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The instructional leadership and 21st-century competencies of Indonesian school principals

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Abstract

Poor teaching quality indicates an unpleasant learning environment, tends to inherit knowledge that impacts the learning process as limited to tacit knowledge, and does not reach the explicit knowledge process, resulting in lower productivity and poor morale. This study aims to analyze the influence of instructional leadership on the competencies of school leaders in the 21st century. The descriptive method was used, with a cross-sectional survey design and a quantitative approach. The participants were 384 school principals, with a sample of 196 from different levels of public elementary, junior high, senior high, and vocational high schools in Riau province. The study results showed a P-value of 0.000, a t-value of 21.188, and a p-value of 0.05. These results indicate that instructional leadership significantly contributes to 21st-century competencies. Based on the average variable of school leadership, the visionary indicator has a high contribution. Meanwhile, the indicators with the highest contributions to 21st-century competencies are critical thinking and problem-solving. In conclusion, policymakers, especially the government, should conduct instructional leadership training for school principals focusing on the functions of visionaries, virtual managers, innovators, mentors, conveners, and virtual teams.

Keywords: 21st-century competence, Instructional leadership, School principals.

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Contents

Contribution of this paper to the literature

This research offers valuable insights into 21st-century skills within instructional leadership, specifically analyzing how Indonesian principals' leadership styles influence these competencies. It highlights the importance of fostering critical thinking and problem-solving abilities among educators. The findings recommend that principals adopt roles such as visionaries, virtual managers, innovators, mentors, coordinators, and virtual team leaders to enhance their effectiveness in developing these essential skills.

1. Introduction

The Government Regulation Number 19 of 2005 concerning National Education states that the learning process in educational institutions is organized in an interactive, inspiring, fun, and challenging manner to encourage students to participate actively and provide sufficient space for creativity, independence, and initiative (Indonesia, 2005). Furthermore, according to the Ministry of Education, there is a shift in the educational process towards 21st-century competencies that enable access to information anywhere and at any time. The implementation of digital technology has become widespread across workplaces and has shifted educational development towards information and communication technology (ICT) as a key strategy for education management in the 21st century (Muslihin, Suryana, Suherman, & Dahlan, 2022; Raman, Thannimalai, & Ismail, 2019). Therefore, the new paradigm occurs and emphasizes the position of the school principal to be more active (Jenkins, 2009; Jenkinson & Benson, 2016).

The school principal is a critical figure in a school management system who should be able to think critically, solve problems, demonstrate creativity and innovation, interact collaboratively with strong leadership (Ritchie, Wabano, & Young, 2010), understand the academic culture, communicate effectively, mediate fluently, and demonstrate proficient ICT skills and independence (Bush, 2015; Hallinger, 2003). According to previous studies, competency development is a variable that mediates the decisions of school principals in concrete terms as a motivating force, given the demands of 21st-century education (Ismail, 2017; Shearer & Park, 2018). In practice, research from the Education Office of Lampung Province regarding the competency test results conducted on school principals shows that the longer the tenure as a school principal, the lower the average score obtained (Dinas Pendidikan Riau, 2021). For individuals with 1-4 years of service, the average principal's score is 46.41. For those with more than 9-12 years of service, the average score is only 45.47. For principals with over 12 years of experience, this score drops significantly to 42.78. This phenomenon contradicts the core principles of educational quality, as success indicators are determined by the competence and performance of school principals (Natuna, 2018; Zepeda, 2014).

Indonesia is a matter of concern. Based on data from UNESCO (UNESCO, 1996), the ranking of the Human Development Index indicates that the quality of education has decreased. Out of 189 countries worldwide, Indonesia ranks 107th (Alahmad, Stamenkovska, & Gyori, 2021; Mensah, 2019). According to a survey by Political and Economic Risk Consultant (PERC), Indonesia's education quality is ranked fifth out of ten countries in Southeast Asia, behind Singapore, Brunei Darussalam, Malaysia, and Thailand (Neumerski, 2013).

