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E-leadership of the school principals in implementing online learning during COVID-19 pandemic at public senior high schools

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This research aimed to discover the implementation of e-leadership for school principals during the COVID-19 pandemic and its effect on school performance through changes in teacher behavior. Quantitative research was used where it involved 8 public high schools with 150 respondents. The results showed that: (1) the implementation of e-leadership for school principals during the COVID-19 pandemic was at a very high level for the dimensions of the vision of continuous learning and professional development of teachers, and at a high level for the dimensions of classroom supervision and teacher performance assessment; (2) none of the independent variables have a correlation with the dependent variable greater than > 0.50. The correlation between the independent variable and the dependent variable is at a simple stage for teacher behavior and a low stage for teacher performance; (3) the result of measurement model test with Confirmatory Factor Analysis (CFA) shows that the loading factor of each indicator is greater than 0.60, which means that the indicators are valid for measuring the variable; (4) the results of the structural model test show that the principal's e-leadership variable, scientific competence (pedagogical knowledge and pedagogical content knowledge), personality competence and e-skills have a positive and significant effect on teacher behavior with a value of ***$p = < 0.05$. Teacher performance also has a positive and significant effect with a value of ***$p = < 0.05$ which makes H-1−H-9 accepted. Proportionally, e-leadership remains the main variable compared to other variables which gives the largest contribution to improving teacher performance through changes in teacher behavior by (0.280), scientific competence variables (pedagogical knowledge and content knowledge) and teacher personality, respectively, contribute to improved performance through changes in teacher behavior of (0.083) and (0.152). The e-skill competency variable of teachers contributes to increased

performance through changes in teacher behavior of (0.177). The practical implication of this research is that principals need to change their roles and leadership styles from conventional to electronic-based learning leadership styles to realize effective online learning.

Introduction

Keeping up with the advancement of electronic-based ICT infrastructure, entering the early twenty first century to the second decade, the study of leadership no longer focuses on face-to-face leadership but has evolved to electronic-based leadership and management (Jameson, 2013). The complexity of the work of a millennial era leader has shifted policies from conventional management to web application-based management. The consequence is that a leader must move quickly to empower staff to have skills in operating various application systems related to school management and effective online learning processes (Anderson, 2008; Garrison, 2011; Pokhrel and Chhetri, 2021).

A principal is not only required to be able to influence but is also required to be able to combine his or her leadership with web-based management (Hamzah et al., 2021). Because some aspects of work in schools ranging from student data collection, financial reporting, accountability for School Operational Fund (*Bantuan Operasional Sekolah*—BOS), Special Allocation Fund (*Dana Alokasi Khusus*—DAK), new student admission systems and several other aspects must be reported online.

The complexity of the work of school principals at home and abroad in the twenty-first century millennial era does not only focus on efforts to influence subordinates to achieve the vision and mission of the schools and carry out scheduled classroom supervision, but also involves many administrative tasks related to school physical work. This condition has consequences for looser social relations between the teacher and the head. In addition, principals are often busy with paper work, meetings and work outside school have made them become the strangers in their own schools (Jean-Marie et al., 2009; Ibrahim, 2015). To overcome this problem, the presence of information technology on personal computers, laptops, and smartphones and cellphone applications in monitoring online school activities is widely needed. The school must be able to complete the e-learning facilities and servers that can support the principals' duties online in order to exercise their influence and managerial for the effective face-to-face and online learning process (Álvarez et al., 2013).

During the first years of the twenty-first century, majority of senior high schools in Padang have utilized web-based

computer technology to collect data on new students who are connected to educational institutions as well as education agencies and ministries and the Computer-Based National Examination (*Ujian Nasional Berbasis Komputer*—UNBK) in optimizing the e-teaching and learning process that can be controlled digitally (Aral et al., 2012; Retnawati et al., 2017; Biantoro and Arfianti, 2019; Handoko et al., 2019). As a result, schools require new sorts of administrators who are experienced at using new technologies for educational practices and performance procedures. As a result, principals must adapt their roles to become electronic leaders. Electronic leadership or e-leadership is a new paradigm that requires a leader to be virtually able to achieve goals supported by a work team that can operate computers with internet-based applications (Weng and Tang, 2014; AlAjmi, 2022). In addition, it is not enough for teachers to only master scientific competences (pedagogical knowledge and content knowledge) and personality competencies but also must be able to operate online-based learning (Arruti et al., 2022).

In connection with the widespread spread of the COVID-19 outbreak that hit many countries around the world including Indonesia at the end of 2019, it has prompted the government to issue Government Regulation number 21 of 2020 and Ministry of health regulation number 9 of 2020 concerning Large-Scale Social Restrictions. Therefore, the only solution that can be offered is to carry out online learning and stop face-to-face learning activities in class starting from March 23, 2020 (Sartika et al., 2021). The demand for e-leadership in the learning aspect is increasingly expected to be able to move teachers to be able to change conventional teaching habits into online-based teaching methods through various application platforms, example, WhatsApp, Google Classroom, Edmodo, Quizzi, Zoom Cloud, Jitsi, etc. The learning leadership model was chosen to serve as e-leadership for school principals because according to Robinson et al. (2007) and Day et al. (2016), the effect size of learning leadership is the highest compared to other leadership models. In fact, the effect size of the principals' learning leadership is three times greater than the effect size of the principals' transformational leadership.

E-leadership is not only required to be able to integrate technology into leadership practices but is also expected to be

able to provide changes in teacher behavior and performance from conventional teaching methods to online-based learning (Coman et al., 2020; Omar and Ismail, 2020; Ritonga et al., 2022b). A teacher must not only have instructional competence, but also professionalism, self-control, and social awareness based on the National Education System Law but also to have the e-skills required for the online learning process (Hüsing et al., 2013; Polat et al., 2022). According to Ibrahim (2017), professional teachers are teachers who have knowledge (content knowledge), teachers who have proficiency and skills in the learning process (pedagogical knowledge and content knowledge) and teachers who have personalities who are exemplary and highly committed in carrying out their profession as teachers. In addition, teachers must also have good e-skill abilities. It can be concluded that a professional teacher is a teacher who has a broad knowledge of the content and content of learning material, has a good personality that can be role models for students, has skills in designing learning programs and is able to choose the right strategy in managing the learning process.

The problems faced in implementing e-leadership is sometimes defined not by a lack of resources or a failure of e-learning platforms, but by the conduct of leaders and teachers, e.g., reluctance to adapt and change conventional work patterns to digital work patterns (Jameson et al., 2006). There are several schools that already have their own platforms and it is possible to operate several applications that can support leadership tasks and teachers in carrying out daily tasks. However, some principals do not use it because they have lack self-confidence and e-skills. They believe that using technological means in management can lead to difficult issues (Aurangzeb and Mazhar, 2019).

A survey of the literature reveals that there is no suitable study on e-leadership model to use as a benchmark in the establishment of e-learning systems in education and the pilot study. The goals of this research are to determine the stages of applying e-leadership techniques, teachers' abilities, and changes in teachers' actions and behaviors during the COVID-19 in Public Senior High Schools in Padang.

Literature reviews

E-leadership is characterized as a social influence method facilitated by digital computer applications that results in behavioral and performance change of individual and group teachers in school organizations (Avolio et al., 2000; Fu, 2013; Wart et al., 2019; Benitez et al., 2022). The results of Jameson et al. (2006) research on e-leadership defines it as a "virtual influence relationship." Here, e-leadership is an effort to influence the subordinate through various daily interactions in educational institutions by regularly using social networking facilities both at home and at work. Electronic leadership

skills are also defined as "integrated technology leadership" between expertise in utilizing digital technology and skill for organizational leadership and management (Cortellazzo et al., 2019; Lien et al., 2022). Adaptive Structural Theory (Avolio et al., 2000) explained that the integration between the ability to use technology and leadership have an influence on one another in electronic organizations. The integration of technology with leadership is highly dependent on the quality of electronic knowledge, electronic skills, and the qualities of electronic leadership (Avolio and Kahai, 2003; Purvanova and Bono, 2009).

