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THE PROFESSIONAL COMPETENCY DEVELOPMENT MODEL OF SCIENCE TEACHERS THROUGH LEARNING LEADERSHIP

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ABSTRACT

This research aims to analyze the model for developing the professional competence of science teachers through learning leadership. This method is quantitative research applied to a survey with a cross-sectional design. The participants were the science teachers at Pati residency, with 240 respondents. The researchers collected a questionnaire consisting of 46 validated questions with estimated reliability. The questions consisted of four teacher competence models and three leadership learning indicators. The researchers analyzed with the Structural Equation Modeling, SEM. Based on the data analysis, the science teacher competency development model is positively influenced by learning leadership by 15% in the small category. It also showed that the science teacher competency model formed from indicators of professional development and learning practices is in the large category, while professional knowledge and soft skills are in the moderate category. This research concluded that learning leadership contributed little to the science teacher competency development model. In the era of independent learning, it was important for school principals to increase the development of professional competency models for science teachers so that they can implement student-centered learning. The results of these findings provided input to school principals to improve their leadership in managing teacher learning, starting from planning, learning processes, evaluation, and reflection, while science teachers to improve their professional competence through learning activities with lesson studies and research actions as well as activities outside of learning such as training and seminars.

Keywords: competence model; learning leadership; professional; science teachers

INTRODUCTION

In this independent learning era, the roles of the principals as leaders are essential in leadership and school management, especially in developing human resource quality for excellent learning. As the Regulation for Teachers and Lecturers mandates, sustainable teacher development becomes the policy to improve educational quality. The role of the principals includes leading the learning and encouraging and creating a productive working environment through the educational process (Supriadi & Yusof, 2015; Wardah, 2015; Azainil et al., 2021).

The main objective of learning leadership in science is to provide excellent service to students by considering their potential, talents, preferences, and needs. Besides that, it facilitates learning to realize and improve students' achievements, motivate learning, trigger curiosity, fulfill creativity, create innovation, establish entrepreneurship, and improve long-life awareness of science, technology, and art development. Titi (2023) and Robbins (2017) state that the conceptual and theoretical frameworks are used to establish the school effectiveness model by the school

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leadership, motivate the teachers, organize the learning, and encourage the members to reach the objectives. Effective leadership is an essential factor in realizing the success of learning objectives. School principals must master interactive skills with teachers, especially in integrating technology into teaching and learning. Thus, school principals determine the quality of the school (Pan et al., 2015; Urick, 2016).

School principals lead, organize, and manage the promotion of the teaching-learning program at their schools. They are responsible for managing the learning process at schools. Therefore, school principals must have managerial, communication, interpersonal, and implementation mastery of technology (Wong & Daud, 2017; Azainil et al., 2021b). School principals are vital in managing educational institutions, especially learning (Ermita, 2010). The applicable managerial skills to empower the human resources and other available resources can reach the vision and mission of the schools. Managerial skills positively and significantly influence teacher performance and productivity (Faisal, 2013; Harahap, 2017; Meidiana et al., 2020).

Student-centered leadership serves the learning based on its characteristics. Learning leadership makes the teaching-learning process at schools a priority to improve learning outcomes. Learning-oriented leadership refers to the facilitator role of a principal to empower the management and leadership (Widiyan et al., 2020; Lundqvist et al., 2023). The primary skills of school principals include (1) assessment, (2) instructional leadership, (3) objective unity, (4) leadership vision, (5) diversity, (6) learning community, (7) reflection, (8) organizational management, (9) professional development, (10) collaboration, (11) curriculum and teaching, and (12) professionalism (Harahap, 2017; Azainil et al., 2021b).

The principal leadership styles influence the school's objective achievement, including efforts to improve teacher professionalism. This matter is vital for educating the students. Learning is the primary principle of the educational unit. However, low teacher quality provides significant problems in education. A qualified teacher is essential to achieving educational objectives (Purwanto, 2021; Sinaga, 2018; Hasanah et al., 2020). Therefore, developing a professional competence model for teachers is a critical necessity. Kemendikbud (2022) explains that education and training are efforts to improve teachers' cognition, teaching skills, and professionalism to improve the teaching-learning process.

Holmes (2013) explains that competence refers to an individual condition while working on a particular job. This matter describes the actions, behaviors, and results of individuals. Therefore, the improvement of teachers' professional skills is correlated to the effort to improve competence. This matter describes what teachers must do, behave, and target to realize excellent cognition, attitude, and skill.

Based on the interview, some science teachers in Kudus had difficulties developing their learning due to the curriculum change. Many administration and required programs must be settled by teachers in a limited time. Thus, they had no time to develop their competencies. Teachers also experience difficulties caused by students, science learning irrelevant to discovery activities, and a lack of facilities and learning supporting technology. Besides that, teachers' understanding of the implementation of the curriculum, irrelevant educational background, inadequate facilities, administrative burden, and difficulty in implementing the curriculum became the primary factors of low science teacher competence (Hoesny & Darmayanti, 2021; Indrawati & Nurpati, 2022). Because of that, this research tries to provide another option for making policy.