Moreover, quality in education includes educational inputs, processes, and outputs (Bajracharya, 2019). In practice, school input supports a quality learning process, which not only teaches knowledge, skills, and attitudes (Rokhman, Hum, & Syaifudin, 2014; Suwanda et al., 2023) but also develops and fosters a sense of love, mutual understanding, and friendship (Asgari, Dasgupta, & Stout, 2012). Nevertheless, in reality, the school climate is not easy to achieve. The indications with a negative "connotation" in school have become increasingly vicious. Various conflicts, ranging from the simplest form, such as verbal behavior (Suherman et al., 2019). Persecution and even murder have been committed by several students at school (Bardeen & Read, 2010).

No issue is more fundamental at the level of modern education than the problems of learning, creating a pleasant school environment as an effort to improve the quality of education, and normative efforts for the development of students. At the World Education Forum in Dakar in 2000, it was agreed that education should be able to respond to the challenges of the 21st century, such as (1) providing equal access to learning and other life skills programs for all youth and adults; (2) improving the quality of education and learning outcomes, especially in literacy, numeracy, and essential life skills; (3) enhancing mutual understanding, peace, and tolerance to prevent violence and conflict, and changing people's mindsets to reduce conflict or violent behavior (Ab Kadir, 2017; Natuna & Rinaldi, 2017).

Recognizing the importance of quality education, researchers and academics have conducted studies over the past five years on the significance, nature, and diversity of efforts to develop quality education (Baharun, 2017). This research has generally focused on school-based change, addressing a range of objectives: strengthening academic supervision, developing teaching staff capacity, curriculum development in schools, and e-leadership (Lunenburg & Irby, 2011). There is no research with comprehensive findings on how principals' instructional leadership is developed in the 21st century, so the significance of this research lies in analyzing the influence of principals' instructional leadership in terms of content, process, and evaluation. Research in the last five years has primarily focused on educational quality outputs. Additionally, most studies are descriptive, which means that the number of studies focusing on configurational analysis of leadership influence is limited. Therefore, this research aims to explore how educational leadership influences principals' competencies in the 21st century.

2. Literature Review

Competence is a choice, desire, will, and intention that can be encouraged, controlled, and developed through culture, and competence is a behavior that should be maintained and transmitted within the culture of a society (Aitken, Pelletier, & Baxter, 2016). The importance of competence development has been acknowledged by Deci and Ryan, Hull, Lewin, Loevinger, Maslow, Rogers, Ryan & Deci, Shapiro, Tolman, and White. Generally, the competence of developing individuals to be proactive with potential and capable of controlling thoughts, feelings, and actions is emphasized. Individuals tend to develop in an integrated manner, and they are encouraged to be autonomous based on their social environment. The successful development of student competencies will lead to a constructive direction. The results of the study of Deci and Ryan (2000) and Suwanda et al. (2023) principals who have competence, will show behavior such as: perseverance and persistence in achieving goals, enjoying work more,

higher self-satisfaction, committed to their actions, and harmonious relationships with others and show higher conceptual knowledge.

Over the past three years (2015, 2016, and 2017), competency development has been conducted in educational settings and communities. Some research results in educational settings were conducted by Deci and Ryan (2000). The findings of these studies are still under-researched, particularly among individuals aged 25-50 years. The research highlights behavioral tendencies related to intrinsic motivation, which drives individuals to engage in activities they find genuinely interesting, motivated solely by personal enjoyment and satisfaction. A third finding emphasizes the tendency of internalized behavior in following rules and social conventions, which should be adapted or integrated into personal functions. The fourth finding indicates that individuals develop competencies involving cognitive dimensions, including factual, conceptual, procedural, and metacognitive knowledge. These cognitive aspects influence processes such as memory, understanding, application, analysis, evaluation, and creation.

Thus, the direction of competency development research is carried out in educational settings. The most significant strategy for developing 21st-century competencies for school principals is through the role of personal models and experiences. In developing competencies, the results of the literature review and the latest research on competency development, namely the ESEM Model (Exploratory Structural Equation Modeling), the Model of Participation and Performance Processes (Fernandez-Rio, 2015), are noteworthy. The most recent research indicates that efforts to develop competencies are primarily focused on leadership models and performance models. The former is rooted in a holistic model of knowledge creation, including tacit knowledge, which can be considered and reconstructed into an integral part of the underlying philosophy of competency development.

