strengthening digital resilience, the ability of educational innovation, and monitoring school performance digitally. From the perspective of teacher professional commitment, increasing teacher innovation can be done with the following priority strategies: involvement in the decision-making process, abilities in evaluation and reflection, improving self-competence, ability to prepare to overcome educational challenges, and teacher discipline in their duties. The results imply that all educational institutions should enhance digital leadership and professional commitment so that teacher innovativeness can increase optimally.

5. Acknowledgments

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