Journal of Research Administration
Society of Research Administrators International

INFLUENTIAL FACTORS AFFECTING THE PERFORMANCE OF PRIMARY SCIENCE TEACHING IN WESTERN PROVINCE SCHOOLS, SRI LANKA

Vipula Kulathunga, Ooi B. Keat, Jacqueline Tham
Management and Science University, Malaysia
*vipulakulatunga@gmail.com

Abstract
The child's science education has a positive effect on their later science learning achievement. This research examined the factors: primary teachers' attributes (science knowledge, science process skills, teaching strategies, qualifications, and experience) and principal influence (instructional leadership and supervision) that impact primary science teaching via environment-related activities as an integrated subject in the schools of the Western Province of Sri Lanka. The primary teachers are trained as general primary teachers and are not trained for science teaching. The data were collected from 416 in-service general primary teachers using a five-point Likert scale questionnaire blended with a Google form. The sample was a proportionate stratified random sample in teaching grade-wise from the three districts of Colombo, Kalutara, and Gampaha in the Western Province of Sri Lanka. The data collection and analysis were followed by quantitative and survey methods, and we followed descriptive and inferential statistics with SPSS and AMOS software. The structural equation method was applied to test the hypothesis of the proposed model by following the exploratory factor analysis (EFA) and the confirmatory factor analysis (CFA). The structural equation model fit indices of the study: incremenetal fit (CFI) 0.90, parsimonions fit (the value of CMIN/Df) 2.41, and absolute fit (RMSEA) 0.060 were acceptable to fit. Primary teachers had a high ($r = 0.69$, $p > 0.05$) and principal influence had a low ($r = 0.26$, $p > 0.05$) positive and significant correlational impact on the science teaching performance of the acceptable model. The primary teachers' attributes: the teaching strategies ($r = 0.86$), experience ($r = 0.83$), and science process skills ($r = 0.88$) had significant and positive high influence; the knowledge of science ($r = 0.55$) had moderately high positive and significant influence; and the qualification impact was insignificant. Instructional leadership and supervision of the principals were not distinguished as two dimensions in the context of the Western Province of Sri Lanka in the dimension reduction of the principal component method in the EFA. The professional development for the primary teachers and the principal needs to be conducted based on the findings. Educational policies and procedures in Sri Lankan primary schools can incorporate the findings. Further studies should focus on studying the supplementary variables that impact the teachers' efficacy, including classroom resources, student engagement, and parental involvement.

Keywords: Primary Teacher, Principal Influence, Science Teaching

Introduction
With the emergence of the fourth industrial revolution, the demand for science education is continuing to rise (Zhou, 2019). The science education is a key factor of sustainable development of any country (Maryann et al., 2019). Acquired science knowledge and process skills in childhood lead to eventual success in science learning (Taylor, 2020). According to Piaget's theory of cognitive development, a child reaches the major phases of cognitive development within the first twelve years of life (Nortje, 2022; Cherry, 2020). Thus, it appears crucial to

provide the required learning experiences and environment for cognitive growth during the primary education period. Vygotsky's sociocultural theory demonstrated that the cognitive growth of a child can be facilitated by structuring the kid's surroundings, and a professionally qualified teacher that is required for the Zone of Proximal Development (Allman, 2020; McLeod, 2022). Consequently, it can be stated that preparing to impart proper and high-quality science knowledge and abilities at the primary level is a crucial prerequisite in later science education (Hafeez, 2021). Therefore, it is crucial to provide properly planned science education in the primary grades.

There are two primary sorts of elements that impact a teacher's performance: internal and external factors. Internal determinants include teacher competencies, whereas external aspects include the principal and school-related variables (Kanya et al., 2021). As teachers' components, Kanya et al. (2021) identified psychology, emotional intelligence, self-efficacy, social skills, and personality. Zhubi & Ismajli (2022) claims that subject knowledge and teaching methodologies are necessary for a competent teacher. In addition, assessment and curriculum knowledge, as well as classroom management skills, are required for effective teaching (Lord, 2022), and the socioeconomic background of teachers can impact teaching (Ngema, 2016). A lack of prior experience in the relevant subject, a lack of enthusiasm for the subject, a lack of subject material knowledge and practical abilities, and a low socioeconomic background might be highlighted as variables that negatively impact teaching (Dabney et al., 2020; Steinberg & Yang, 2022). Almost all these aspects affect the professional growth of a science teacher, and via professional development (Cockpim & Somprach, 2019).

The content expertise of the teacher is one of the reasons for the success in the classroom (Zhubi & Ismajli, 2022). Hartati et al. (2019) expressed that when the subject is well-known and the teacher has confidence in teaching it, misconceptions are avoided. When the teacher is incompetent, variety of strategies play a role, such as avoiding the important parts of the subject, sticking to the facts in the book, not taking part in the learning process (by not giving tests and doing activities), and discourage students from asking questions (Lord, 2022). Therefore, content knowledge has a positive effect on teaching effectiveness and student achievement (Padhi, 2021). Moreover, a teacher's pedagogical knowledge is essential for a successful teaching-learning process (Fauzi et al., 2017). Pedagogy improves the confidence of the teacher which leads to effective teaching (Dewi et al., 2020).