Considerations for analyzing the influence of 21st-century competencies from the principal's leadership, specifically the first competency development, are based on organismic integration theory. This theory suggests that achieving intrinsic motivation involves a regulatory style aligned along an internalization continuum. The more individuals are able to internalize their extrinsic motives, the greater their autonomy and connectedness (Muslihin et al., 2022).

Second, competency development is studied based on causality orientations theory, which describes the tendency to behave and act within the environment. Individuals with an autonomy orientation are more interested in and appreciate activities; those with a control orientation are more focused on the rewards and benefits associated with their activities; and individuals with an impersonal orientation are more concerned with competence in performing their activities. Competency development is also examined through cognitive evaluation theory, which explores how the environment or social context influences intrinsic motivation such as rewards, interpersonal control, and ego and how these factors can foster aspects of autonomy and competence (Ryan & Deci, 2000a, 2000b).

3. Materials and Methods

3.1. Research Design

This study examined the problems encountered during the research process. The data were obtained through a survey. Additionally, the data describe the characteristics of the studied problem. The method used in this study was descriptive, and the research design was a cross-sectional survey (Levin, 2006), with a quantitative approach. The demographic data of the participants are presented in Table 1.

3.2. Participants

The participants were school principals in Pekanbaru City and Dumai City, totaling 387 individuals. Non-probability sampling was used, specifically convenience sampling. Consequently, 196 respondents willing to participate in the research process and representing specific characteristics to be studied were selected. Table 1 describes the number of study participants in detail as follows.

Table 1. Participants by gender, age, and field of teaching.

No	Demographic information	Categories	N	%
1	Region	Pekanbaru City	98	50
		Dumai City	98	50
2	Gender	Male	89	45.5
		Female	107	54.5
3	Age	31 - 40 years old	53	27
		41 – 50 years old	89	45.4
		51 – 60 years old	54	27.6
4	Tenure	1 – 10 years	39	19.8
		11 – 20 years	72	36.7
		> 21 years	85	43.5
5	School principals' expertise	Science and mathematics	38	19.4
		Language	35	17.9
		Social science/Humanities	79	40.3
		Vocational	44	22.4

Based on the multicultural perspective of the City of Dumai, in 2020, the population of Dumai city consisted of various ethnic groups such as Malays (majority), Batak, Minang, Javanese, Chinese, and Bugis. The quality of education in Dumai has improved with highly developed educational facilities and the implementation of a high-quality national standards system. Pekanbaru City's proportion of Javanese, Batak, and Chinese populations is relatively high. The ethnic diversity in Pekanbaru City has enabled effective cooperation in education. This finding is supported by the quality of education in Pekanbaru City, which prioritizes the concept of the nation within the context of national character education as its flagship program. Therefore, selecting participants is very sustainable and unique and should be followed up or developed regarding the quality of education that school principals deliver for 21st-century competencies.

3.3. Instrument Instructional Leadership

The leadership learning instrument is based on Eberts and Stone (1988) , which has six indicators: (1) Visionary; (2) Conveners; (3) Virtual Team/Sponsored Team; (4) Managers; (5) Innovators; and (6) Mentors. From the identified indicators, 25 items were developed, including 17 preferred items and six disliked items, using a Likert scale with five points, ranging from 0 (Does not describe me) to 5 (Describes me very well).

3.4. Instrument 21st Century Competency

Meanwhile, the 21st-century competency variables of the principal are based on the following indicators: (1) Critical Thinking & Problem Solving; (2) Creativity and Innovation; (3) Collaboration, Teamwork, and Leadership; (4) Cross-Cultural Understanding; (5) Communication and Media Fluency; (6) Computing and ICT Fluency; and (7) Career and Independence. The instrument validity test process involves stages such as item readability testing, judgment by three experts, and data analysis using the Rasch model.

3.5. Validity and Reliability Test

The validity results of the Instructional Leadership instrument, using the Rasch model, indicated that the unidimensionality test showed the raw variance explained by the measure was 32.1%, which is within the acceptable range. The 21st-century competency instrument demonstrated that the raw variance explained by the measure was 34.4%, also within the acceptable range. The reliability test of the Instructional Leadership instrument yielded a person reliability value of 0.68 and an item reliability value of 0.87. For the 21st-century competency instrument for the principal, the person reliability value was 0.71, and the item reliability value was 0.91.