Based on the search results on research related to e-leadership and its effect on changes in teacher behavior and performance during the second decade of the twenty-first century, there is only a small amount of research that examines e-leadership (Xu et al., 2022). These studies generally focus more on the electronic skills of principals (Garcia, 2015), electronic leadership, industrialization, and educational technology innovation (Bowen et al., 2013), methods of electronic long term planning and study objectives (Aguilos and Fuchs, 2022), electronic leadership style (Aggarwal, 2014), and responsibilities and abilities of electronic leaders (Tan, 2010; Leong et al., 2016), as well as the psychological impact of COVID-19 on teachers (Arruti et al., 2022).

Scientists and educational observers agree that study on e-leadership in education is currently limited. However, everyone agrees it is a new field and that additional research is needed. Due to the scarcity of e-leadership research in education, numerous scholars have voiced worry about the "what" and "how to" apply e-leadership in schools (Hamzah et al., 2021). Wart et al. (2019) for example, are worried about a weak piece in an e-leadership strategy that lacks the right model and structure for e-leadership practice, as well as the action plans required to promote school performance. Much study is needed to address questions about numerous indicators, such as what affects the effects of e practice in schools and how to influence the capacity of e-leadership teaching and learning?; to what extent is the influence of e-leadership practices on teacher behavior and performance in implementing effective online-based learning in schools?; and to what extent does a teacher have e-skill competencies in implementing online-based learning?

Based on the literature review above, it needs to be emphasized that the scope of this study is limited to e-learning leadership of the principals, teachers' competence and teachers' behavior and performance.

E-learning leadership refers to learning leadership that is developed from the results of a model synthesis of Hallinger and Murphy (1985) and Blase and Blase (2000); which includes four dimensions, i.e., (1) learning vision, (2) learning supervision, (3) continuous teacher professional development, and (4) teacher performance appraisal. The effect of e-learning leadership is also focused on teacher behavior and performance because based on the results of a review of 40 research results conducted by

Hallinger (2007), principal leadership has a more consistent effect on student achievement than its direct effect. This means that to improve student achievement, a principal must concentrate more on improving teacher behavior change and performance to produce high-achieving students. According by Bush (2004) also revealed that learning leadership is a very important dimension because it focuses on the core activities of the school, e.g., the control of learning activities in the classroom is well controlled. Improving the quality of learning in schools can only be carried out and takes place continuously if the behavior and performance of teachers as the main actors can be controlled and improved continuously (O'Shea, 2021).

Teachers' competence which is the focus of this study refers to the competence of teachers proposed by Syahruddin et al. (2013) and Harianto et al. (2021) which includes scientific competences (content knowledge and pedagogical knowledge), personal competences and teacher e-skills, and not teacher competencies based on the Law on National Education System which includes instructional competence, professionalism, self-control, and social awareness. Professional competence and instructional competence are combined into scientific competences, while teachers' social competences are not the focus of this research.

A review of many literatures, especially in countries, shows that there is no appropriate research-based e-leadership model that can be used as a reference in implementing e-learning platforms in schools. The purpose of this study was to identify the stages of implementing e-leadership practices, teacher competencies and changes to teacher behavior and performance during the COVID-19 period at Padang City Public High School. In particular, it is to prove the following hypotheses:

> H-1: e-Leadership of the principal's learning has a positive and significant effect on teacher behavior.
>
> H-2: Pedagogical knowledge competence and content knowledge of teachers have a positive and significant effect on teacher behavior.
>
> H-3: The teacher's personality competence has a positive and significant effect on teacher behavior.
>
> H-4: Teacher e-Skills have a positive and significant effect on teacher behavior.
>
> H-5: Teacher behavior has a positive and significant effect on teacher performance.
>
> H-6: e-Leadership of the principal's learning has a positive and significant effect on teacher performance.
>
> H-7: pedagogical knowledge competence and content knowledge have a positive and significant effect on teacher performance.
>
> H-8: Personality competence has a positive and significant effect on teacher performance.
>
> H-9: e-Skill has a positive and significant effect on teacher performance.

Research methods

This study applies a quantitative approach with a questionnaire as an instrument of research data collection. According to Creswell and Creswell (2014), the findings could gather data straightforwardly from the subject under investigation and establish population-wide generalizations. The populations of this study are 16 public high schools in Padang. The school sample was determined based on the characteristics of the area. Padang City consists of two main areas: downtown and suburban areas. The four sample schools are in downtown (SMAN 2, SMAN 4, SMAN 6, and SMAN 10) and the other four are in the suburbs (SMAN 5, SMAN 9, SMAN 12, and SMAN 14). The data sources for each school consisted of the principal, four vice principals, four Natural Science teachers (Mathematics, Chemistry, Physics, and Biology), four Social Studies teachers (History, Economics, Geography, and Sociology), and the General Science teachers (Indonesia language, Religious Studies, Civic Education, English, and Cultural Arts) from each school. The total number of N samples is 150 consisting of 8 school principals, 32 deputy principals and 70 teachers for Natural Sciences and Social Studies and 40 teachers in General Science. The study was conducted for 8 weeks, starting from the fourth week of July to the first week of September 2020.

This research instrument applies a Likert scale of 5 to show agreement in every statement submitted. Respondents can provide answers to each statement by circling the number. The Likert scale used is: First, 5 = strongly agree, 4 = agree, 3 = disagree, 2 = disagree, and 1 = strongly disagree. Second, 5 = always, 4 = often, 3 = sometimes, 2 = rarely, and 1 = never.

All data obtained were analyzed using the Statistical Package for Social Sciences (SPSS version 20), To examine the validity and reliability of the instruments for each construct under research, item-total correlation analysis and the Cronbach Alpha technique, as well as component analysis utilizing Exploratory Fact Analysis, were utilized. Confirmatory factor analysis (CFA) is being performed in the meanwhile to identify the instrument components that comprise the sole factor of this study design.

Descriptive analysis is used to examine the phases of implementation for each concept using a passing score and standard deviation. The minimal score for interpretation is derived using Ahmad (2002) scale, which is shown in Table 1.

Pearson correlation is used to assess the strength of the association between variables in a research hypothesis. The results of the analysis (r) are classified into three categories: low, medium, and high, as shown in Table 2.

The link between latent constructs and their predictors, as well as the correlation between the two independent variable and the dependent variable of this study, is examined using measurement models and structural models.

TABLE 1 Minimum score of interpretation by scale.

Range	Interpretation
1.00–1.89	Very low
1.90–2.69	Low
2.70–3.49	Mediocre
3.50–4.29	High
4.30–5.00	Very high

TABLE 2 The relationship between the two constructs (Jackson, 2009).

No.	Correlation coefficient (r)	Relationship strength
1.	±0.70–1.00	High
2.	±0.30–0.69	Medium
3.	±0.00–0.29	Low

Results and discussion

The results of this study reveal the results of the validity and reliability of the instruments and the e-Leadership stage of learning, teachers' competence, behavior and performances during the online learning period of the pandemic COVID-19 in Padang. Furthermore, it also reveals the test results of measurement models and structural models.

The e-learning leadership variable consists of 18 instruments which are grouped into four dimensions: (a) learning vision, (b) learning supervision, (c) continuous teacher professional development, and (d) teacher performance assessment. The competency variables of pedagogical knowledge and content knowledge consisted of nine instruments, the teachers' personality competency variable consisted of five instruments, the teachers' e-Skill variable consisted of four instruments, the teachers' behavior variable during the COVID-19 pandemic consisted of four instruments, the teachers' performance variable during the pandemic period. COVID-19 consists of 10 instruments. Four variables act as independent variables on teachers' behavior variables and teachers' performance, then teachers' behavior variables simultaneously also act as independent variables on teachers' performance variables.