The principal is a factor that affects the learning and teaching processes in a school (Cockpim & Somprach, 2019). The principal's guidance and leadership especially influence the teacher's teaching (Baptiste, 2019). Instructional leadership is any action or activity taken by the principal to create excellent teaching by providing the necessary support and guidance to the teacher to achieve the desired levels of student achievement (Stroud, 2021), which is the primary goal of a school. Demirdag (2021) stated that this includes creating the vision and mission of the school, communicating the goals and objectives of the school, creating the professional development of the teacher, managing the curriculum and teaching, monitoring and increasing the quality of teaching, creating a positive learning environment in the school, monitoring and evaluating teaching methods, and regulating the level of achievement of students. The instructional leader works with the teacher to ensure the development of student achievement by monitoring, planning, coordinating, and evaluating classroom activities (Hassan et al., 2019; Pardosi & Utari, 2022). Principal instructional leadership offers the required direction for the teacher’s performances and their professional development (Lord, 2022).

A teacher's successful teaching requires continuous supervision and guidance (Padhi & Sahu, 2020). Supervision involves observing classrooms and the learning-teaching process, analyzing

learning-teaching conditions and processes, ensuring the provision of infrastructure and learning materials, and providing positive guidance (Sudarni et al., 2021). Thus, by strengthening the traditions, values, habits, etc. of the school culture, maintaining a positive school culture, motivating teachers, and increasing the efficiency and productivity of the learning and teaching process that can improve the teacher's performance (Sophianingreki, 2019). The supervisor must have the ability to research the identification of needs and reach related decisions, as well as an understanding of various supervision methods (Hindun et al., 2022). Supervision shows a direct and non-direct relationship with the teacher's teaching success (Suriagiri et al., 2022). Supervision helps in the professional development of the teacher (Padhi & Sahu, 2020) and thereby increases the teacher's self-confidence in teaching which affects teachers' effective teaching performances as well as students' successful achievements.

Science Teaching

The teaching model based on John Locke's impression (Phuong Thuy, 2020)**:** This model posits that an infant is born devoid of any substance. It was explicated that learning occurs via the formation of mental impressions in response to any experience encountered during the learning process or language. It has been demonstrated that language and the senses are crucial in this situation. Successful or effective learning, it was stated, is entirely dependent on the teacher's competence and communication skills.

Glaser's fundamental instructional framework (Kirthika, 2022)**:** This model specifically takes into account the psychological background. Here, we will present the four primary stages of the teaching process. The components include instructional objectives, initial behavior, teaching methods, and performance assessment. The instructional objectives are defined as a detailed explanation of specific tasks. It differentiates between the objectives of the school, the child, and the teacher. The task must be prepared in advance for the teaching and learning process to be carried out. These can be expressed as statements of behavior. Initial behavior refers to the minimum level of proficiency required to comprehend the lesson's content. This represents the child's foundational understanding. This marks the commencement of the teaching. The subsequent point of behavior should mark the conclusion. Teaching methods are the strategies, techniques, or methods that can be employed to efficiently and effortlessly accomplish a child's learning objectives. Evaluating performance involves the teacher's assessment of how proficiently the child has acquired the subject matter. The teacher has the discretion to choose any method to measure performance, but it must meet the criteria of being effective, valid, and reliable.

The primary science capital teaching approach (Nag Chowdhuri et al. 2021)**:** The objective is to equip children with the necessary scientific understanding, values, perspectives, and social connections. Three important steps make up the model. Base is the first stage. Best practices in elementary education form the foundation. Encouraging students to learn by doing requires incorporating good teaching practices like teaching through play, exploring, designing experiments, testing, and model development, among others. Foundations that are mandatory constitute the second phase. A more inclusive and equitable approach to teaching science in elementary schools must be maintained. Three main approaches are suggested by the model. One is to start learning with the child; two is to cultivate teaching and learning; and three is to assist the child in expressing themselves and exercising their agency. The third level features three columns on the lower level. The columns include: 1. Customization and regionalization 2. Inspiring, appreciating, and connecting; 3. Constructing the dimensions of science capital. For

educators looking to implement this strategy, these columns provide helpful pointers. The aforementioned model is designed specifically for use in elementary school science classes.

Problem Statement

Although official science education in Sri Lanka does not commence until the junior secondary level, children in the primary grades receive science knowledge and skills through environmental related activities as an integrated subject (National Institute of Education, Sri Lanka, 2021). Within this context, there are no separate science teachers in the primary grades, and the science content is taught by general primary teachers, most of them do not have a sound science educational background as they are not trained for exploring or experiencing science teacher training when the recruitment or later stages (NEC, 2022). Thus, since these teachers are non-science teachers, one primary problem with their science teaching capability is that it is necessary to ask how the influencing factors affect the teaching of science. However, no studies have been done in Sri Lanka to understand the extent of primary teachers' characteristics and principals' leadership influence on the primary science teaching. No existing research has examined the combined impact of principal leadership, organizational culture, and teacher competence on teacher performance (Kanya et al., 2021). In light of this, this study focuses on finding out the characteristics of the primary teachers affecting the teaching of primary science and determining the principals' leadership influence on the teaching of primary science and the elements that influence the teaching of science in conjunction with environmental activities among primary school teachers. To our knowledge, no studies have yielded on primary science teaching who non-science primary teachers are in the context of the study. The study finds that to fill the knowledge gaps, it is crucial to successfully implement science education in integrated manner in the primary grades without a trained science teacher or a proper science curriculum. These findings may support policymakers and implementers in the successful implementation of science knowledge and process skills through the integrated curriculum in primary grades in Sri Lanka as well as internationally. These backgrounds of the research problems led following objectives for the study.