Leadership and learning are interconnected concepts that garnered significant attention in the research literature. Several studies have delved into the relationship between learning and leadership, aiming to bridge gaps in understanding and practice. Similarly, Nilsen et al. (2018) focused on learning leadership within police investigations, emphasizing the importance of bridging the gap between teaching and practice in leadership development. Moreover, Cheng et al. (2016) have highlighted the complexities of school autonomy, leadership, and learning initiatives, pointing out the need for frameworks to identify gaps and weaknesses in existing research. Crans et al. (2022) focused on feedback-seeking behavior as a workplace learning strategy, emphasizing the role of leadership behaviors in promoting professional development through feedback. In conclusion, the literature on learning leadership is diverse and multidisciplinary, encompassing various aspects such as organizational learning, educational leadership, and leadership styles. While progress has been made in understanding the relationship between learning and leadership, research gaps must be addressed to enhance leadership development and promote a culture of continuous learning within organizations.

Setiawan and Sugiyanto (2020) also found that science teachers' processing skills had to be improved, especially regarding data communication and interpretation skills. Leaders with excellent directions, guidance, and opportunity provision for science teachers to develop their professionalism can solve teachers' problems. This research has four indicators of science teacher competence: professional cognition, learning practice, professional development, and soft skills. Excellent and accurate management can improve the skills.

The efforts of improving teacher professionalism bring some challenges for the schools, such as 1) initial teacher quality development without considering the short or long-term investments, 2) the teacher quality development to improve soft skills instead of physical skills for the sake of long-term benefit, 3) the teacher quality development with excellent plan and sustainable program, and 4) the teacher vulnerability of the teacher due to piracy or promotion to other educational institutions with some reasons (Ubrodiyanto, 2007). The teacher learning program is an excellent appreciation effort (Day, 2017).

Therefore, principals must have excellent leadership skills to lead the learning process and manage the educational institution (Andriani et al., 2018). The competence of a school principal refers to the managerial skills in an educational unit with managerial tasks (Kristiawan et al., 2017). The school's managerial quality relies on the leader roles. As leaders and managers, principals have the tasks and responsibilities of managing the school and making the school successful (Mbangula & Albert, 2022).

The effective and transformative leadership model of principals could positively influence the professional competence development of science teachers. The impacts of leadership in learning become the primary focus of school principals. A previous study also found that effective leadership promotes a supportive learning environment and teacher development (Leithwood et al., 2004). Implementing the leadership model in deciding on professionalism improvement must be discussed to encourage the teachers' happiness, satisfaction, and responsibilities to execute the decision (Nuswantoro, 2023).

Transformational leadership focuses on the inspiration and motivation of the subordinates to reach a fantastic result. In this Merdeka Belajar era, transforming principal and teacher roles is essential to realize qualified learning with student orientation. Principals must optimize their roles as learning leaders to encourage teachers and develop their professional competence. This research analyzes principal leadership in developing the professional competence model of science teachers at senior high schools.

According to a preliminary study, this research has novelty as the answer to the gap in research that must be addressed to enhance leadership development and promote a culture of continuous learning within institutions. The novelty is developing teachers' professional competence to carry out student-centered learning by promoting and embedding it as a school culture.

METHODS

This quantitative research applied a survey type with a cross-sectional design. Creswell and Poth (2016) explain that quantitative research collects data from specific points at a certain period. The population consisted of all science teachers in Pati. The researchers took the samples with convenience sampling. The research participants were 240 science teachers in Pati.

The researchers collected the data with a questionnaire consisting of 46 items regarding teachers' professional competence. On the other hand, the other 16 questions correlated to the school principals' learning leadership model. The questionnaire is helpful to collect the data by providing a list of questions and statements. The researchers used Google Forms to obtain the information from the respondents (Putra & Renaldo, 2020).

This research applied the closed questionnaire to obtain data about the respondents' experiences. Then, the respondents could only select the most relevant answer from the answer choices. The researchers collected the data with a validated and reliable questionnaire of 46 questions. This question covers four indicators of science teacher competencies: professional cognition, learning practice, professional development, and soft skills. On the other hand, the leadership learning indicators were the learning environment, leadership planning, learning promotion, leadership reflection, and learning quality improvement. The researchers shared the 4-Likert scale instrument with the alternative answers: the score of (1) refers to development, the score of (2) is reliable, the score of (3) is reliable; and the score of (4) is expert.

The leadership model covers the following indicators: (1) learning environment development focusing on the tenth graders. This indicator con-

sisted of four aspects (X1, X2, X3, and X4); (2) leadership planning and implementation, consisting of four aspects (Y1, Y2, Y3, Y4); and (3) the reflection and improvement of learning quality, consisting of four aspects (Z1, Z2, Z3, and Z4).