From the results of the instrument validity and reliability test of each variable using Cronbach Alpha, the item correlation value was obtained with the total score (r) > 0.30, while the reliability value of each instrument item from each variable was obtained an alpha value > 0.60. The results of this test have dropped one item of instrument for variable pedagogical knowledge and content knowledge and two items of instrument for variable personality competence, and five items of instrument for teachers' performance. The results of the validity and reliability test can be concluded that the instrument has good validity and reliability as suggested by Creswell and Creswell (2014).

Furthermore, the validity and reliability tests of the instrument were carried out using exploration factor analysis so that the component matrix formed a single factor with a loading factor of > 0.50. The results of factor analysis for each variable can be seen in Table 3.

The results of factor analysis such as Table 3 show that 18 indicators grouped into four dimensions have been able to explain the e-learning leadership variable so that the KMO Bartlett's test value and anti-image correlation and factor matrix values are obtained with a loading factor of > 0.50. Next, the results of the analysis of the competency variables Pedagogical knowledge and content knowledge with eight analysis results show the acquisition of the KMO Bartlett's test and the anti-image Correlation and Matrix Factor values with a loading factor of > 0.50. The results of the analysis of personality competency variables consist of five indicators. The results of the analysis show that the five indicators can explain the variable with a loading factor of > 0.50. Meanwhile, the results of the analysis of the teacher's e-Skill competency variable can also be explained by four indicators with a loading factor of > 0.50. The results of the analysis of teacher behavior variables can also be explained by the indicators with a loading factor of > 0.50. Finally, the teacher performance variables can also be explained by the indicators so that the KMO Bartlett's test value and the anti-image Correlation and Matrix Factor values are obtained with a loading factor of > 0.50. The results of instrument analysis with factor analysis can be concluded that the instrument is valid and forms a single factor for all variables. Meanwhile, the KMO Bartlett's test generated > 0.50 which indicates that the analysis can be continued to the next stage.

Furthermore, the results of measurement model analysis with CFA to determine the loading factor from indicator to variable can be seen in Diagram 1 below.

Based on Figure 1 above, specifically for the e-learning leadership variable which consists of 18 instruments, it is conceptualized into four dimensions: (1) learning vision; (2) learning supervision; (3) continuous professional development; and (4) teacher performance assessment. Meanwhile, other variables are directly measured from the indicators to each variable. The loading factor from the dimensions to the e-leadership variable as a manifest variable to the latent variable can be seen in Tables 4–9.

Table 4 shows the loading factor above the number > 0.60 and the Variance extracted value (0.646). The results of this analysis show that four dimensions, namely learning vision, teaching and learning supervision, teacher professional development and teacher performance appraisal, can explain the e-learning leadership construct. The remaining 64.6% is explained by other dimensions.

According to Hallinger and Heck (2002) and Leithwood et al. (2004), the principal's learning leadership as a mentorship activity plays a significant role in deciding a school's success in establishing student learning accomplishment. The aspects of

TABLE 3 Summary of validity test results with factor analysis.

| Independent and dependent variable	The perceptions of principals, deputy principals and teachers		
	Anti-image Correlation > 0.50	Matrix Factors > 0.50	KMO Bartlett's test > 0.50
1 e-Learning leadership			
a. Vision of learning	0.686–0.834	0.670–0.884	0.778 sig. 000 < 0.05
b. Supervision of learning	0.724–0.837	0.766–0.804	0.781 sig. 000 < 0.05
c. Professional development	0.684–0.830	0.710–0.834	0.738 sig. 000 < 0.05
d. Performance assessment	0.734–0.878	0.698–0.890	0.783 sig. 000 < 0.05
2 Scientific competence (pedagogical knowledge and content knowledge)	0.724–0.852	0.698–0.890	0.635 sig. 000 < 0.05
3 Teacher personality competence	0.677–0.812	0.397–0.680	0.715
4 e-Skill teacher	0.678–0.792	0.612–0.927	0.729
5 COVID-19 teacher behavior	0.741–0.828	0.681–0.932	0.797
6 Teacher Performance during the COVID-19 Period	0.674–0.770	0.452–0.831	0.715
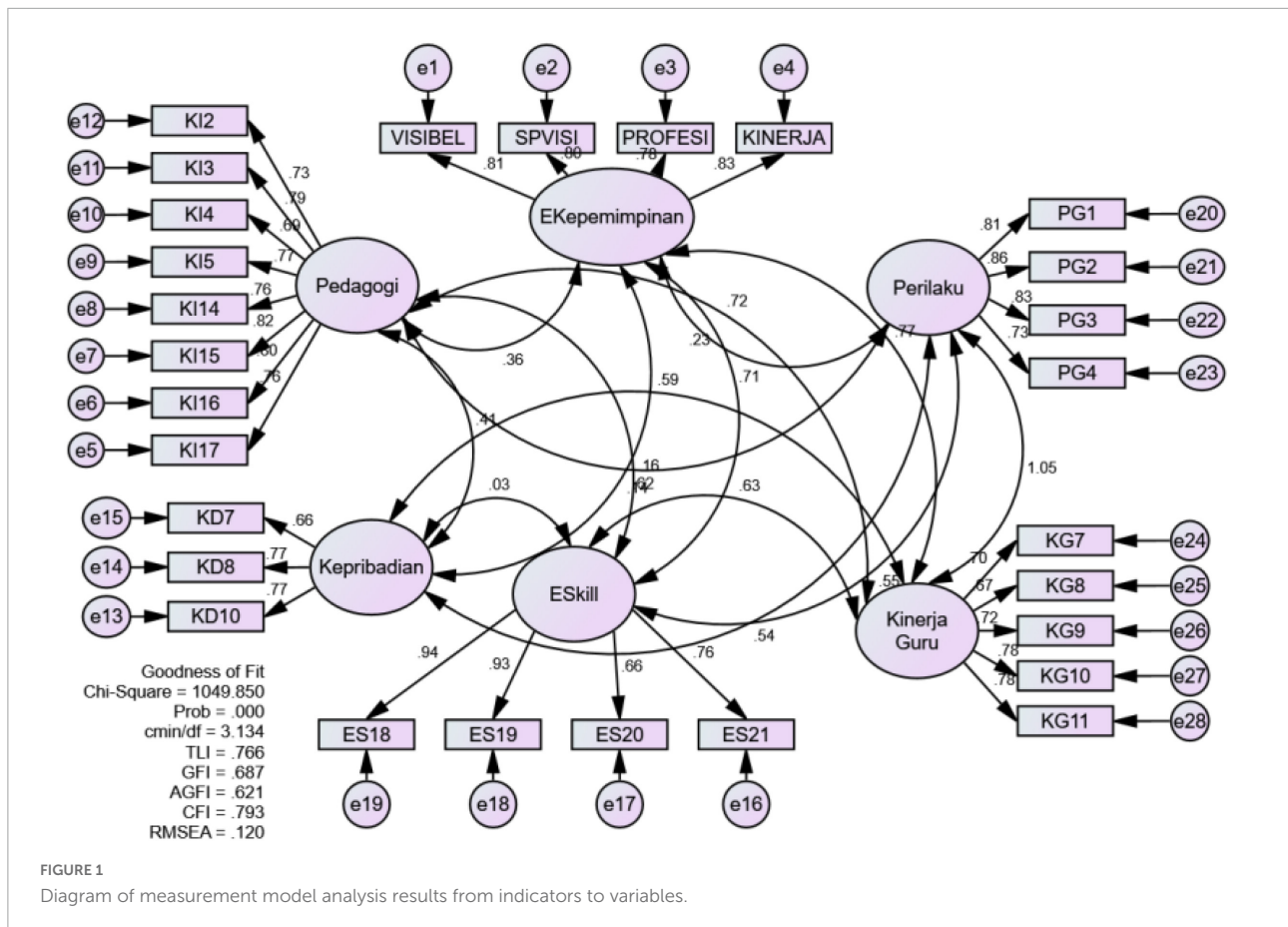
FIGURE 1
Diagram of measurement model analysis results from indicators to variables.

learning leadership with measurements can be used to assess the principal's successful learning leadership. Learning leadership according to Robinson et al. (2009) can have an important effect on changes in teacher behavior and performance in creating student learning achievement. According to Smith and Piele (2006), the dimensions of learning leadership serve to provide direction for everyone involved in an organization.