***Research Objectives*;**

1. To find out the characteristics of the elementary teachers affecting on the elementary science teaching.
2. To determine the principals' leadership influence on the elementary science teaching.

The study is conducted base on the schools of the western province of Sri Lanka. The unit of analysis is elementary general teacher of the schools in the western province of Sri Lanka. Sri Lanka intends to make reforms to education in 2024/2025, thus the findings of this study will be crucial for formulating and implementing policy. Also, the findings of this study will be useful in improving science education in elementary schools in all countries with untrained elementary school teachers as well as implementing an integrated curriculum.

Methodology

The study conducted a thorough examination of the teaching performance of public primary teachers in schools located in the Western Province of Sri Lanka. It is followed by a quantitative and survey method that the investigation collected raw data from primary school teachers using a questionnaire in a blended mode. The blended method of the data collection was made equity opportunities for responses from the three districts: Colombo, Kalutara and Gampaha of the

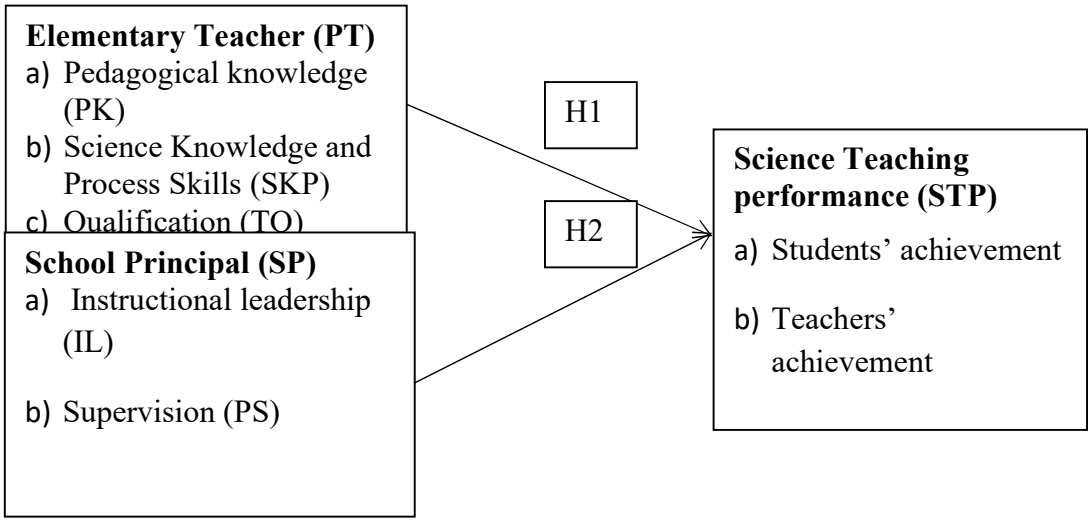
Western Province. This study's target population consisted of primary general cadre teachers from grades 1 to 5 in the primary grades of schools in Western province of Sri Lanka. The researchers employed a stratified proportional random sample strategy based on teaching grade strata, bearing in mind the degree of representativeness, generalizability, time constraints, and study objective (Azam et al., 2021). The unit of analysis was a general primary cadre teacher in the primary grades. The study has a cross-sectional time horizon because the data were collected only once. The sample frame is the Ministry of Education's national educational management information system (NEMIS) 2020 database of institutions. The sample size of 375 for the research is determined by applying the Krejcle and Morgan (1970) table. The questionnaire distributed among 625 primary (general) teachers were determined a response rate of 60% to the sample size in the schools of Sri Lanka's western province. Based on the available literature, prior research, and purpose of the investigation, the researcher selected descriptive and inferential statistics for correlation and regression analysis. Statistical software applications: AMOS and SPSS , are currently being used to effectively analyze the data. At first, descriptive statistics, specifically weighted mean procedures were used to quantitatively evaluate teaching ability across various aspects. Following that, correlation and regression studies were performed to determine the connections between the primary teacher, principal, and teachers' performance. The purpose of these analyses was to determine the degree to which the primary teacher and principal impact the overall performance of science teaching in the classroom. The study utilized a meticulous analytical method to enhance comprehension of the intricate dynamics that influence teaching efficacy. Additionally, it provided practical suggestions for science education enhancing educational practices in the region. Before consenting to participate as a subject in the current study, the purpose, objectives, methods, significance, privacy, and confidentiality of the information provided to the teacher.

Conceptual Framework for the Study

The following theoretical framework is developed for the inquiry from the literature reviews.

Figure 1:

The conceptual framework of the study



Based on the conceptual framework, the study is led by two hypotheses as follows;

H1: There is a relationship between the primary teacher and primary science teaching performance.
H2: There is a relationship between the school principal and primary teacher's science teaching performance.