The professional competence of science teacher are the following: (1) the professional cognition of three indicators, structural analysis and cognitive flow for learning (A), explaining the leader-competence task step (B), determining the learning objective based on the students characteristics, curriculum, and Pancasila learning profile; (2) the professional learning practice consisting of 4 indicators, developing the classroom environment to facilitate the students' learning conviniently and securely (D); arranging the design, sharing the feedback, and delivery the learning report (F), taking the parents and community in the learning (G), (3) developing the profession with five indicators: showing the reflective habit to develop independently (H), showing the matureness of spirituality, moral, and emotion to behave base don the code of conduct (I), showing the practice and habit to behave based on student orientation (J), developing the potentials collaboratively to establish the performance behavior (K), and actively participating in the network and professional organization to develop the career (L), (4) soft skill of the teachers (M), consisting of: the communication skill of a learning process, solving problems in the learning, critical thinking, creative thinking, leading, and collaborating.

The researchers obtained the data and examined it using the preliminary test. The researchers analyzed the data validity and reliability to explain the excellent status of the collected data. After that, data analysis continued using Structural Equation Modeling (SEM) with the Goodness-of-Fit (GOF) performance evaluation stage, which was carried out by testing SEM assumptions and data interpretation.

RESULTS AND DISCUSSION

Leadership learning and science teacher competence measurements were based on the distributed questionnaire for the science teachers in Kudus, Jepara, Pati, Demak, and Rembang regencies. The sample consisted of 240 junior high school teachers. The researchers distributed the questionnaire via Google form with 46 question items. Figure 1 shows the results of the questionnaire analysis and the scores obtained for the

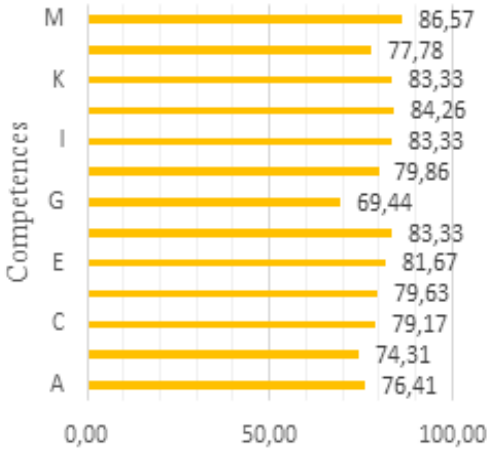

Figure 1. Science Teacher Competences

Figure 1 shows that the G indicator involves parents and communities in learning. The lowest score obtained by teachers is observable without being habituated to involve the parents. The teachers did not have the vital knowledge to involve parents in the learning (Malatji et al., 2023). The collaboration between parents and teachers is an important aspect of improving learning outcomes. However, the teachers rarely implemented this matter (Javier & Ramier, 2019). The highest score is observable in soft skills. The teachers have high soft skills because they have communication, problem-solving, critical thinking, creative thinking, leadership, and collaborative skills in learning. On the other hand, the rare frequency of parent involvement occurred due to the teachers applying a lesson study practice. Sustainable learning with lesson study could improve teacher performance (Van Den Boom-Muilenburg et al., 2022).

Principal leadership becomes the determinant factor in a school's advancement. The principal leadership and teacher performance positively influence the school's effectiveness (Mulyani et al., 2020). The quality of school leadership significantly influences teacher performance and student achievement (Pardosi & Tria, 2022). This matter is important to investigate due to the influence of the teacher management. Professional teachers, such as the professional science teachers at junior high school, are the key to learning success. Effective learning requires adequate school principal and teacher competence (Hidayat, 2017).

On the other hand, principal leadership in learning includes the learning environment development based on the students, planning and implementing the learning based on the students, and implementing the reflection and quality improvement of the learning process with student focus. The leadership model of the learning influenced the achievement of science teacher competencies. This matter influenced the learning quality improvement. A significant influence was observable between the principal leadership and the teacher performance (Sakerani et al., 2019). Abubakar et al. (2018) explain that competent principals influence teacher performance. Lesson study provides pedagogical influence for the school principal. This makes the principal a trainer and an assessor instead of an evaluator (Lee & Marjorie, 2019). Soft skills are the individual qualities that influence the teacher's competence (Beniwal & Poonam, 2020). After obtaining the profile of the science teacher competence and leadership learning, the researchers analyzed the data descriptively, as shown in Figure 2.