In the learning vision dimension, the principal's learning leadership is reflected in the behavior of the principal to ensure that teachers carry out online learning during the COVID-19 period. The principal communicates with teachers online so that the lesson plan continues to be used as a reference in handling out the cognitive development; utilizing knowledge acquisition still makes reference to the material advancement

TABLE 4 The loading factor from the dimension to the y-variable is learning leadership.

Code	Indicators are conceptualized into four dimensions	Estimates with loadings factor > 0.60
VISIBEL	Learning vision	0.814
SPVISI	Learning supervision	0.796
PROFESI	Continuous professional development	0.777
KINERJA	Teachers' performance appraisal	0.828
	Variance extracted: $(0.814^2 + 0.796^2 + 0.777^2 + 0.828^{2)})/4 = 0.646$ (64.6%).	

TABLE 5 Loading factor from indicators to scientific variables (pedagogical knowledge and content knowledge).

Code	Indicators	Estimates with loadings factor > 0.60
KI2	I employ a range of approaches to increase learners' eagerness to study.	0.727
KI3	I can efficiently organize the class such that diverse learning activities occur catching Students' interests.	0.786
KI4	I actively help students in the learning process by paying attention to each individual.	0.689
KI5	I listen and pay attention to all student questions and answers, both correct and wrong, to measure the level of student understanding.	0.770
KI14	I am an expert in the subject area, as well as knowledgeable and fluent in carrying out learning exercises.	0.765
KI15	I respond well to any questions or opinions submitted by students and then give answers correctly and correctly.	0.823
KI16	I compile the material, plan and implement learning containing appropriate, up-to-date information, and help students understand the concept of the learning material that I convey	0.798
KI17	I master a variety of learning strategies to make students interested in learning	0.756
	Variance extracted: $(0.727^2 + 0.786^2 + 0.689^2 + 0.770^2 + 0.765^2 + 0.823^2 + 0.798^2 + 0.756^2)/8 = 0.586$ (58.6%).	

TABLE 6 The loading factor from the indicators to the teacher personality competency variables.

Code	Indicators	Estimates with loadings factor > 0.60
KD7	I have a broad view of the diversity of the Indonesian nation from the aspects of culture, ethnicity and religion	0.656
KD8	I talk and behave with students without differentiating from one another	0.774
KD10	I am among those who are proud of my profession as a teacher	0.773
	Variance extracted: $(0.656^2 + 0.774^2 + 0.773^2)/3 = 0.542$ (54.2%).	

TABLE 7 The loading factor from the indicator to the teachers' e-skill variable (teachers' proficiency in e-learning).

Code	Indicators	Estimates with loadings factor > 0.60
ES18	I am proficient in using e-learning applications.	0.942
ES19	I am good at using computer technology.	0.927
ES20	I am good at using various electronic media (Zoom, Facebook, WhatsApp, Google, Line, Instagram).	0.655
ES21	I am good at accessing various learning resources via the internet.	0.763
	Variance extracted = $(0.942^2 + 0.927^2 + 0.655^2 + 0.763^2)/4 = 0.689$ (68.9%).	

TABLE 8 The loading factor from the indicator to the teachers' behavior variable during the COVID-19 pandemic.

Code	Indicators	Estimates with loadings factor > 0.60
PG1	Encouraging me to be skilled in using e-learning applications	0.815
PG2	Encouraging me to be skilled at accessing various learning resources via the internet	0.860
PG3	Encouraging me to master electronic learning strategies and media so that the learning process took place effectively	0.831
PG4	Encouraging me to communicate online learning materials effectively	0.727
	Variance extracted: $(0.815^2 + 0.860^2 + 0.831^2 + 0.727^2)/4 = 0.656$ (65.6%).	

Code	Indicators	Estimates with loadings factor > 0.60
KG7	The amount of work I have produced is in accordance with the demands of the school.	0.701
KG8	I can carry out my duties and responsibilities online according to the targets set by the school.	0.671
KG9	I complete assignments and work on time.	0.722
KG10	I can provide weekly reports on the implementation of online learning according to the specified time.	0.776
KG11	I was able to work with colleagues effectively.	0.783
	Variance extracted: $(0.701^2 + 0.671^2 + 0.722^2 + 0.776^2 + 0.783^2)/5 = 0.536$ (53.6%).	

indicators that have been established so that the classification of learning tools and approaches is modified to the position and circumstances of students, as well as the properties of each measure and mastery to be realized. The assessment process is adjusted to the indicators of competency attainment in the knowledge, attitudes, and skills of students so that they always strive to ensure that quality online learning is carried out. The learning vision is built based on the competency standards of graduates to be achieved together. Therefore, e-Leadership of school principals is more focused on implementing the learning process properly in accordance with predetermined learning standards. Firdaus et al. (2022) suggest that the principal's learning leadership is reflected in the form of actions taken by the principal to develop a productive and satisfying work environment for students.

The learning supervision dimension is reflected in the behavior of the principal to ensure that there is a communication process between the principal and the teacher that classroom supervision is carried out online. The online learning process is tightly controlled to ensure that teachers have the knowledge in applying e-learning and can distinguish teachers who are skilled at implementing online learning from those who are not. Indicators of the learning supervision dimension have been able to measure the principal's learning leadership that an effective principal must supervise learning for learning improvement through continuous teacher professional development (Ozdemir and Sahin, 2020).

Learning leadership from the dimension of continuous professional development is important for improving the quality of learning (DuFour and Berkey, 1995). DuFour and Berkey (1995) stated that the success of the principal's efforts to realize effective learning is determined by the continuous professional development activities of teachers. The same thing was stated by Smith and Piele (2006) who said that effectiveness is closely related to school programs to develop sustainable human resource capacity in schools. The indicators of the dimensions of sustainable professional development by the principal are reflected in the behavior of the principal to ensure that teachers implement: online learning during the COVID-19 pandemic, the principal always tries to develop the ability of teachers to increase the effectiveness of online learning; online learning during the COVID-19 pandemic, the principal encourages

teachers to take part in webinar self-development activities; online learning during the COVID-19 pandemic, the principal created conditions for the professional development of teachers in applying e-learning; online learning during the COVID-19 pandemic, the principal developed online learning techniques with peers; online learning during the COVID-19 pandemic, the principal encouraged teachers to be active in subject teacher deliberation online activities.

In the performance appraisal dimension, according to Kim et al. (2019), the principal ensures that teachers are evaluated continuously and measured on the strengths and weaknesses of teacher pedagogy and scientist pedagogy based on data from various sources. According to Alonzo et al. (2021), teacher assessment and feedback functions as a means of academic communication between the principal and the teacher to obtain a common understanding of learning problems. The same view is shared by Samuel and Berhanu (2019) that teacher performance appraisal serves to identify the strengths and weaknesses of teachers in implementing classroom learning. The dimensions of the e-leadership learning performance assessment of school principals during the COVID-19 period were reflected in the form of behavior: school principals assessed teacher performance online and continuously; the principal submits the assessment criteria online to the teacher; the principal submits the online assessment schedule to the teacher; the principal provides information online to the teacher about the results of the assessment of strengths and weaknesses in implementing learning.

Analysis of measurement models for scientific variables (pedagogical knowledge and content knowledge) is measured by eight indicators in Table 5.

Table 5 above shows the loadings factor showing a number above > 0.60 with a Variance extracted value (0.586). The results of this analysis show that all indicators can explain the constructs of scientific competence (pedagogical knowledge and content knowledge) with a figure of 58.6%, the rest is explained by other indicators.

Professional teachers according to Jeanpierre et al. (2005), Liakopoulou (2011), and Abu-Tineh et al. (2017) are teachers who have competence in the aspects of the learning process and strategy; teachers who can understand the psychology of students; are able to motivate and pay attention to all students.

According to Bakar (2018), professional teachers are teachers whose behavior can be reflected in the form of teachers who master the material to be taught, are able to plan systematic learning, and convey to students various approaches and learning strategies so that students are interested in study.

