TITLE: Science teacher' leadership styles and competencies from the perspective of high school students: A path analysis study

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Research Article

Science teacher' leadership styles and competencies from the perspective of high school students: A path analysis study

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Article Info	Abstract
	Science teachers' leadership styles and competencies were very important for science learning caused those to have a strong impact on learning outcomes and determine school effectiveness. This study was aimed to investigate the influence of leadership style variables on teacher competence and effective learning based on students' perspectives. This research was survey research with a quantitative approach. Participants of this study were 243 senior high school students majoring in Science at SMAN (Sate Senior High School) 1 Metro, SMAN 2 Bandar Lampung, and SMAN 3 East Lampung. The data on teacher competencies and effective learning was collected using a questionnaire with a Likert scale of 5 options and the data on leadership styles was collected using a questionnaire developed by Northouse (2011). The data analysis techniques used were the path analysis. This study obtained several findings, namely: democratic leadership had a significant effect on teacher competence while laissez-faire leadership had no significant effect on teacher competence; there was a positive and significant influence between teacher competence (professional, pedagogic, personality, and social) on the effectiveness of science learning; and there was a positive and significant influence of the democratic leadership style on the effectiveness of science learning while the laissez-faire leadership style did not have a significant effect on the effectiveness of science learning. Based on the finding, schools need to pay attention to science teachers' leadership styles and competencies, teachers should have democratic leadership styles in learning.

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Introduction

Educational research tends to find relationship variables to identify problems that may arise from teachers and teaching. To achieve this goal, education experts try to formulate, study, and improve the learning system by arranging steps to create effective learning. One of the factors that can determine the success of the learning process is this effective learning (Sulistyowati et al. 2020). This should be the teachers' concern for improving the quality of learning.

Research on effective learning has been carried out with several researchers, which are Bistari (2017), Edmonds (1979), Hapsari et al. (2020), Mortimore (1993), Nasution (2016), Sammons et al. (1995), and Setyosari (2017). Based on Mortimore (1993), there are 11 characteristics of effective school teachers, four of it are; Firstly, teachers who focus solely on learning, secondly, those who are concern about the learning process, thirdly, those who have a high expectancy of pupil learning achievement, and those that carry out continual learning and assessment cognitive, affective, and psychomotor domains of each student'.

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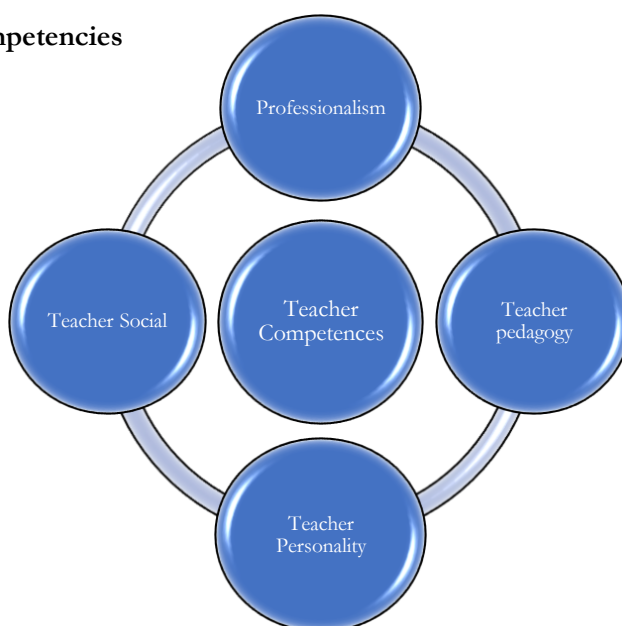
Science Teacher Competencies

Figure 1.
Teacher Competences

Teacher competencies have an important effect on learning outcomes. Competent teachers will be able to create an effective and fun learning environment better and are better at managing their classes so that student learning outcomes can be optimized. In science learning, science teachers have an important role in conveying science concepts which often require a complicated depiction process.

In reviewing the literature has discussed that teacher personality makes a successful teacher (Getzels & Jackson, 1963; Creemers, 1992). Teacher professionalism described elements of knowledge involving subject matter content, teachers' ways of thinking on a discipline (Bruner, 1963; Tom and Valli,1990). Teacher social describing its' practical knowledge, in which they find themselves (their class and subject domain) and the way they form theories about specific situations (Beijaard & Verloop, 1996), while other study revealed that it describes kinds of teacher behavior that contribute on the performance of learning (Brophy & Good, 1986; Simon & Boyer, 1974). In another study, Loughran et al., (2004), have a perspective about teaching pedagogy, that the teacher should have attracted much more attention. Because it was an essential factor to develop self-study movement, for instance, the enormous growth of studies.