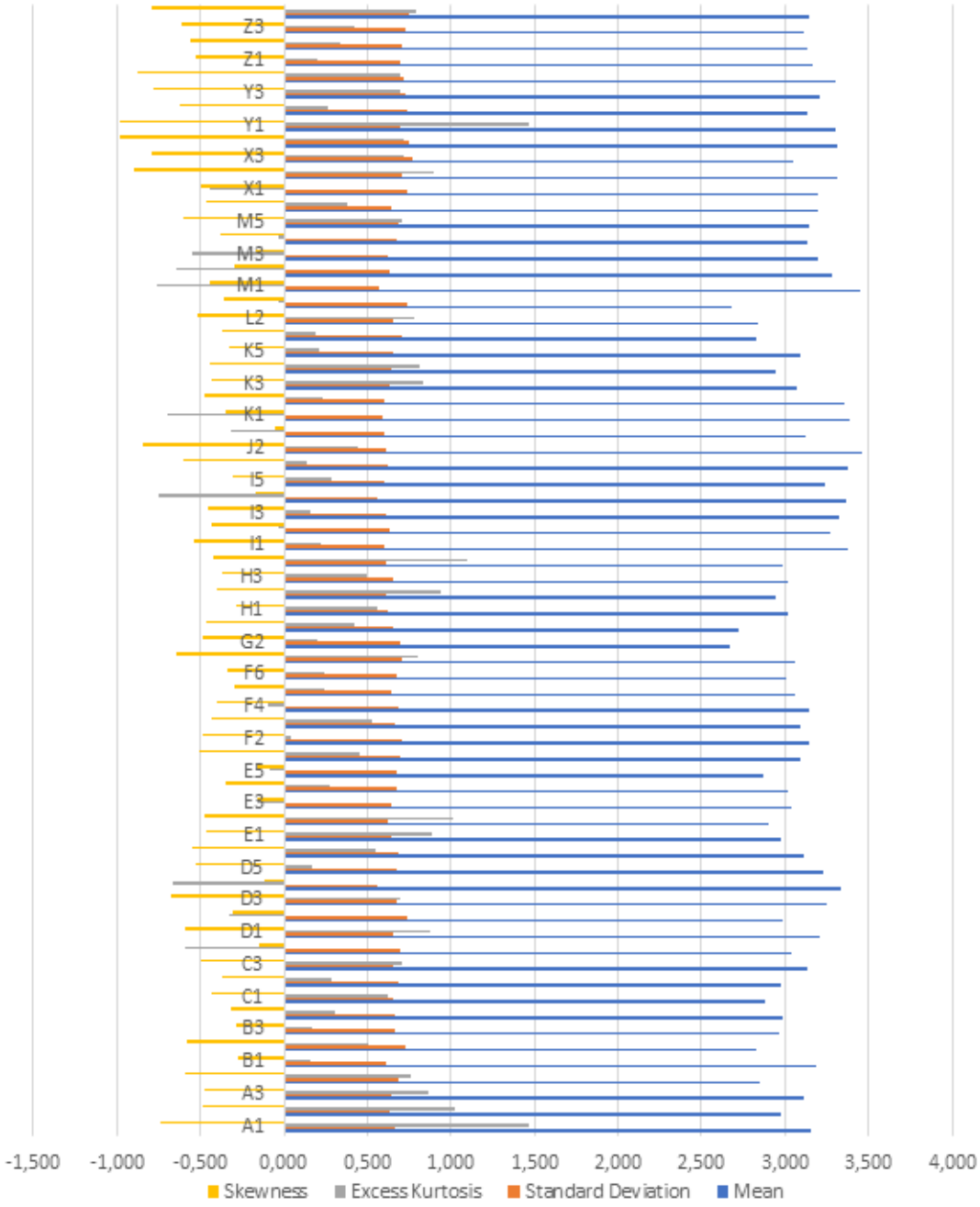

Figure 2. Descriptive Data

Figure 2 shows the kurtosis statistics of science teacher competencies ranging from -0.764 to 1.464. The kurtosis of leadership learning of the principal ranges from -0.447 and 1.461. The skewness threshold is -2; the skewness is -1; the kurtosis threshold is -7; and the kurtosis is -7. The results show the normal distribution of the data (Nawanir et al., 2018). Based on the skewness and kurtosis, the data distribution is normal. Figure 3 presents the PLS-Path Model.