The results of measurement model analysis for teacher personality competency variables can be seen in Table 6.

Table 6 shows that the loadings factor shows a number above > 0.60 with a Variance extracted value (0.542). The results of this analysis show that all indicators can explain the construct of teacher personality competence by 54.2% which is reflected in the behavior of teachers who have a broad view of diversity from aspects of culture, ethnicity, and religion, speak and behave non-discriminatory and are proud of their profession as a teacher. Hakim (2015) and Göncz (2017) agreed that professional teachers are teachers who have a broad view of the diversity of the Indonesian nation from the aspects of culture, ethnicity, and religion. They do not discriminate and what is important is a teacher who is proud of his profession.

The results of the measurement model analysis for the Teacher e-Skill variable can be seen in Table 7.

Table 7 shows the loadings factor showing a number above > 0.60 with a Variance extracted value (0.689). The results of this analysis show that all indicators can explain the construct of E-Skill Teachers (teacher proficiency in e-learning) of 68.9%. To support the implementation of the online learning process during the COVID-19 period, teachers who have e-skills in using e-learning applications are proficient in using computer technology, proficient in using various electronic media (Zoom, Facebook, WhatsApp, Google, Line, Instagram), proficient in accessing various learning resources via the internet. From various research results on e-leadership and the effectiveness of online learning, it is revealed that many teachers are stuttering or are literate in computer technology. Roach and Lemasters (2006) in their research explain the ability of e-skills of teachers to correlate with teacher behavior and performance in aspects of online learning during the COVID-19 period. Teachers who can carry out learning effectively are teachers who have good e-skills in the field of information technology and computers.

The results of measurement model analysis for teacher behavior variables during the COVID-19 pandemic can be seen in Table 8.

Table 8 shows the loadings factor showing a number above > 0.60 with a Variance extracted value (0.656). The results of this analysis show that all indicators can explain the construct of the COVID-19 Teacher Behavior by 65.6%. This analysis is meaningful to support the online learning program during the COVID-19 period, a change in teacher behavior is needed to be skilled in using e-learning applications, skilled in accessing various learning resources via the internet, mastering strategies and electronic learning media so that the learning process takes place effectively, can communicate online learning material effectively. The indicators of this variable are in accordance with

Sunarsi et al. (2020) who stated that teachers who have curious behaviors are motivated to master information technology and computers tend to be more effective in implementing online learning during the COVID-19 pandemic.

Finally, the results of the measurement model analysis for teacher performance variables during the COVID-19 pandemic can be seen in Table 9.

Table 9 shows the loadings factor showing a number above > 0.60 with the value of Variance extracted (0.536). This analysis means that the construct of teacher performance can be explained by the indicators as much as 53.6%. Teacher performance variables during the COVID-19 pandemic are reflected by teachers with indicators that the amount of work produced is in accordance with the demands of the school, can carry out tasks and responsibilities online according to the targets set by the school, in completing assignments and work on time, can provide weekly reports on the implementation of online learning according to the specified time, able to cooperate with peers effectively (Hyslop-Margison and Sears, 2010; Elliott, 2015).

The standardized regression values in Tables 4–9 and the diagram above show the loading factor of each indicator against the construct where all the values are > 0.60, which means that these indicators are valid as indicators for measuring constructs. While the extracted Variance value of each construct is above > 0.50, meaning that the indicators can explain the variables above 50% have met the requirements for a construct.

To see covariances, the relationship between independent variables can be seen in Table 10.

Table 10 shows the value (p) of the variable e-Leadership of learning = 0.120 > 0.05 indicating that at a significant level of 5% there is no significant relationship between e-Leadership and teacher personality competence; value (p) of scientific competence variable (pedagogical knowledge and content knowledge) = 0.125 > 0.05 indicates that there is no significant relationship between scientific competence (pedagogical knowledge and content knowledge) and teacher e-skill competence; value (p) of the variable e-Leadership = *** < 0.05 indicates that there is a significant relationship between e-leadership and the variable of scientific competence (pedagogical knowledge and content knowledge); value (p) of the e-Leadership variable = 0.005 < 0.05 indicates that there is a significant relationship between e-leadership and teacher e-Skills; the value (p) of the teacher's personality competence variable = 0.826 > 0.05 indicates that there is no relationship between personality competence and teacher's e-Skills; the p-value of the scientific competence variable (pedagogical knowledge and content knowledge) = *** < 0.05 illustrates that there is a significant relationship between scientific competence (pedagogical knowledge and content knowledge) and the teacher's personality competence.

To see how closely the correlated variables are, it can be seen in Table 11.

TABLE 10   Covariances: (Group number 1—Default model).

			Estimate	S.E.	C.R.	P	Label
e-Leadership	<–>	Personality	0.016	0.010	1.556	0.120	Not correlated
Pedagogic	<–>	e-Skill	0.030	0.019	1.535	0.125	Not correlated
e-Leadership	<–>	Pedagogic	0.064	0.017	3.783	***	Simple
e-Leadership	<–>	e-Skill	0.037	0.013	2.811	0.005	Simple
Personality	<–>	e-Skill	0.003	0.013	0.220	0.826	Not correlated
Pedagogic	<–>	Personality	0.070	0.018	3.959	***	Simple

***P < 0.05, p-value 0.005 and <0.05.

TABLE 11   The strength of the relationship between independent variables (Group number 1—Default model).

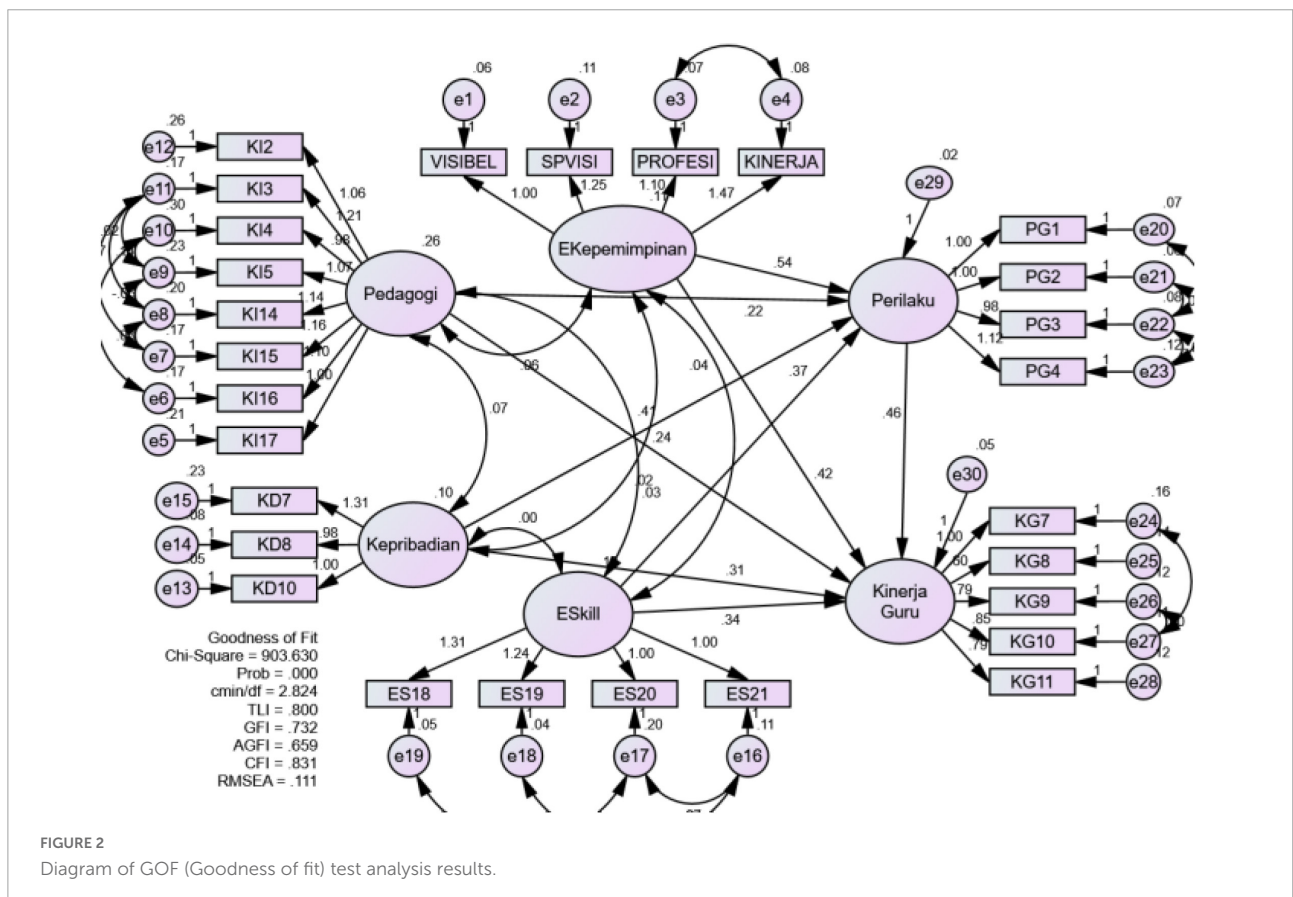|			Estimate	Relationship strength
e-Leadership	<–>	Personality	0.151	Not correlated
Pedagogic	<–>	e-Skill	0.135	Not correlated
e-Leadership	<- >	Pedagogic	0.380	Simple
e-Leadership	<–>	e-Skill	0.261	Low
Personality	<–>	e-Skill	0.021	Not correlated
Pedagogic	<–>	Personality	0.427	Simple