3.6. Data Analysis Procedure

The data analysis technique in this study included reviewing the data, grouping the items based on indicators, and creating tables for the raw scores. The data were analyzed using descriptive statistics, focusing on the mean and standard deviation values. Additionally, the data were analyzed using statistical inference to understand the relationships between variables, the magnitude of influence, the contribution of the variables, and the contribution of each indicator to the research variables. However, SPSS (Statistical Product and Service Solutions) version 22.0 was used for data analysis, so the reliability and overall statistics are based on the cross-tabulation in the statistical program. The research data analysis on the competency of 21st-century school principals in Pekanbaru and Dumai included descriptive statistical analysis using the mean and standard deviation, as well as inferential statistical analysis by conducting correlation and contribution tests based on the Summary Model Regression.

4. Result

The analysis of the respondent's profile is based on the mean value of the respondent's demographics concerning research indicators and variables. Respondent demographics include gender and years of service.

Table 2. The mean value of 21st century instructional leadership and competency variables based on the demographics of the respondents.

Instructional leadership variables			
Demography	**Indicator**	**N**	**Mean**
Gender	Male	89	3.84
	Female	107	3.71
Average		196	3.78
Tenure	1 – 10 years	39	3.73
	11 – 20 years	72	3.70
	> 21 years	85	3.84
Average		196	3.76
21st century competency variables			
Gender	Male	89	3.82
	Female	107	3.72
Average		196	3.77
Tenure	1 – 10 years	39	3.78
	11 – 20 years	72	3.68
	> 21 years	85	3.82
Average		196	3.76

Table 2 presents, this study found that instructional leadership was higher for males with a working period of 21 years and over. These findings conclude that, in terms of fulfilling obligations as a school leader, instructional leadership is categorized as high, with a mean value of 3.77. The results for 21st-century competencies are also higher among males with 21 or more years of service. The competence of 21st-century principals was found to be in the high category, with a mean value of 3.76.

4.1. The Analysis of School Principals' Leadership and the 21st-Century Competencies

The descriptive statistical analysis included the calculation of the mean value for the instructional leadership variable based on its indicators: (1) Visionaries; (2) Conveners; (3) Virtual Teams/Sponsored Teams; (4) Managers; (5) Innovators; and (6) Mentors. Additionally, the school principals' 21st-century competency variable was assessed based on the indicators outlined in Table 3.

Table 3. The mean score of the school principals' 21st-century competencies.

No	Instructional leadership variable		21st century competency variable	
	Indicators	Mean	Indicators	Mean
1	Visionary	3.88	Critical thinking & problem solving	3.84
2	Convener	3.74	Creativity and innovation	3.74
3	Virtual team/Team sponsor	3.76	Collaboration, teamwork and leadership	3.74
4	Manager	3.79	Cross cultural understanding	3.77
5	Innovator	3.72	Communication and media fluency	3.81
6	Mentor	3.75	Computation and ICT fluency	3.63
7	Visionary	3.88	Career and self-reliance	3.78
8	Convener	3.74		
9	Virtual team/Team sponsor	3.76		

This finding indicates that the mean value of 3.76 was obtained based on the instructional leadership indicator. It suggests that the leadership of the school principal is already high but still requires improvement, particularly in indicators categorized as the lowest compared to others, such as Innovator.

4.2. The Analysis of School Principals' Leadership and 21st-Century Competencies Normality Test

The normality test was conducted to determine whether the data distribution of each variable was normal. This test was carried out using the Kolmogorov-Smirnov normality test, knowing that the data is normally distributed if the significance value (sig) > 0.05. If a significance value (sig) is <0.05, then the data is not normally distributed. In detail, it can be seen in Table 4.

Table 4. The normality test results of school principals' leadership and 21st-century competencies based on Kolmogorov-Smirnov.