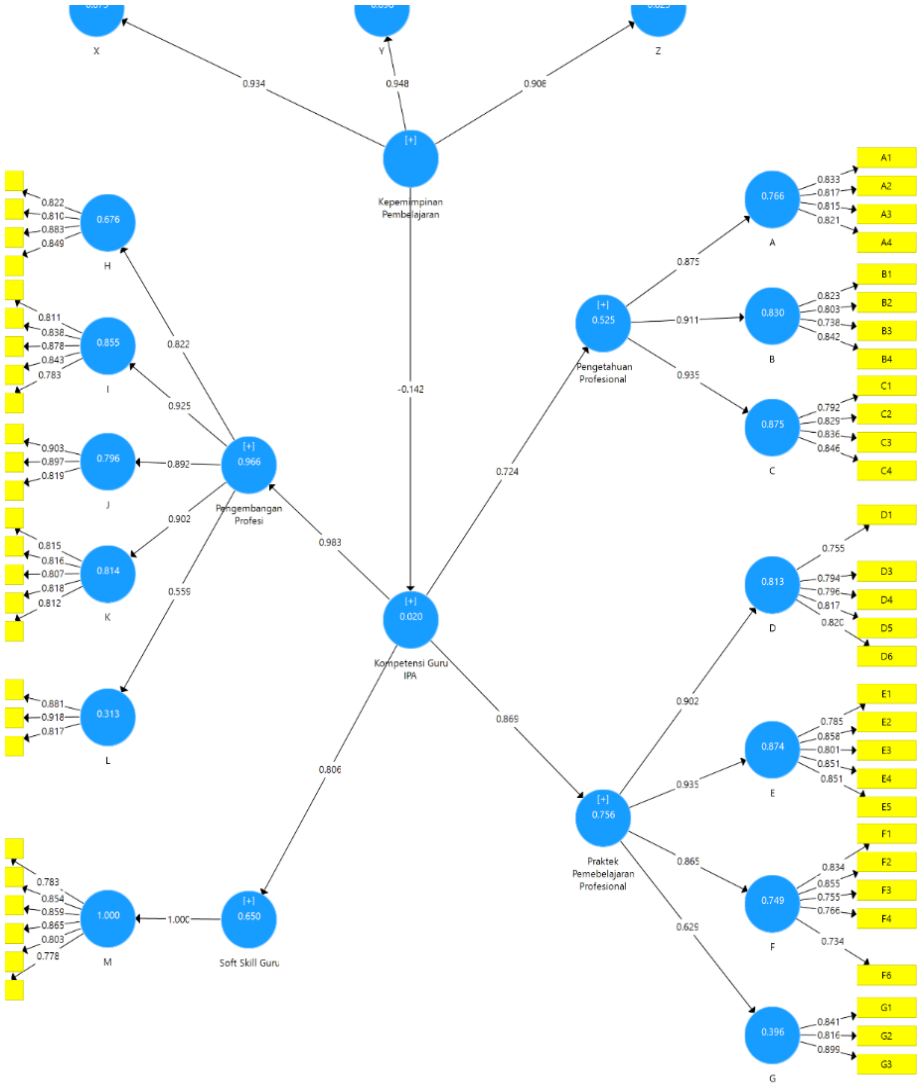

Figure 3. The Modified Path-PLS Model

Figure 3 shows that the principal's leadership learning influences the development of the science teacher competence model. High leadership learning leads to high teaching performance of the teachers (Suryani et al., 2020). The principal leadership influences the learning outcomes (Hou et al., 2019). On the other hand, teacher performance is influenced by competition and principal leadership (Suratman et al., 2020). Some indicators, such as professional cognition, professional learning practice, professional development, and soft skills, influence science teachers' competence. On the other hand, leadership learning is influenced by developing the learning environment, planning and implementing the learning process, and reflecting and improving the learning quality with a focus on the students. The principal influences the most outstanding leadership learning in planning and promoting student-focused learning.

The role of the principal in learning positively influences the teacher's practices (Er, 2021). On the other hand, science competence is influenced by the teacher's professional deve-

lopment. The creative principle could realize a conducive working climate. Principal leadership influences the teacher's creativity (Chang et al., 2021). A principal's instructional leadership positively influences teachers' collaboration frequency in learning (Mora-Ruano et al., 2021).

After obtaining the PLS-path model, the researchers measured the validity and the construct reliability to determine the validity of the measurement model. This research used convergent validity with the indicators of outer loading, Cronbach's Alpha, rho A, composite reliability (CR), and average variance extracted (AVE). Then, the researchers applied the SEM analysis to determine the validity and reliability of each component (Nawanir et al., 2018). Figure 4 shows the convergent validity and internal consistency reliability.