FIGURE 2
Diagram of GOF (Goodness of fit) test analysis results.

Based on the results of the analysis of Table 11, it can be concluded that the correlation between each independent variable is below the correlation number < 0.50, this indicates that there is no close correlation between the independent variables. This means that the four variables can be used as good predictors of the dependent variable. Denscombe (2014)

TABLE 12 Goodness-of-fit model.

Goodness-of-fit (GOF)	Analysis results	Cut off value	Model evaluation
Chi-square	$\chi^2 = 903$ Prob = 0.000	Probability $\geq$ 0.05	Deficient
TLI	0.800	TLI > 0.90	Approaching
GFI	0.732	GFI > 0.90	Deficient
AGFI	0.659	AGFI > 0.90	Deficient
CFI	0.831	CFI > 0.90	Approaching
RMSEA	0.111	RMSEA $\leq$ 0.08	Deficient

states that the variables that meet the requirements as a predictor of the dependent variable are independent variables that are not correlated with each other so that the contribution of each variable can be seen measured and not biased by other variables (Mohajan, 2017).

Next, **Diagram 1** above provides summary information on the GOF (Goodness-of-fit) test results on the model not yet fit with the data. AMOS provides recommendations for connecting some residuals from several indicators so that the model fits into the data. The results of several modifications based on Amos' recommendations can be shown in **Diagram 2** below.

The **Figure 2** above summarizes the goodness-of-fit test findings for the study model, presented in **Table 12**.

Based on the GOF criteria in SEM stated by Santoso (2012), the results of the analysis show that GOF is improving but does not meet the specified standards, thus it is concluded that the model is fit with data at the level of "marginal fit."

Furthermore, based on **Diagram 2** above, a structural model test is performed to determine the strength and effect of the link between variables to test the hypotheses H -1–H -9. The results of the analysis can be seen in **Table 13**.

Based on the results of the analysis as shown in **Table 13**, it can be stated as follows:

1. The effects of e-Leadership on learning by principals on teachers' behavior
   The value of the standardized regression weight coefficient between the variable e-leadership learning principals and

teachers' behavior variables is 0.536 with a probability of 0.000 or $p = ^{***} < 0.05$ so that H-1 is accepted, which means the variable e-leadership learning principals have a positive effect and significant to the teachers' behavior variable. The higher the e-learning leadership values of the principal, the higher the value of behavior, and vice versa;

2. The effects of the competence of pedagogical knowledge and content knowledge of teachers on teacher behavior
   The standardized regression weight coefficient value between the pedagogical competence variable of teachers' knowledge and teachers' behavior variables is 0.222 with a probability of.000 or $p = ^{***} < 0.05$ so that H-1 is accepted with a probability of 0.000 or $p = ^{***} < 0.05$ so that H-2 is accepted, which means that the variable pedagogical competence knowledge has a positive and significant effect on teacher behavior variables. The higher the competency values of the pedagogical knowledge, the higher the value of teachers' behavior, and vice versa;

3. The effects of teachers' personality competence on teacher behavior
   The coefficient value of standardized regression weight between personality competence variables and teachers' behavior variables is 0.414 with a probability of 0.000 or $p = ^{***} < 0.05$ so that H-3 is accepted, which means that the teachers' personality competency variable has a positive and significant effect on teachers' behavior variables. The higher the personality competency score, the higher the behavior value, and vice versa;

4. The effect of teachers' e-Skill on teachers' behavior
   The value of the standardized regression weight coefficient between the teacher's e-Skill variable and the teachers' behavior variable is 0.375 with a probability of 0.000 or $p = ^{***} < 0.05$ so that H-4 is accepted, which means that the teacher e-Skill variable has a positive and significant effect on teachers' behavior variable. The higher the e-Skill value, the higher the behavior value, and vice versa;

5. The effects of teachers' behavior on teachers' performance
   The value of the standardized regression weight coefficient between the Teacher Behavior variable and the teacher

TABLE 13 The effect of the independent variable on the dependent variable.

Regression weights: (Group number 1—Default model)			Estimate	S.E.	C.R.	P	Label
Behavior	<—	e-Leadership	0.536	0.072	7.439	***	
Behavior	<—	Pedagogic	0.222	0.045	4.905	***	
Behavior	<—	Personality	0.414	0.074	5.570	***	
Behavior	<—	e-Skill	0.375	0.052	7.266	***	
Teachers' performance	<—	Behavior	0.464	0.229	2.025	0.043	
Teachers' performance	<—	e-Leadership	0.420	0.156	2.689	0.007	
Teachers' performance	<—	Pedagogy	0.241	0.078	3.101	0.002	
Teachers' performance	<—	Personality	0.306	0.145	2.109	0.035	
Teachers' performance	<—	e-Skill	0.343	0.109	3.160	0.002	

***P < 0.05, p-value 0.005 and <0.05.

TABLE 14   Correlation of the independent variable to the dependent variable.

			Estimate (r)	Quadratic correlation (r^2)	Percentage %	Level
Behavior	<—	e-leadership	0.437	0.191	19.1%	Simple
Behavior	<—	Pedagogic	0.278	0.077	7.7%	Low
Behavior	<—	Personality	0.327	0.107	10.7%	Simple
Behavior	<—	e-Skill	0.395	0.156	15.6%	Simple
Teachers' performance	<—	Behavior	0.339	0.115	11.5%	Simple
Teachers' performance	<—	e-Leadership	0.249	0.062	6.2%	Low
Teachers' performance	<—	Pedagogic	0.220	0.048	4.8%	Low
Teachers' performance	<—	Personality	0.176	0.031	3.1%	Low
Teachers' performance	<—	e-Skill	0.264	0.070	7.0%	Low

performance variable is 464 with a probability of 0.043 or $p = 0.043 < 0.05$ so that H-5 is accepted, which means that the teachers' behavior variable has a positive and significant effect on teachers' performance variables. The higher the value of teachers' behavior, the higher the value of teacher performance, and vice versa;

6. The effects of e-Leadership learning of the school principal on teachers' performance
   The value of the standardized regression weight coefficient between the variable e-leadership learning principals and teachers' performance variables is 0.420 with a probability of 0.007 or $p = 0.007 < 0.05$ so that H-6 is accepted, which means the variable e-leadership learning principals have a positive and significant effect on the variable teacher performance. The higher the e-learning leadership values of the principal, the higher the teacher performance value, and vice versa;