Results and Discussion

We used SPSS and AMOS software to analyze the collected data through a questionnaire. We followed the exploratory factor analysis (EFA), the confirmatory factor analysis (CFA), and the structural equation method (SEM). The structural equation method was followed by two steps method: the measurement model and structural model. However, Out of 625 primary teachers who participated in this research study, only 492 responded. The response rate was 79% which was higher than the 60% response rate expected in the study. Among those responses, responses with incomplete and unclear responses were removed. Outliers were then removed and the final number of responses used for analysis was 416, which was more than the expected sample of 375. This table 01 provides a summary of the demographic statistics for the grade, gender and district in the studied dataset. The mean value of 1.96 for gender is represented by the fact that female teachers make up 95.7% of the primary school teaching within the dataset. It is also confirmed that a correct sample representation has been done because it closely matches the gender representation of the entire primary teacher ministry of Education's information system of Sri Lanka (Ministry of Education, Sri Lanka, 2021). There is nearly equal representation from each grade from one to five as a proportionate stratified sample of the study, as shown by the median value of 3.10. In addition, the sample distribution is reflective of the three districts studied (Kalutara, Gampaha, and Colombo) to a near-perfect degree, with a mean value of 1.97 falling very close to 2. This data suggests that the study's representation has fairly geographical balanced distribution. In addition, the data seems to follow a normal distribution based on the skewness and kurtosis for the grade and district. The range has a skewness value of -0.08. Despite its negative bias, the value is quite small. The value is relatively near to a symmetric normal distribution because it is significantly lower than ±1.96 ($p > .05$) (Hair et al., 2018). In addition, the skewness and kurtosis values for the three districts are less than 1.96, with 0.06 and -1.49, respectively, indicating that the sample is normally distributed and proportional. The results of these studies demonstrate that the teachers' responses follow a normal distribution. The mean value of 2.92, which is very close to 3.0 for teaching experience, shows that most of the sample of primary teachers has more than 10 years of teaching experience in primary grades.

Table 01

The descriptive statistics for the Grade, Gender, and District

	Grade	Gender	District
Valid	416	416	416
Mean	3.05	1.96	2.01
Skewness	-0.04	-4.51	-0.01
Kurtosis	-1.19	18.39	-1.56
Minimum	1.00	1.00	1.00
Maximum	5.00	2.00	3.00

The table 02 indicates that variables with Kaiser-Meyer-Olkin (KMO) values greater than 0.7 indicate that the sample is adequate for analyzing all model variables, and Cronchbach's Alpha values greater than 0.7 demonstrate that the items have internal consistency and reliability.

Table 02
The KMO value and Cronbach's alpha for the studied variables

Variable	Dimension	KMO value	Cronbach's Alpha	No. of Items
Primary Teacher (PT)	Science Knowledge (SK)	0.96	0.97	7
	Science Process Skills (SP)			9
	Teaching Strategies (TSM)			6
	Teachers' Qualification (TQ)			5
	Teachers' experience (PTE)			8
Principal Influences (PI)	Instructional Leadership and Supervision	0.94	0.94	10
Teachers' Performance (TPO)	Students' Achievement and Teachers' Achievement	0.90	0.93	4 5

Science Background of the Primary Teachers

Table 3 shows that more than 98.6% of primary teachers passed the science subject at the O/L examination. The mean value for the science results of the O/L examination was 3.00. The mean value is indicated majority primary teachers have good passes for science subject at their O/L examination. The primary teachers have good science knowledge and skills in basic level.

Table 3
The primary teachers' science achievement in the Ordinary Level examination

Grade of pass	Frequency	Percent	Cumulative Percent
Distinction	43	10.3	10.3
Very good	52	12.5	22.8
Credit	208	50.0	72.8
General	107	25.7	98.6
Weak	6	1.4	100.0

Table 4: more than 92.1% primary teachers are studied subject streams; art and commerce for the A/L examination (senior secondary education) that are indicating the teachers are having less science based senior secondary education. The finding was comparative with the study of Batuigas et al. (2022) analysis that the educational achievement has a significant and positive impact on the teaching performance.

Table 4

The primary teachers studied the subject stream of Advanced Level

Subject Stream	Frequency	Percent	Cumulative Percent
Art	306	73.6	73.6
Commerce	77	18.5	92.1
Technology	1	.2	92.3
Math	5	1.2	93.5
Bio	27	6.5	100.0

The overall picture of the primary teacher is that they are competent with science knowledge and process skills that are at the ordinary level of the science curriculum in Sri Lanka. That means they may have enough science knowledge and process skills to teach science content as an integrated subject in the primary grades in Sri Lanka.

The Primary Teachers' Dimension

Table 05 shows that the impact and correlation between dimension and the primary teacher. The teaching strategies shows high importance by the highest mean value; 3.80 and correlation between teaching strategies and the primary teacher is very high strong. Science process skills shows high impact with the high mean value 3.68 and it has strongest correlation with the primary teacher. The experience also has high impact and high correlation with the primary teacher. The science knowledge has lowest impact with the mean value 3.10 among the dimensions. But it has a high correlation 0.70 with the primary teacher. The teacher's qualification has a high impact compare to the science knowledge but the correlation between the qualification and the primary teacher is moderately low. However the study of Batuigas et al. (2022) shows that teacher training has a significant and positive impact on teaching performance. Therefore, teaching strategies, science process skills, experience, and science knowledge are all important factors for primary teachers. Although science knowledge may have the least significant influence, it still maintains a substantial correlation with the primary teacher. On the other hand, teacher qualification, although influential, is not as strongly associated with the primary teacher compared to other factors.

Table 05

The mean values, and Pearson' correlation coefficient for the dimensions

Dimension of the primary teacher	Mean value	Parsons' Correlation coefficient
Science Knowledge	3.10	0.70
Science Process skills	3.68	0.90
Teaching strategies	3.80	0.80
Qualification	3.21	0.26
Experience	3.51	0.83

Note.