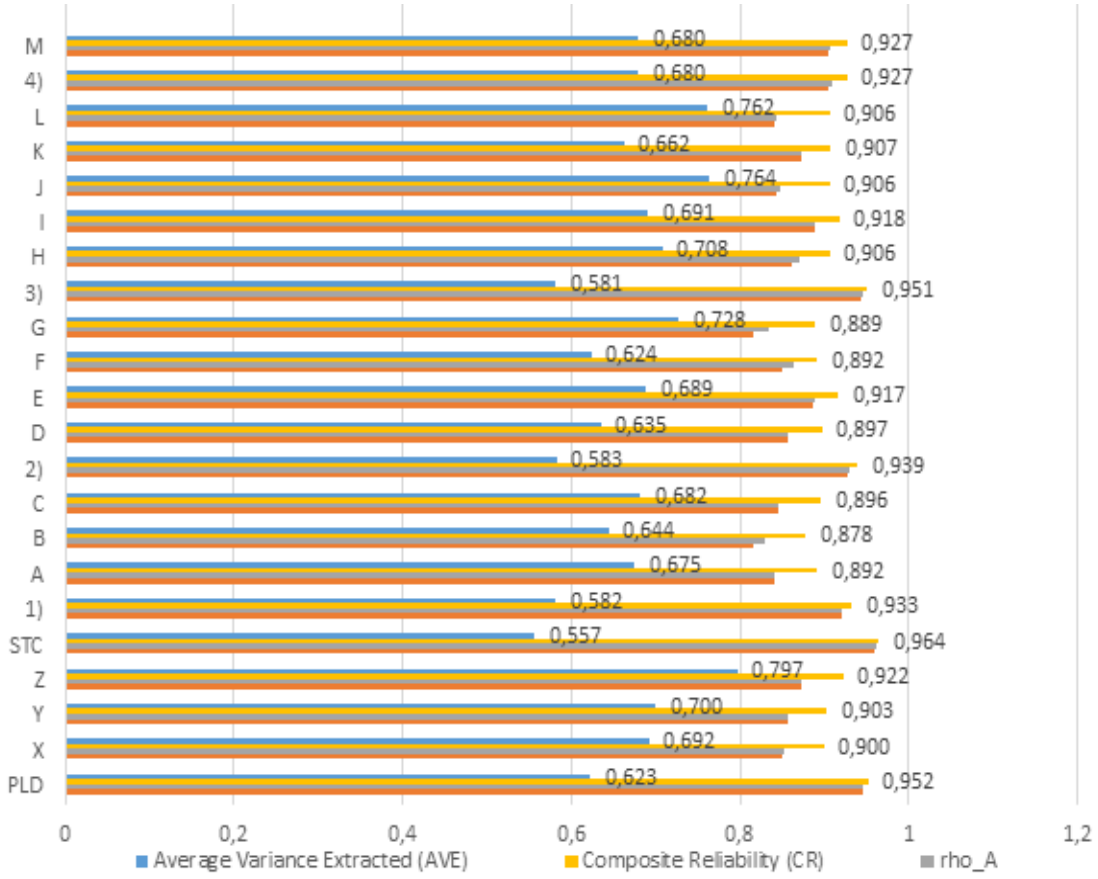

Figure 4. The Convergent Validity and the Internal Consistency Reliability

All indicators of outer loading must be significant statistically. Figure 4 shows that the outer loading is higher than 0.708, AVE > 0.5, and CR > 0.7. Thus, the convergent validity meets the requirement, and the construct explains more than half of the indicator variants (Hair et al., 2017). Therefore, the researchers concluded that the items met the Convergent Validity and Internal Consistency Reliability criteria.

The PLS model analysis included the measurement and structural models (Yulisman et al., 2020). The analysis of the measurement model consists of validity and reliability. The reliability test applied the conservative factor compared to the composite-based test (Canatay, 2022). Table 1 shows the discriminant validity to ensure the items' capabilities to measure the constructs.

Table 1. Discriminant Validity: Fornell & Larcker Criterion

	A	B	C	D	E	F	G	H	I	J	K	L	M	X	Y	Z
A	0.821															
B	0.723	**0.802**														
C	0.724	0.797	**0.826**													
D	0.612	0.721	0.694	**0.797**												
E	0.672	0.709	0.756	0.734	0.830											
F	0.646	0.735	0.724	0.739	0.758	**0.790**										
G	0.439	0.563	0.493	0.621	0.559	0.603	**0.853**									
H	0.584	0.642	0.647	0.743	0.734	0.738	0.545	**0.841**								
I	0.543	0.575	0.556	0.741	0.583	0.672	0.512	0.708	**0.831**							
J	0.467	0.573	0.518	0.694	0.583	0.637	0.485	0.661	0.768	**0.874**						
K	0.491	0.564	0.498	0.721	0.602	0.663	0.539	0.716	0.740	0.760	**0.813**					
L	0.500	0.506	0.579	0.570	0.637	0.588	0.454	0.587	0.484	0.480	0.514	**0.873**				
M	0.587	0.609	0.58	0.652	0.621	0.643	0.496	0.641	0.703	0.642	0.692	0.563	**0.825**			
X	-0.115	-0.129	-0.098	-0.094	-0.114	-0.144	-0.063	-0.165	-0.169	-0.092	-0.090	-0.036	-0.048	**0.832**		
Y	-0.130	-0.125	-0.090	-0.099	-0.093	-0.136	-0.133	-0.146	-0.175	-0.087	-0.082	-0.008	-0.055	0.827	**0.836**	
Z	-0.128	-0.120	-0.144	-0.088	-0.138	-0.140	-0.120	-0.157	-0.192	-0.105	-0.058	-0.064	-0.069	0.786	0.802	**0.893**

Note: Diagonal values (bolder) are the square root of AVE, and off-diagonals are correlation coefficients.

Table 1 shows the data discriminant validity instrument. The discriminant validity is useful in determining the uniqueness of a construct from other constructs. The discriminant validity test was based on the Fornerll and Larker criteria of the AVE square root of a latent variable. This AVE must be higher than the correlation between the latent variable and other variables (Hair et al., 2017). The Fornell criterion test prevents multicollinearity problems (Hamid et al., 2017).

After obtaining a valid and reliable instrument, the researchers used the R-square to determine the coefficient determinant and the effects. Table 2 shows the R-square test results.

Table 2. The R^2 (Coefficient of Determination)

	R Square	**R Square Adjusted**	**Category**	
Science Teacher Competences	0.020	0.015	Weak	15% Science Teacher Competence due to Leadership
Professional Cognition	0.525	0.522	Moderate	
Professional Development	0.966	0.966	Substantial	
Learning Practices	0.756	0.754	Substantial	
Soft Skill	0.650	0.648	Moderate	
A	0.766	0.764	Substantial	
B	0.830	0.829	Substantial	
C	0.875	0.874	Substantial	
D	0.813	0.812	Substantial	
E	0.874	0.874	Substantial	
F	0.749	0.747	Moderate	
G	0.396	0.393	Weak	
H	0.676	0.674	Moderate	
I	0.855	0.854	Substantial	
J	0.796	0.794	Substantial	
K	0.814	0.813	Substantial	

	R Square	R Square Adjusted	Category
L	0.313	0.309	Weak
M	1.000	1.000	Substantial
X	0.873	0.872	Substantial
Y	0.898	0.898	Substantial
Z	0.825	0.824	Substantial

Remarks:

- ✓ A percentage of 15% of science teacher competencies receive some influence by the principal leadership with weak category.
- ✓ Professional cognition influences the science teacher's competence with moderate category.
- ✓ Professional development influences science teachers' competence in a substantial category.
- ✓ Professional learning practice influences science teachers' competence in a substantial category.
- ✓ Teacher soft skills influence science teacher competence in the moderate category.