7. The effects of competency pedagogical knowledge on teachers' performance
   The value of the standardized regression weight coefficient between the variable pedagogical knowledge competence and the teachers' performance variable is 0.241 with a probability of 0.002 or $p = 0.002 < 0.05$ so that H-7 is accepted, which means that the variable pedagogical competence knowledge has a positive and significant effect on teacher performance variables. The higher the pedagogical knowledge competency score, the higher the teacher performance score, and vice versa;

8. The effects of personality competence on teachers' performance
   The value of the standardized regression weight coefficient between the personality competence variable and the teacher performance variable is 0.306 with a probability of 0.035 or $p = 0.035 < 0.05$ so that H-8 is accepted, which means that the personality competency variable has a positive and significant effect on teacher performance variables. The higher the personality competency score, the higher the teacher performance score, and vice versa;

9. The effects of teachers' e-Skill on teachers' performance

The value of the standardized regression weight coefficient between the teacher e-Skill variable and the teachers' performance variable is 0.343 with a probability of 0.002 or $p = 0.002$ *** < 0.05 so that H-9 is accepted, which means that the e-Skill variable has a positive and significant effect on teacher performance variables. The higher the e-Skill score, the higher the teacher's performance score, and vice versa.

Thus the structural equations are:

1. Teachers' behavior = 0.536 × e-Leadership + 0.536 × e-Leadership + 0.222 × pedagogical knowledge competence + 0.414 × Personality competence + 0.375 × e-Skill + e
2. Teachers' Performance = 0.464 × Teachers' behavior + 0.464 × Teachers' behavior + 0.420 × e-Leadership + 0.241 × pedagogical knowledge competence + 0.306 × Personality competence + 0.343 × e-Skill + e

The value of $p = $ *** (meaning the number is below 0.001, so this is significant at the level of significance of 0.01 which is certainly better than the real level of 0.05).

Furthermore, to see how closely the correlation between the independent variable and the dependent variable can be seen in Table 14.

From Table 14, it can be concluded that none of the independent variables have a correlation with the dependent variable greater than > 0.50. Principal e-learning leadership, teacher personality competence and teacher e-Skill correlate at a simple stage with teacher behavior during the COVID-19 pandemic. Meanwhile, teacher behavior also correlates at a simple stage with teacher performance. e-Learning leadership, scientific competence (pedagogical knowledge and content knowledge), personality competence, and e-Skill correlated at a low stage with teacher performance during the COVID-19 pandemic. The results of this analysis show a weak correlation between e-learning leadership of a principal, teacher competence and teacher e-Skill with teacher behavior and performance during the COVID-19 pandemic. For this

reason, the government's policy in implementing the online chasing process since March 2020 needs to be followed up with continuous professional development for teachers. The results of the analysis of e-learning leadership for school principals during the COVID-19 pandemic shows that four dimensions of learning leadership contribute to improving teacher performance through changes in teacher behavior in mastery of computer technology to realize effective online learning.

Based on the results of the structural model test in Table 13, to see the magnitude of the direct and indirect effects and the total effect of the independent variable on the dependent variable, path analysis is used, as shown in the diagram below. For ease of understanding, each variable is given a symbol as follows:

e-Learning leadership	X_1
Scientific competence (Pedagogical knowledge and content knowledge)	X_2
Teacher personality competence	X_3
e-Skill teacher	X_4
COVID-19 teacher behavior	X_5
Teacher performance during the COVID-19 period	Y

The magnitude of the influence proportionally for each variable is as follows:

1. The effect of e-Leadership leadership (X_1) on teacher performance (Y) and indirect influence through teacher behavior (X_5)

DIAGRAM 1
The direct and indirect effect of X_1 on Y.
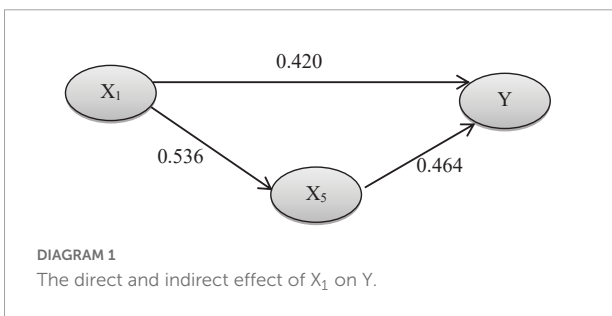
$$\text{Direct effect } X_1 = pYX_1 \times pYX_1$$
$$= (0.420)(0.420)$$
$$= 0.176$$

Effect through the correlation with X_5

$$= pYX_1 \times rx_1x_5 \times pX_5Y$$
$$= (0.420)(0.536)$$
$$= 0.104$$

Total influence on $Y = 0.176 + 0.104 = 0.280$

The direct effect of X_1 on Y is 17.6%, while the effect through correlation with X_5 is 10.4% and the total influence is 28.0%.

2. The effect of pedagogical knowledge and content knowledge (X_2) on teacher performance (Y) and indirect influence through teacher behavior (X_5)

DIAGRAM 2
The direct and indirect effect of X_2 on Y.
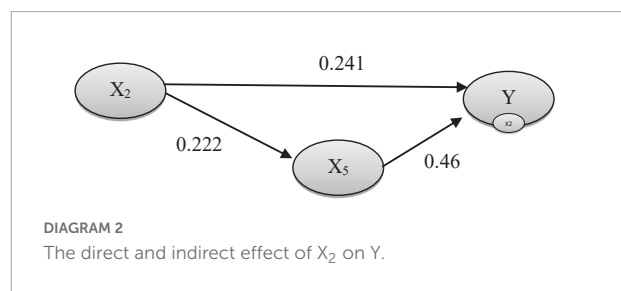
$$\text{Direct effect } X_2 = pYX_2 \times pYX_2$$
$$= (0.241)(0.241)$$
$$= 0.058$$

Effect through the correlation with X_5

$$= pYX_2 \times rx_2x_5 \times pX_5Y$$
$$= (0.241)(0.222)(0.464)$$
$$= 0.025$$

Total influence on $Y = 0.058 + 0.025 = 0.083$

The direct effect of X_2 on Y is 5.8%, while the effect through the correlation relationship with X_5 is 2.5% and the total influence is 8.3%.

3. The effect of teacher's personality competence (X_3) on teacher performance (Y) and indirect influence through teacher behavior (X_5)


DIAGRAM 3
The direct and indirect effect of X_3 on Y.
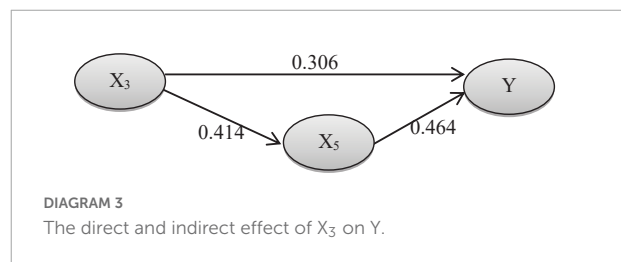
$$\text{Direct effect } X_3 = pYX_3 \times pYX_3$$
$$= (0.306)(0.306)$$
$$= 0.094$$

Effect through the correlation with X_5

$$= pYX_3 x r x_3 x_5 x p X_5 Y$$
$$= (0.306)(0.414)(0.464)$$
$$= 0.059$$
$$\text{Total influence on } Y = 0.094 + 0.059$$
$$= 0.152$$

The direct effect of X_3 on Y is 9.4%, while the effect through the correlation relationship with X_5 is 5.9% and the total influence is 15.2%.