Correlation is significant at the .05 level (2-tailed)

The primary teacher role encompasses various dimensions, such as science process skills, teaching strategies, experience, science knowledge, and qualification. The average value of the primary teacher is 3.51, suggesting a significant influence on the teacher's performance in teaching science. Furthermore, there exists a Pearson correlation coefficient of 0.67 between the primary teacher and the teacher's science teaching performance, indicating a statistically significant and meaningful association. Another study shows that teachers' subject knowledge is a key factor for effective teaching (Ekmekci et al., 2019). The study of Kijkuakul (2019) reveal that misconception in science is impact on the effective teaching. This implies that the proficiency and capability of the main instructor play a significant role in the overall achievement in teaching science. Essentially, the competence of primary teachers in different areas significantly impacts their performance in teaching science. Moreover, there is a clear connection between the effectiveness of primary teachers and their ability to teach science.

Principal Influence

The mean value of 3.68 and Pearson's correlation coefficient of 0.58 show that the impact of principal influence is positively high and the correlation between principal influence and primary teachers's science teaching performance is moderately high. This implies that the capacity of school principals can play a significant role in improving primary science teaching performance. The literature reviews show that the principal has two dimensions: instructional leadership and supervision. However, the principal component analysis and varimax method apply the exploratory factor analysis to the dataset, resulting in a rotated component matrix that only includes one component in the context of the sample of the Western Province of Sri Lanka. This means the role of principal cannot be segregated as instructional leadership and supervision in the school of the Western Province of Sri Lanka, and there is a cumulative impact. So, the professional development programme for the principal need to be consisted instrutional leadership as well as supervison.

The Structural Equation Model Of Primary Teachers' Science Teaching Performance

The exploratory factor analysis resulted in the primary teacher's attributes and principal influence having an important impact and significant correlation on the primary teachers' science teaching performance. Then the confirmatory factor analysis (CFA) applied by using AMOS software to test the fit of a hypothesized model. This analysis is specifically valuable for evaluating the accuracy of a group of measurement items in relation to their anticipated underlying constructs. Performing Confirmatory Factor Analysis (CFA) using an Individual Measurement Model entails the distinct specification and evaluation of the measurement model for each latent construct.

Step 1: measurement model

Figure S1 show the measurement model of the hypothesised model. The fit indexes for the measurement model are:

Table 06: Parsimonions fit index (CMIN/Df) value of 2.12 that the value is ≤3 it indicates the proposed model an acceptable good fit. The incremental fit value of 0.91 that above 0.90 indicates an acceptable fit the model. The value of 0.05 is below 0.07 that is indicates the absolute fit for the model acceptable fit. If the three indices: the parsimonions fit, the incremenetal fit and absolute fit, are fit, the measurement model is fit (Hair et al.,2018).

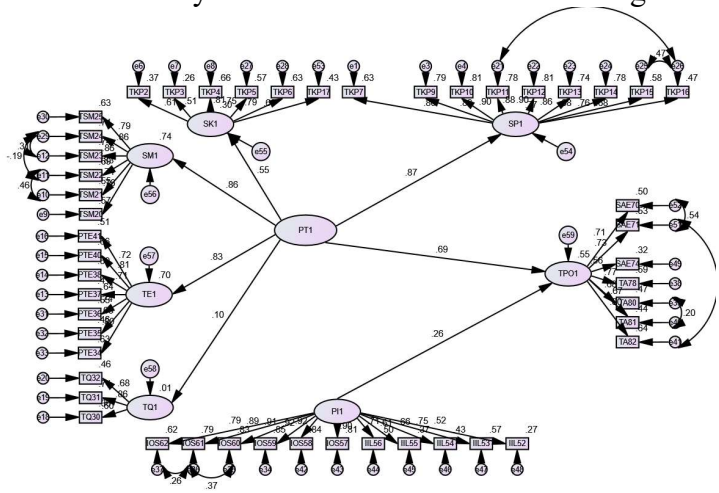
Table 06
The fit indices for the Measurement model

Name of category	Goodness of Fit	Threshold values	Result	Model evaluation
Parsimonions fit	CMIN/Df	≤ 3	2.12	Good fit
Incremenetal fit	CFI	≥ 0.8	0.91	Acceptable fit
Absolute fit	RMSEA	≤ 0.08	0.05	Acceptable fit

Step 2: Structural Model

The subsequent analysis verifies the unidimensionality, validity, and reliability of all latent constructs prior to constructing the structural model. Unidimensionality is attained when the measuring items exhibit satisfactory factor loadings for the corresponding latent construct. All items in the measurement model have factor loadings that exceed the cutoff point of 0.5, as stated by Hair et al. (2018). The items with factor loadings below the threshold cutoff point of 0.5 were eliminated. The following items were removed: 1, 8, 28, and 73. The diagram of the structural model is as follows.

Figure 2
The Structural Model of the Primary Teacher for the Science Teaching Performance



The fit indices of table 07 for the structural model show that the hypothesized model is an acceptable fit.