Table 2 shows the principal leadership toward the science teacher's competence. Principal leadership slightly influences the science teacher's competence. The teacher profession and professional learning practice influence the establishment of the professional competence model in a substantial category. On the other hand, professional cognition and teacher soft skills influence the moderate category. However, principal learning leadership positively influences science teachers' competence by a percentage of 15%. The remaining percentage, 85%, came from other factors. Kanya et al. (2021) also found that principal leadership influenced teacher performance by a percentage of 35%. This matter shows that a few external actors influence teacher competence. The most influential factors come from the internal side of the teachers. Internal factors greatly influence the teacher's professional development, unlike external factors. Attitudes, knowledge, and skills influence the teacher's competence. On the other hand, school climate was the external factor influencing teacher competence (Ismail et al., 2021).

Table 4 shows the influence of learning environmental development, focusing on the student toward the principal leadership learning (X). The other influences were observable in the planning and learning process implementation with a focus on the students (Y) and the reflection and revision of learning process quality with a focus on the students (Z). However, the planning and learning process implementation indicators greatly contribute to the principal leadership learning model. This occurred because the principals led the teachers and planned the learning process, focusing on the students. The principals also shared feedback on the planning and learning process. The principals also acted as examples for the teachers by showing the learning practices and providing support to make the teachers focus on promoting student-focused learning. The collaboration between the principal and the teachers could influence the school's achievements and culture (Sahlin, 2023). In this case, the principals guided the teachers directly to promote student-focused learning and to establish communication between the principal and teacher. Leaders with excellent skills have achievement and high-performance standard orientations (Saleem et al., 2020). Man principals apply instructional, positional, and facilitative leadership to support the teacher's collaborative practices (Rigby et al., 2021). The principals' behaviors, leadership styles, and effective communication influence the teacher's performance (Purnomo et al., 2020). The principal communication and collaboration with the teacher could improve the teacher's teachings (Li et al., 2023).

Principal leadership in learning influenced science teacher competences by 15%. On the other hand, professional knowledge, professional learning practice, professional development, and teacher soft skills influenced the science teacher competences. Professional science cognition influenced teacher competence by a percentage of 52.2%. Teacher professional development influenced science teacher competencies by a percentage of 75.4%. Professional learning practice influenced science teacher competence by a percentage of 64.8%. Then, the teacher's soft skills influenced the science teacher's competence. The results showed that the teacher profession was the highest contributing indicator toward science te-

acher competence. Professional cognition or professional knowledge was the highest contributor toward the science teacher's competence. Professional knowledge is associated with the structural analysis and cognitive flow for learning, explaining the competence mastery step of the students, and applying the relevant objectives based on the student's characteristics, curriculum, and Pancasila learning profiles. Material cognition, student characteristics, science learning strategy, assessment, and pedagogy are the essential factors that influence the science teacher's competence (Nouri et al., 2021). In this competency, having a partner, receiving suggestions, and having a learning community is important to improve competence. Principals have the role of creating a collaborative environment for the teachers (Meyer et al., 2022). The learning community excellently contributes to the teacher's competence, especially in problem-solution (Damjanovic & Jolyn, 2021). Teachers' professional development significantly contributed to the self-development reflection, spiritual maturity, morality, and behavioral emotions toward the ethical codes of teachers, the practices, and the working behaviors based on the students. The professional development must also apply collaboration to establish working ethos, active participation within the network, and professional organization to develop a career. This competence is correlated to the personal life and internal factors of teachers. Teacher emotionality also influences teachers' professionalism (González-Calvo & Arias-Carballal, 2017).

In the indicator of teacher professional cognition, the greatest effect was observable from the relevant learning objective determination based on the students' characteristics, curriculum, and Pancasila learning profile (87.4%). On the other hand, the lowest contribution was 76.4%. This matter was observable in the structural analysis and the cognition plot for the learning. The aspect greatly contributed because the teachers could understand the students' characteristics to promote different learning based on the Merdeka curriculum. This matter led to the Pancasila learning profile. Principals' leadership slightly influences the teacher's professionalism. However, this matter substantially influenced the school's cultural climate (Lutfiyana & Sugito, 2019). The lowest aspect occurred because the teachers could not analyze the requirement to master the concepts of a science discipline and evaluate the curriculum's structural concept and material. The integration between science and lessons becomes the core of science learning. However, most teachers find it difficult (Cavadas et al., 2022).