4. The effect of teacher e-Skills (X_4) on teacher performance (Y) and indirect influence through teacher behavior (X_5)

DIAGRAM 4
The direct and indirect effect of X_4 on Y.
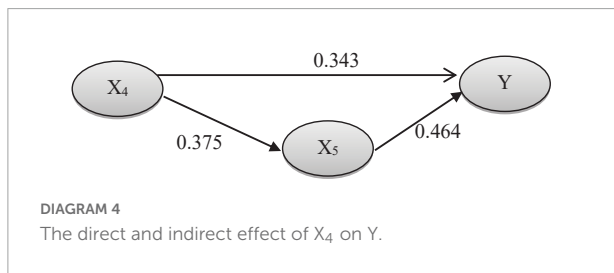
$$\text{Direct effect } X_4 = pYX4 \times pYX4$$
$$= (0.343)(0.343)$$
$$= 0.118$$

Effect through the correlation with X_5

$$= pYX3 \times rx3 \times 5 \times pX5Y$$
$$= (0.343)(0.375)(0.464)$$
$$= 0.060$$
$$\text{Total influence on } Y = 0.118 + 0.060$$
$$= 0.177$$

The direct effect of X4 on Y is 11.8%, while the effect through the correlation relationship with X5 is 6.0% and the total influence is 17.7%.

The results of the analysis of the magnitude of the direct effect and the indirect effect and the total effect of the independent variable on the dependent variable show that there is a positive and significant effect of each independent variable with the dependent variable,

then also affect proportionally to the variable of teacher performance during the COVID-19 pandemic through the variable teacher behavior. Many research results suggest that leadership factors are the main factors that can create effective schools, as stated by Demond (2009) and Bhujel (2021) that the main characteristic of effective schools is strong and professional principal leadership that focuses on implementing the learning process optimally and understanding that teacher professional development through changes in behavior can improve teacher performance in creating student learning achievement.

The spread of the COVID-19 outbreaks at the end of 2019 prompted the government to issue a policy to implement online learning in early 2020, consequently, encouraging school principals to implement electronic leadership or e-leadership to control the learning process online. The research findings show that e-leadership contributes to improving teacher performance through changes in teacher behavior by 28%, scientific competency variables (pedagogical knowledge and content knowledge) and teacher personality each contribute to improved performance through changes in teacher behavior by 8.3 and 15.2%. Meanwhile, the e-skill competency variable of teachers contributed to increased performance through changes in teacher behavior by 17.7%. From the distribution of data on the contribution of each of these variables, it can be concluded that the e-leadership factor remains a major factor in efforts to improve performance through changes in teacher behavior in the implementation of online learning in senior high schools in Padang during the COVID-19 pandemic. The demand for e-leadership in the learning aspect is increasingly expected to be able to motivate teachers to be able to change the habitual patterns of conventional teaching into online-based teaching methods using applications; WhatsApp Group, Google Classroom, Edmodo, Quizzi, Zoom Cloud, Jitsi, and others. The learning leadership model was chosen to be used as e-leadership for school principals because according to Robinson et al. (2009) based on a meta-analysis of 13 studies on principal leadership and the results showed that the effect size of learning leadership was the highest compared to other leadership models. In fact, the effect size of the highest school principal's learning leadership is three times greater than the effect size of the principal's transformational leadership.

The findings of this study indicate that e-leadership is able to provide changes in teacher behavior and performance from conventional teaching methods to being able to carry out online-based learning, these findings are consistent with Albidewi (2014) view in a study entitled E-leadership system: A futuristic vision, that e-leadership is a strategic factor that can change the behavior of members in the organizational structure, both the leader and the subordinate of the leader himself. The findings of this study are also in accordance with the adaptive structuration theory by Avolio and Kahai

(2003) which explains the role of leadership and information management through electronic message systems enabling the participation of many parties in organizational activities. This theory confirms that e-leadership has a significant effect on the behavior and performance of subordinates in the organizational system. Even though the contribution has not been maximized, it still makes e-leadership the main factor that provides concentration compared to other variables on the behavior and performance of teachers in public high schools in Padang city. As stated by Sebastian et al. (2014) stated that effective schooling can only be done through strong and professional leadership.

Next, the variable that gave the largest contribution after e-leadership was the ability of teachers' e-skills in the aspects of information technology and computers, which had an effect of 17.7%. E-skills of teachers in using e-learning applications, proficient in using computer technology, proficient in using various electronic media (Zoom, Facebook, WhatsApp, Google, Line, and Instagram), proficient in accessing various learning resources via the internet are important factors in becoming professional teachers in the online learning process. This finding is in accordance with the research results Hüsing et al. (2013) and Ritonga et al. (2022b) who state that teachers who are effective in implementing online learning are those who have e-skills in the field of information technology and computers.

The other research findings on the scientific competence (pedagogical and pedagogical content knowledge) and personality contribute to improving teacher performance through behavior change during the COVID-19 pandemic are also in accordance with the views of Ibrahim (2012) which suggests that teachers who have extensive knowledge about the content and content of learning materials, have personalities that can be role models for other teachers and have skills in designing learning programs and choosing the right strategies in managing the learning process. They are factors that can manipulate teachers' behavior to improve teachers' performance in implementing online learning during the COVID-19 period in Padang.

Conclusion

The use of four dimensions of e-learning leadership for principals; the learning vision and sustainable teacher professional development, is at a very high stage while the dimensions of classroom supervision and teacher performance appraisal are at a high stage. While the implementation of scientific competence (pedagogical and pedagogical content knowledge), teacher personality and e-skills are at a very high stage. Meanwhile, the aspects of teacher behavior and teacher performance are also at a very high stage. Then, the e-Leadership learning of the principal, teacher

personality competence and teacher e-Skill correlated at a simple stage with teacher behavior during the COVID-19 pandemic. Teacher behavior also correlates at a simple stage with teacher performance. e-Learning leadership, scientific competence (pedagogical and content knowledge), personality competence, and e-Skill correlated at a low stage with teacher performance.

The result of measurement model test with CFA shows that the indicators of each dimension of e-leadership illustrate the relationship between latent variables and their indicators that meet the requirements to measure the e-leadership variable. Likewise, the indicators of scientific competency variables (pedagogical knowledge and pedagogical content knowledge), personality competencies and teacher e-skills, teacher behavior and performance during the COVID-19 pandemic also fulfill the requirements to describe the relationship between latent variables and their indicators. Each variable has been tested and can describe a variable.

The results of the structural model test that describe the relationship and influence of the independent variable on the dependent variable indicate that the principal's e-leadership variable, scientific competence (pedagogical knowledge and pedagogical content knowledge), personality competence and e-skill have a positive and significant effect on teacher behavior. Research findings also show that e-leadership contributes to improving teacher performance through changes in teacher behavior. Meanwhile, the competency variable of e-skills for teachers with a focus on mastery of skills in using information technology and computers contributes to increased performance through changes in teacher behavior.

The practical implication of this research is that principals need to change their roles and leadership styles from conventional to electronic-based learning leadership styles to realize effective online learning. The four dimensions of learning leadership models Hallinger and Murphy (1985) and Blase and Blase (2000) which consist of the dimensions (1) learning vision, (2) learning supervision, (3) continuous teacher professional development, and (4) teacher performance assessment must become a focus for principals in implementing an electronic-based learning leadership style. The development of teacher e-skill competencies in using information technology and computers to support effective online learning needs to be a school priority program.

Data availability statement

The original contributions presented in this study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

Author contributions

RI: conceptualization (ideas; formulation and evolution of overarching research goals and aims), methodology (development and design of methodology; creation of models), software (programming, software development; designing computer programs; implementation of the computer code, etc.), formal analysis (application of statistical, mathematical, computational, and other formal techniques to analyze and synthesize study data), investigation (conducting a research and investigation process, specifically performing the experiments, and data and evidence collection), resources (provision of study materials, reagents, materials, participants, samples, instrumentation, computing resources, and other analysis tools), and funding acquisition (acquisition of the financial support for the project leading to this publication). MR: writing—original draft preparation (creation and/or presentation of the published work), specifically writing the initial draft (including substantive translation), project administration (management and coordination responsibility for the research activity planning and execution), and funding acquisition (acquisition of the financial support for the project leading to this publication). MK: writing—review and editing (preparation, creation, and presentation of the published work by those from the original research group, specifically critical review, commentary, and revision—including pre-or post-publication stages), supervision (oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team), and funding acquisition (acquisition of the financial support for the project leading to this publication). All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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