Y			X
N		196	196
Normal parameters	Mean	3.7622	3.7697
	Std. deviation	0.2083	0.25461
Most extreme differences	Absolute	0.046	0.06
	Positive	0.042	0.06
	Negative	-0.046	-0.058
Test statistic		0.046	0.06
Asymp. sig. (2-tailed)		0.200	0.081

Based on Table 4, it is explained that the Kolmogorov-Smirnov normality test for significance values is as follows: first, on the instructional leadership variable (X) with a sig value of 0.060 (0.081> 0.05), which means that the data is normally distributed; and secondly, on the school principals' 21st Century Competency variable (Y) with a value of 0.200 (0.200> 0.05). This result means that the data is normally distributed.

4.3. The Linearity Analysis of School Principals' Leadership and the 21st-Century Competence

The linearity test aimed to determine whether the variable data has a significant linear relationship. This test was used as a prerequisite for parametric statistics, especially in correlation or linear regression analysis, included in the associative hypothesis. Linearity testing was conducted using the SPSS program version 25.0. Specifically, the linearity test yielded a significant value (sig) for the deviation from instructional leadership (X) with school principals' 21st-century competencies (Y), as shown in Table 5.

Table 5. The linearity test results of the school principals' 21st-century competencies.

Sum of squares				df	Mean square	F	Sig.
The school principals' 21st-century competencies in instructional leadership	Between groups	(Combined)	6.457	44	0.147	11.057	0
		Linearity	5.908	1	5.908	445.13	0
		Deviation from linearity	0.549	43	0.013	0.962	0.545
	Within groups		2.004	151	0.013	0	0
	Total		8.461	195	0	0	0

Table 5 explains the significance of the linearity test of 0.545, which is greater than 0.05. Thus, it can be concluded that there is a significant linear relationship between instructional leadership variables (X) and the school principals' 21st-century competencies (Y). The distribution of the data indicates a normality level, demonstrating that the instructional leadership data on the school principals' 21st-century competencies are distributed linearly.

4.4. The Hypothesis Testing of the School Principals' Leadership on 21st-Century Competencies

The analysis results indicate that each research variable's score meets the requirements for subsequent statistical analysis and hypothesis testing. The following are the research hypotheses: Hypothesis 1, the hypothesis to be tested is H0: $\rho x1.y \leq 0$, H1: $\rho x1.y > 0$. Here, hypothesis 0 (H0) testing states that there is no positive influence of instructional leadership (X) on school principals' 21st-century competencies (Y), which opposes the H1 hypothesis, suggesting a positive influence. The hypothesis testing was conducted using regression analysis, Pearson correlation, regression equation, contribution tests with significance testing (to determine if there is a contribution), and an assessment of the contribution amount through a summary model. In detail, Table 6 shows the Pearson correlation test of instructional leadership on school principals' 21st-century competencies.

Table 6. The Pearson correlation test of instructional leadership on school principals' 21st-century competencies.

Correlations			
Y			**X**
Y	Pearson correlation	1	0.836**
	Sig. (2-tailed)		0
	N	196	196
X	Pearson correlation	0.836**	1
	Sig. (2-tailed)	0	
	N	196	196

Note: **. Correlation is significant at the 0.01 level (2-tailed).

Based on the Pearson correlation test between instructional leadership (X) and school principals' 21st-century competencies (Y), which is calculated using the correlation coefficient, a Pearson correlation of 0.836 was obtained. This result indicates a significant relationship between instructional leadership (X) and school principals' 21st-century competencies (Y). Therefore, it can be concluded that there is a significant relationship between the two variables. Furthermore, the analysis describes the significant and linear relationship between the variables, which can be identified through the variable coefficients, as shown in Table 7.

Table 7. The coefficient of instructional leadership on school principals' 21st-century competencies.

Coefficients						
Standardized coefficients						
Beta						
Unstandardized coefficients						
Model B			**Std. error**		**t**	**Sig.**
1	(Constant)	1.185	0.122	0.722	9.722	0
	X	0.684	0.032	0.836	21.188	0

Note: Dependent variable: Y.