In the indicator of professional learning, the most contributing aspects are arranging design and implementing and reflecting effective learning, 87.4%. This happened because of the association between the learning design arrangement, dynamic learning implementation, critical thinking skills, and reflection learning. A dynamic learning design with student involvement becomes important in exploring students' cognition (Nilsson & Lund, 2023). Krell et al. (2023) explain that critical reasoning competence has the highest contribution toward science teacher competence. On the other hand, the lowest contributing aspect involves parents and communities, with a percentage of 38.3%. This happened because most teachers in Indonesia were unfamiliar with parents' involvement in learning. Collaboration between home and school is important for education (Munthe & Westergard, 2023).

The indicator of learning practice professional development had the greatest contributions from spiritual maturity, morality, and emotion to behave based on the codes of teacher ethics with a percentage of 85.5%. Most respondents were civil servants or PC (the contracted civil apparatus). Thus, they had stable emotions, spirituality, and adherence to the ethical code of a teacher. The spirituality, job satisfaction, and achievement motivation significantly influence the teacher performance (Gewasari et al., 2017). The principal leadership contributed toward the teacher's professional development. This matter eventually leads to science learning achievement (Tan, 2023). The lowest contributing factor is active participation within the professional network and organization in developing a career, with a percentage of 59.6%. This happened because the teachers lacked a network and only focused on the teacher performance group at specific educational units. Thus, teachers rarely had a national-level network. Teachers could learn from other experts and knowledgeable teachers, but this matter was difficult to realize (Serin, 2017).

Table 3 shows the contribution of leadership toward the science teacher competence.

Tabel 3. f^2 (*Effect Size*)

	Professional Cognition	Science Teacher Competences	Professional Development	Learning Practices	Soft Skill
Professional Cognition		5.700			
A	6.013				
B	7.780				
C	8.435				
D				8.176	
E				6.804	
F				7.952	
G				1.884	
H			4.820		
I			6.002		
J			4.316		
K			6.788		
L			1.484		
M					65849.925
Professional Development		12.832			
Learning Practice		17.873			
Teacher Soft Skill		2.995			

Table 3 shows the data about the low contribution of professional cognition, 5.7% toward the science teacher competence. The professional development has a low contribution toward the science teacher competence, 12.83%. Professional learning practice contributes moderately, with a percentage of 17.88%. On the other hand, the soft skill of the teacher contributes with a percentage of 2.99%.

After obtaining data about the influence of learning leadership on science teacher competence, 15% of the researchers examined the hypothesis. The researchers examined whether the learning leadership of the principal positively influenced the science teacher's competence with SMART PLS 3.0. This software was developed by Ringle et al. (2015). The researchers examined the significance of the components based on the path coefficient. Table 4 shows the results.

Table 4. Summary of hypothesis

Hypothesis	Path	Std. Beta	Std. Error	T-value	Bias	Confidence Interval		Decision
						5.00%	95.00%	
Leadership positively influences science teachers' competencies.	Learning leadership > Science teacher competence	-0,142	0,064	2,206	-0,003	-0,233	-0,020	Supportive

Note: $p \leq 0,05$ (1-tailed test)

Note: T value is higher than 1.96. Thus, the result accepts the hypothesis.

Table 4 shows the hypothesis test of one party. The obtained t-count is 2.206 with a t-table of 1.96, indicating t-count > t-table. Thus, the result accepts the hypothesis. Thus, the researchers concluded that principal leadership positively influenced science teacher competence by 15%. This matter indicates that the principal made an effort to lead the learning environment, lead the plan, implement the learning process, reflect, and improve the quality of the learning activity. Through this process, teachers can receive guidance and suggestions from the principal about the promoted learning. Besides that, the principal must supervise the teachers to assess and monitor the teacher's performance, starting from the administration, learning promotion, and teacher performance. Rosalina et al. (2023) also found the influence of supervision on the teacher performance. Farida et al. (2022) explain that clinical supervision and principal influence teacher competence. The principal leadership influences the teacher's performance. However, autocratic leadership and democracy could optimize teacher performance (Parveen et al., 2022). Excellent principles lead to effective learning (Simanjuntak, 2021). School principals must apply leadership styles based on the school levels and characteristics (Sarwar et al., 2022). Although principal leadership influences teacher performance, 85% comes from other factors. Xie et al. (2022) found that teachers' self-efficacy received some influence from the principal. However, the high influences were observable on the teacher collaboration and experience. Besides that, the teacher's performance also received some influence from the teacher's internal capability, external party sentiment, and environment. Principals are the parts of external party contribution. This matter lowers the science teacher's competence. Pan and Chen (2021) found that school principals did not directly influence teacher competence, but the teaching and curriculum revision did.

The limitation of this research is that the research only applies to the ex-residency area of Pati, and another limitation is that not all predictor variables were included in this research, so that other predictor variables will be suggested for further research.

CONCLUSION

Based on data analysis and hypothesis testing, the results showed that the science teacher professional competency development model was positively influenced by learning leadership. The research results show that the science teacher competency model is formed from indicators of professional development and learning practices in the large category, while professional knowledge and soft skills are in the medium category. The research found that the principal's learning leadership influenced the professional competence of science teachers in the small category. For this reason, school principals need to transform their roles in the era of independent learning, and these findings also provide suggestions for science teachers to improve professional competence and student-centered innovative learning.

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