Table 07
The fit indices for the Structural model

Name of category	Goodness of Fit	Threshold values	Result	Model evaluation
Parsimonions fit	CMIN/Df	≤ 3	2.41	Good fit
Incremental fit	CFI	≥ 0.8	0.90	Acceptable fit
Absolute fit	RMSEA	≤ 0.08	0.06	Acceptable fit

Primary Teacher

Table 08 shows that the relationship between the primary teacher and their science teaching performance has a p value less than 0.00 and a standard regression weight of 0.69, which means the relationship is statistically significant and has a high influence. This reveals that the science teaching performance level is highly dependent on the primary teacher's attributes. Science knowledge, science process skills, teaching strategies, and experience have p values less than 0.05, showing that they've all significantly contributed to the to the dimensions of the primary teachers. The study of Batuigas et al. (2022) analysis explained that the experince has an insignificant impact on the teaching performance. However, the teachers' qualifications, such as degrees and masters, are not statistically significant due to a p value greater than 0.05, and the low correlation of 0.098 indicates a slight influence on the primary teachers in the context of the Western Province of Sri Lanka. However Ekmekci et al. (2019) study in mathematical education shows that the qualification has a very strong positive and significant factor for the teaching performance. Teaching strategies, experience, and science process skills have a very positive influence, and science knowledge has a moderately positive influence on the primary teacher. The study of Ekmekci et al. (2019) also proved that teachers' experience, and subject knowledge have impact on the teachers' performance. The multiple linear regression Analysis of Batuigas et al. (2022) explained that the educational achievement and the training programmes can be improved teaching performances. So, the professional development programs like educational and training that need to improve the science knowledge of the primary teachers to uplift their science teaching performance in the primary grades. Science education benefits from having teachers who are both knowledgeable and capable of making a difference (Kijkuakul, 2019).

Principal

The value of Table 8 shows that the principal influence has a significant influence ($p > 0.05$); however, a standardized regression weight of 0.26 points toward a positive and weak influence on the science teaching performance of the primary teachers. The study of Sophianingreki (2019) also shows that the influence of the principal's academic supervision has a positive and a low impact on the teachers' performance in the context of the Santo Yosef Middle School in Surabaya, Indonesia. However Kanya et al. (2021) study show that principal leadership is a most influence factor for teacher's teaching performance when compare to the teacher's competencies and the school culture. The result of the action research in Thialand shows that the school leadership has strong influence to primary teachers' professional developments (Kijkuakul, 2019). The study reveal that the principal's professional development programs that need to be composed of relevant parts focus on primary science teaching. .

Table 8
The relationship between all variables of the Structural Model

Relationship between two variables	**Significancy (*p> .05*)**	**Standardized Regression Weights**
Science Knowledge and the primary teacher	0.00	0.55
Science Process Skills and the primary teacher	0.00	0.88
Teaching Strategies and the primary teacher	0.00	0.86
Teacher's qualification and the primary teacher	0.10	0.10
Teacher's experience and the primary teacher	0.00	0.83

Primary teacher and science teaching performance	0.00	0.69
Principal influence and science teaching performance	0.00	0.26

The two hypothesis constructed based on the conceptual framework are supported.
H1: There is a relationship between the primary teacher and primary science teaching performance.
H2: There is a relationship between the school principal and primary teacher's science teaching performance.
Primary teachers which supported by dimensions: science knowledge, science process skill, teaching strategies and experience are strongly impact on the science learning achivement of students and teachers. However the teachers' qualification influence is very weak and not momentous factor for students' science achivements and teachers' teaching achivements. Principal influence is a major factor, and the level of influnce is weak for the science teaching-learning succefulness.

Conclusion

The investigation could concentrate on comprehensively understanding the elements that impact the teaching performance of elementary teachers in the western province of Sri Lanka, specifically in the realm of science education. The study underscores the multifaceted aspect of teaching performance, placing emphasis on elements such as the attributes of the elementary teacher and the involvement of the administrator. This highlights that the quality of science education teaching is not just determined by the teacher's personal abilities, but also by the wider organizational elements that are represented by the principal's leadership.
An examination of mean values uncovers certain areas where elementary teachers could gain from focused professional development. Specifically, when specific items relating to science knowledge and process abilities have low mean values, it suggests that there may be areas of weakness in the teachers' comprehension and utilization of scientific concepts. To improve teaching effectiveness in science education, it would be beneficial to address these gaps by implementing focused training programs.

Implications for Policy and Practice

The study's findings have ramifications for educational policies and procedures targeted at enhancing scientific education in elementary schools. For example, authorities should contemplate allocating resources towards professional development initiatives that specifically aim to improve teachers' expertise in science subjects and their teaching methods. In addition, school administrators should give priority to recruiting and keeping highly qualified teachers with relevant teaching experience in order to create an optimal learning environment for science education.

References

Allman, B. (2020). *Socioculturalism - The Students' Guide to Learning Design and Research*. https://edtechbooks.org/studentguide/socioculturalism

Amani, M., Jumriadi, & Hafiz, A. (2020). The influence of school principal supervision, motivation, and work satisfaction on teachers' performance. *Revista Argentina De Clínica Psicológica*, *29*(5), 804–810.

Azam, S. M. F., Yajid, M. S. A., Tham, J., Khatibi, A., Johar, M. G. M., & Ariffin, I. A. (2021). *Research Methodology: Building Research Skills*. McGraw-Hill Education (Malaysia).

Baptiste, M. (2019). No Teacher Left Behind: The Impact of Principal Leadership Styles on Teacher Job Satisfaction and Student Success. *Journal of International Education and Leadership*, *9*(1).

Batuigas, F. D., Leyson, F., C., Fernandez, L. T., Napil, J. N., & Sumanga, C. S. (2022). Factors affecting teaching performance of junior high school teachers of Madridejos National High School. *Asia Research Network Journal of Education*, *2*(1), 40–47.