Based on Table 7 regarding the variable coefficients of instructional leadership (X) with the school principals' 21st-century competencies (Y), the values obtained are a = 1.185 and b = 0.684; thus, the regression equation becomes Y = 1.185 + 0.684X, and it can be interpreted that the relationship of these variables is significant and linear. The constant (a) of 1.185 indicates that, in the absence of instructional leadership (X), the school principals' 21st-century competencies (Y) are 1.185. The regression coefficient (b) is 0.684, meaning that each 1-unit increase in the instructional leadership variable (X) results in a 0.684-unit increase in 21st-century principal competence (Y).

A probability value is obtained from the table of the coefficients of instructional leadership (X) on the school principals' 21st-century competencies (Y) to determine whether the hypothesis is accepted or rejected. If the probability value is greater (sig. > 0.05), then H0 is accepted, and H1 is rejected. It means that it is not significant. Meanwhile, if the sig. the probability value is 0.000, then sig. value 0.000 < 0.05, therefore H0 is rejected and H1 is accepted. In other words, instructional leadership (X) contributes significantly to the school principals' 21st-century competencies (Y). Based on the coefficient table of instructional leadership (X) on the school principals' 21st-century competencies (Y), it can be interpreted that the hypothesis stating that there is a positive contribution of instructional leadership (X) to the school principals' 21st-century competencies (Y) is accepted. The hypothesis testing is positively and significantly supported. Therefore, it is also necessary to determine the magnitude of the contribution of the instructional leadership variable (X) to the school principals' 21st-century competencies (Y). This result is concluded in Table 8.

Table 8. The contribution of instructional leadership to the school principals' 21st-century competencies.

Principals'21st-century competencies	R square	Contribution
Instructional leader	0.698	69.80
Critical thinking & problem solving	0.46	10.85
Creativity and innovation	0.59	16.65
Collaboration, teamwork and leadership	0.50	13.55
Cross-cultural understanding	0.40	6.55
Communication and media fluency	0.41	8.50
Computation and ICT fluency	0.40	6.95
Career and self-reliance	0.41	6.75

Based on Table 8, it is shown that R square (r2) = 0.698 or 69.80%, indicating that the contribution of instructional leadership variables to school principals' 21st-century competencies is 69.80%. The remaining 30.20% is determined by other factors not included in this research. Therefore, it can be concluded that the contribution of instructional leadership to school principals' 21st-century competencies is significant and falls within a high category. This result suggests that the effect of the instructional leadership variable (X) on the school principals' 21st-century competencies (Y) is substantial. In other words, higher instructional leadership among school principals will lead to enhanced 21st-century competencies. Furthermore, the contribution of instructional leadership to each of the school principals' 21st-century competency indicators such as critical thinking and problem-solving (46.25%), creativity and innovation (59.09%), collaboration, teamwork, and leadership (50.05%), cross-cultural understanding (40.10%), communication and media fluency (41%), computation and ICT fluency (40.85%), and career and self-reliance (40.75%) varies accordingly.

5. Discussion

Based on the demographics of the respondents, specifically gender and years of service, it was found that the mean score of instructional leadership was higher for men with over 21 years of service. These results suggest that

instructional leadership, with a mean score of 3.77, is in the high category when performing their duties as principals. Based on previous research, Campbell and Mayer (2009), a leader can perform leadership and management functions optimally when they understand and apply the concept and system of instructional leadership. Applying the concept and system of instructional leadership by managers of organizations and companies will also positively impact the effectiveness of leadership and the competitiveness of companies or organizations (Blase & Blase, 1999; Blase & Blase, 2003). In addition, other researchers, Edmonds, Branch, and Mukherjee (1994) and Raman et al. (2019) have found that the existence of technology in the era of globalization can support leaders in carrying out e-leadership to improve public services, which leads to good governance (Sweller, 2021).