Cherry, K. (2020). *The 4 Stages of Cognitive Development*. https://www.verywellmind.com/. https://www.verywellmind.com/piagets-stages-of-cognitive-development-2795457

Cockpim, J., & Somprach, K. (2019). Learning Leadership of School Administrators and Teaching Behavior Affecting the Effectiveness of Teacher Professional Development: Hierarchical Linear Model. *Turkish Online Journal of Educational Technology*, *18*(2), 52–57. http://files.eric.ed.gov/fulltext/EJ1211206.pdf

Dabney, K. P., Good, K. B., Scott, M. R., Johnson, T. N., Chakraverty, D., Milteer, B., & Gray, A. (2020). Preservice Elementary Teachers and Science Instruction: Barriers and Supports. *Winter*, *27*, 92–101.

Demirdag, S. (2021). School Principals' Instructional Leadership as a Predictor of Teacher Motivation. *i.e.: Inquiry in Education*, *13*(2), 6.

Dewi, M. K., Setyosari, P., Kuswandi, D., & Ulfa, S. (2020). Analysis of Kindergarten Teachers on Pedagogical Content Knowledge. *European Journal of Educational Research*, *9*(4), 1701–1721. https://doi.org/10.12973/eu-jer.9.4.1701

Ekmekci, A., Corkin, D. M., & Fan, W. (2019). A multilevel analysis of the impact of teachers' beliefs and mathematical knowledge for teaching on students' mathematics achievement. *Australian Journal of Teacher Education*, *44*(12), 57–80. https://doi.org/10.14221/ajte.2019v44n12.4

Enikanolaye, A. J., & Akanmu, M. A. (2020). Influence of Selected Variables on Mathematics Teaching and Learning in Ilorin South Local Government, Kwara State. *Anatolian Journal of Education*. https://doi.org/10.29333/aje.2020.517a

Fauzi, A. A. S., Abdullah, N., Azlan, N. N. A., & Zahari, A. S. M. (Eds.). (2017). *A Study of Determinant Factors Towards the Quality Teaching Among Teachers at Primary School in Bentong District* (Vol. 46) [English]. Atlantis press.

Hafeez, M. (2021). Impact of teacher's training on interest and academic achievements of students by multiple teaching methods. *Pedagogical Research*, *6*(3), em0102. https://doi.org/10.29333/pr/11088

Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). Partial Least Squares Structural Equation Modeling (PLS-SEM) using R. In *Classroom companion: business*. https://doi.org/10.1007/978-3-030-80519-7

Hartati, Y., Permanasari, A., Sopandi, W., & Mudzakir, A. (2019). Relationship between content knowledge and general pedagogical knowledge on pedagogical content knowledge. *Journal of Physics*. https://doi.org/10.1088/1742-6596/1157/4/042045

Hassan, R., Ahmad, J., & Boon, Y. (2019). Instructional Leadership in Malaysia. *International Journal of Engineering & Technology*, *8*(6), 537–547. https://doi.org/10.14419/ijet.v7i3.30.18346

Hindun, Utaminingsih, Sri, & Sukirman. (2022). The Effect of School Principal Supervision on Job Satisfaction of Elementary School Teachers in Demak District. *Journal of social sciences and humanities*, *1*(5), 23–28.

Kanya, N., Fathoni, A. B., & Ramdani, Z. (2021). Factors affecting teacher performance. *International Journal of Evaluation and Research in Education (IJERE)*, *10*(4), 1462. https://doi.org/10.11591/ijere.v10i4.21693

Kartal, T., & Dilek, I. (2021). Developing Pre-service Elementary Science Teachers' Science Teaching Efficacy Beliefs through Microteaching by Promoting Efficacy Sources. *International Journal on Social and Education Sciences*, *3*(4), 710–731. https://doi.org/10.46328/ijonses.124

Khalid, F., & Husnin, H. (Eds.). (2019). Challenges and support for the development of novice teachers' professional identities. *International Conference Educational Technologies*.

Kijkuakul, S. (2019). Professional changes of primary science teachers: experience on collaborative action research in Thailand. *Asia-Pacific Science Education*, *5*(1). https://doi.org/10.1186/s41029-019-0030-2

Kirthika. (2022, July 5). *Glaser's Basic Teaching Model //Teaching Models//B.Ed Notes//TeacherScript*. https://www.teacherscript.com/2022/07/glasers-basic-teaching-model-teaching.html

Kocasaraç, H., Taşpınar, M., & Karataş, H. (2019). Perceptions of School Principals Working at Science and Social Sciences High Schools on the Characteristics of Innovative Teachers. *Turkish Online Journal of Educational Technology*, *18*(3), 70–87. https://files.eric.ed.gov/fulltext/EJ1223770.pdf

Lord, S. J. (2022). *Teaching and Assessing Classroom Science: Factors Affecting Primary School Teacher Practice*. La Trobe University Victoria, Australia.

Maryann, C., Ofordum & Cecilia, N., & Onyekwena. (2019). Science Education: A Tool for Sustainability in Nigeria's Development. *Multidisciplinary Journal of Education, Research and Development*, *3*(1), 71–80.

Mcleod, S. (2022, May 5). *Vygotsky - Social Development Theory*. https://www.simplypsychology.org/vygotsky.html

Ministry of Education, Sri Lanka. (2020). *2019 Annual Performance Report*.