The school principals' 21st-century competencies are high, with a mean score of 3.76 in fulfilling their duties as school principals. This finding is consistent with previous studies on partnerships for the 21st century (Öztemel & Yıldız-Akyol, 2021) which confirm that 21st-century competencies are formed from a solid understanding of content knowledge, which is then supported by various skills (Yang & Farn, 2009) expertise, and literacy that an individual needs to support his or her personal and professional success (Genesee & Riches, 2006). It is assumed that individuals today live in an environment full of technology, where information is abundant, technological advances are very rapid, and new communication and collaboration patterns are emerging (Weber, Riar, & Morschheuser, 2023). (Success in the digital world depends on essential skills, including critical thinking, problem-solving, communication, and collaboration skills, Ronfeldt, Farmer, McQueen, & Grissom, 2015)

The research findings show a significant relationship between instructional leadership and principals' 21st-century competencies, as indicated by the p-value/Sig, 0.000 (0.000 < 0.05), which indicates a significant relationship between the two variables. This result is supported by previous research (Campbell, Chaseling, Boyd, & Shipway, 2019) that the instructional leadership system fully supports school principals in managing organizations, delegating responsibilities, and promoting instructional leadership among teachers, and consequently, enhances the pedagogical effectiveness of their schools (Shing, Saat, & Loke, 2018). Instructional leadership through school management system changes can transform the entire school culture. This includes data-driven decision-making, monitoring curriculum implementation and learning performance, interacting with teachers, students, and parents, improving the school climate, and increasing student and parent involvement (Putra, Mahdum, Natuna, Syaflita, & Suryana, 2023; Putra et al., 2024). The results are discussed as innovation and a comprehensive innovation model for technology adoption. To improve instructional leadership, we recommend that school principals expand the implementation of school management systems to include students and parents, delegate instructional leadership roles, and monitor teacher activity levels within the system (Hoy & Hoy, 2006).

In addition, the research findings are also supported by previous studies Raman et al. (2019), which state that successful instructional leadership involves the right balance between traditional and new methods, avoiding misunderstandings by carefully communicating intentions to followers, using technology to reach others in engaging ways, and employing technology to address greater diversity in the workforce. To this end, leaders can use tools such as email to communicate a compelling vision, pride in follower accomplishments, or excitement about new ventures. Successful instructional leadership involves balancing traditional and new methods, avoiding misunderstandings by carefully communicating intentions to followers, using technology to reach others engagingly, and utilizing technology to manage greater diversity in the workforce (Edmonds et al., 1994; Learning, Play, & Domain, 2002).

The 21st century requires school principals to take a leadership role in teaching and learning; to develop themselves and others; to expand, innovate, and develop opportunities; to lead school management; and to engage and collaborate with the community. Previous research by Kunter et al. (2013) has explained that leaders indicate that high school graduates, undergraduates, and college graduates are less competent.

The research findings show that the contribution of instructional leadership variables to the competence of school principals in the 21st century was 69.80%. In comparison, the remaining 30.20% was determined by other factors that were not part of this study. This result is supported by a previous study, Polikoff and Porter (2014). In addition, other research, Cohen (2014) states that technology literacy includes the skills and abilities of individuals and society to effectively use digital and Internet technologies to meet their socioeconomic and political needs. Principals must have and carry out good and correct leadership functions and possess 21st-century competencies to realize effective and successful schools. They should be able to demonstrate critical thinking and problem-solving skills, creativity and innovation, collaboration, teamwork, leadership, cross-cultural understanding, communication and media literacy, computer and ICT literacy, as well as career development and independence (Niu, Behar-Horenstein, & Garvan, 2013). With the principal's instructional ability to lead with technological sophistication in the 21st century, the better the principal's instructional leadership at every level of education in Indonesia, the better the principal's 21st-century competencies (Niu et al., 2013).

6. Conclusion

With instructional leadership in the sophisticated technology of the 21st century, principals will possess strong 21st-century competencies. Based on research findings, instructional leadership should be provided through workshops to enhance functions such as visionary thinking, virtual management, innovation, mentorship, convening, and virtual teamwork. Further research is recommended using qualitative methods to identify indicators of improvement in instructional leadership, including critical thinking and problem-solving, creativity and innovation, collaboration, teamwork and leadership, cross-cultural understanding, communication and compassion, computer and ICT literacy, as well as career development and independence.

Acronym

ICT = Information and communication technology.
UNESCO = United Nations Educational, Scientific and Cultural Organization.
PERC = Political and Economic Risk Consultant.
ESEM = Exploratory Structural Equation Modeling.
SPSS = Statistical Package for the Social Sciences.

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