Mora-Ruano, J. G., Schurig, M., & Wittmann, E. (2021). Instructional Leadership as a Vehicle for Teacher Collaboration and Student Achievement. What the German PISA 2015 Sample Tells Us. *Frontiers in Education*, *6*. https://doi.org/10.3389/feduc.2021.582773

Nag Chowdhuri, M., King, H., & Archer, L. (2021). The primary science capital teaching approach. In *Teacher Handbook*. London: University College London.

National Institute of Education. (2021). *National institute of education*. nie.lk. http://nie.lk

National Institute of Education, Sri Lanka. (2021). *Primary curriculu*. http://nie.lk/. http://nie.lk/selesyll

NEC. (2022). National education policy framework (2020-2030). In *www.nec.gov.lk*. National Education Commission, Sri Lanka.

Ngema, M. H. (2016). *Factors that cause poor performance in science subjects at ingwavuma circuit* [MEd thesis]. University of South Africa.

Nortje, A., PhD. (2022, November 18). *Piaget's Stages: 4 Stages of Cognitive Development & Theory*. PositivePsychology.com. https://positivepsychology.com/piaget-stages-theory/

Padhi, G. (2021). Factors Affecting Teaching-Learning Process. *International Journal of Creative Research Thoughts*, *9*(4), 2418–2423.

Padhi, G., & Sahu, A. K. (2020). Factors contributing to teachers' job satisfaction: analysis through principal component analysis. *Journal of Archaeology of Egypt/Egyptology*, *17*(7), 7640–7660.

Pardosi, J., & Utari, T. I. (2022). Effective principal leadership behaviors to improve the teacher performance and the student achievement. *F1000Research*, *10*, 465. https://doi.org/10.12688/f1000research.51549.2

Park, Y. S., Konge, L., & Artino Jr, A. A. R. (2020). The Positivism Paradigm of Research. *Academic Medicine*, *95*(5), 690–694. https://doi.org/10.1097/ACM.0000000000003093

Parveen, K., Tran, P., Kumar, T., & Shah, A. H. (2022). Impact of Principal Leadership Styles on Teacher Job Performance: An Empirical Investigation. *Frontiers in Education*, *7*. https://doi.org/10.3389/feduc.2022.814159

Phuong Thuy, H. T. (2020). John Locke's Educational Ideology with Educational Innovation in Vietnam Today. *Journal of Advances in Education and Philosophy*, *4*(9), 381–386. https://doi.org/10.36348/jaep.2020.v04i09.001

Rodrigues, H. P. C., & Ávila De Lima, J. (2021). Instructional leadership and student achievement: school leaders' perspectives. *International Journal of Leadership in Education*, 1–25. https://doi.org/10.1080/13603124.2020.1869312

Sharif, U. M., Nanyangwe-Moyo, T., Moyo, N., Zheng, X., & Guo, C. (2020). The role of the principal is developing an instructional leadership team in school. *Educational Research and Reviews*, *15*(11), 662–667. https://doi.org/10.5897/err2020.4057

Sophianingreki, S. (Ed.). (2019). *Academic Supervision of Principals, School Culture and Teacher Teaching Performance* (Vol. 387). Atlantis Press.

Steinberg, M. P., & Yang, H. (2022). Does Principal Professional Development Improve Schooling Outcomes? Evidence from Pennsylvania's Inspired Leadership Induction Program. *Journal of Research on Educational Effectiveness*, *15*(4), 799–847. https://doi.org/10.1080/19345747.2022.2052386

Stroud, G. L. (2021, June 21). *Great Principals Are Strong Instructional Leaders First*. https://www.edpost.com/stories/great-principals-are-strong-instructional-leaders-first

Sudarni, Arafat, Y., & Wardiah, D. (Eds.). (2021). *The Supervision Role of the Principal in Improving Teacher Performance at Primary School Level* (Vol. 565). Atlantis press.

Sumiran, S., Waston, W., Sulhadi, S., & Mahmudah, F. N. (2022). The principal's role in improving the quality: A concepts framework to developing school culture. *Frontiers in Education*, *7*. https://doi.org/10.3389/feduc.2022.854463

Suriagiri, S., Akrim, A., & Norhapizah, N. (2022). The influence of school principal supervision, motivation, and work satisfaction on teachers' performance. *Cypriot Journal of Educational Sciences*, *17*(7), 2523–2537. https://doi.org/10.18844/cjes.v17i7.7684

Taylor, P. H. (2020). Science Education: A Societal Imperative. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, *93*(3), 281–285. https://doi.org/10.1080/00098655.2020.1733864

Tiwa, T. M. (2022). The Influence Of Principal's Supervision On Teachers' Performance Motivation. *Journal of Positive School Psychology*, *6*(8), 1100–1108.

Wu, H., Shen, J., Zhang, Y., & Zheng, Y. (2020). Examining the effect of principal leadership on student science achievement. *International Journal of Science Education*, *42*(6), 1017–1039. https://doi.org/10.1080/09500693.2020.1747664

Zhou, Z. (2019). Chinese science education in schools and beyond. *National Science Review*, *6*(2), 183. https://doi.org/10.1093/nsr/nwz017

Zhubi, A., & Ismajli, H. (2022). The Interconnection Between Technological, Pedagogical and Content Knowledge in Primary School Lesson Planning. *Journal of Social Studies Education Research*, *13*(2), 125–146.