Afterward, teacher competence in Indonesia is regulated in the Teacher and Lecturer Law No.14 of 2005, which states that teachers and lecturers must have competency qualifications. Seized competencies are pedagogic, professional, social, also personal competencies. Teacher qualification is a skill needed to do the teacher works through special skills of education.
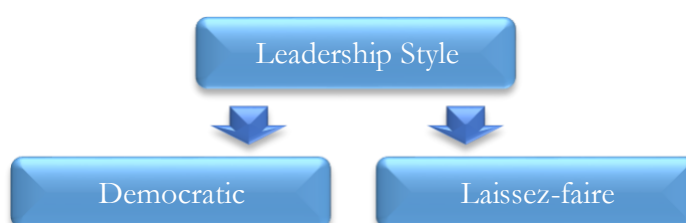
Science Teacher Leadership Styles

Figure 2.
Teacher Leadership Styles

The idea that leadership needs to be distributed to increase the effectiveness of learning in schools is strongly supported by the principal leadership (Indra et al. 2020). In achieving school improvement successful leadership is accepted. The strong influence of leadership on school effectiveness and change has been revealed by research findings from different countries and school contexts (e.g., Van Velzen, Miles, Elholm, Hameyer, & Robin, 1985; Hopkins, 2001; West, Jackson, Harris & Hopkins, 2000). Hopkins (2001) in achieving school improvement on facing challenging

circumstances highlights the centrality of transformational and instructional leadership practices. Yet, other literature studies reveal that leaders who make changes are influenced by different styles of leadership (Hallinger & Heck, 1996; Lashway, 1997).

Several reports on leadership have been carried out by observers and researchers in the education field. The outcomes of this study generally indicate that realizing an effective school-based principal leadership is seen widely as a significant factor (Gaol, 2017; Sammons et al. 1995; Setiyati, 2014). From various leadership theories, the study of principal leadership is evaluated, as an example, the concept of leadership traits by Bass and Stogdill (1990), Pianda (2018), Prihantoro (2017), and Sudharta (2017). Next is the theory of transformational leadership created by Downton (2016) followed by Bass and Riggio (2010) and Cotton (2003). The concept of transactional leadership has been researched by Kuhnert (1994) and Kuhnert & Lewis (1987). Situational leadership has been studied by Hersey & Blanchard (1988).

Leadership style is part of a person's characteristics to influence other people or organizations so that others are willing and able to move and emulate their attitudes and personal disposition towards achieving certain goals (Ali et al. 2015). Democratic leaders offering group members assistance by participating in groups and supporting the involvement of members in deciding while laissez-faire leaders offer to group members less or no guidance by giving up all decision-making. In an experiment, democratic leadership was found to be the most effective styles of the three styles concerning the feeling of involvement, motivation, cooperation, and creativity. However, members in authoritarian groups are perceived as little creative, lots displeased and detached. Likewise, members of the laissez-faire group were found to be less productive by showing small cooperation and satisfaction (Rustin & Armstrong, 2012).

It is clear that democratic leadership facilitates the growth of leaders and another personal potential, while discovered on the experiment. A sense of cultivation for the common interest and individual freedom to act according to one's direction is the essence of democratic leadership for what becomes human, (McClain, Ylimaki & Ford, 2010). Then, democratic leadership creates an atmosphere where persons are encouraged and supported in aspiration of fact by hearts open. Studies from educational administration on democratic leadership school type often focus on how principals exhibit behavior democratic, apply cooperative relationships, and collective decision-making within schools to increase school effectiveness while some studies emphasize the relationship between several administrative variables (Adeyemi & Adu, 2013; Bhatti et al. 2012; Bozdoğan & Sağnak, 2011; Mbera, 2015; Terzi & Derin, 2016).

The Laissez-Faire leadership style has known as the "absence of leadership" (Bass & Avolio, 1990). It states to a "hands-off" method (Northouse, 2011). The Laissez-Faire leadership is considered a distinctive type of devastating leadership since Laissez-Faire leaders show no interest in the needs of subordinates, decisions-making, and provide timely feedback. These leaders are invited to create role conflicts, role ambiguity because they are unable to meet the legitimate expectations of their followers/subordinates (Kelloway et al. 2005), and frequent disagreements through colleagues (Skogstad et al. 2007). Though the destructive and negative nature of laissez-faire leadership has been recognized by researchers, solely a limited number of studies (eg, Kelloway et al. 2005; Skogstad et al. 2007) discuss the adverse effects of the Laissez-Faire leadership.

Problem of Study

The main problem of the study is this;
- ➢ Is the proposed model for science teachers' leadership styles and competencies compatible?

The sub-problems of the study are these;
- ➢ Is there a positive and significant influence of leadership style (democratic and laisezz-faire) on teacher competencies (professional, pedagogic, personality, and social) from students' perspective?
- ➢ Is there a positive and significant influence of teacher competencies (professional, pedagogic, personality, and social) on the effectiveness of science learning from students' perspective?
- ➢ Is there a positive and significant influence of leadership styles (democratic and laisezz-faire) on the effectiveness of science learning from students' perspective?

Method

Research Design

This research is a survey research with a quantitative approach. According to Creswell and Creswell (2017), survey research can collect direct data from specified subjects and make generalizations to the population. The purpose of

survey research is to provide a detailed description of the background and characteristics of a case or event of a general nature (Sugiyono, 2013). The research flow is depicted in Figure 3.
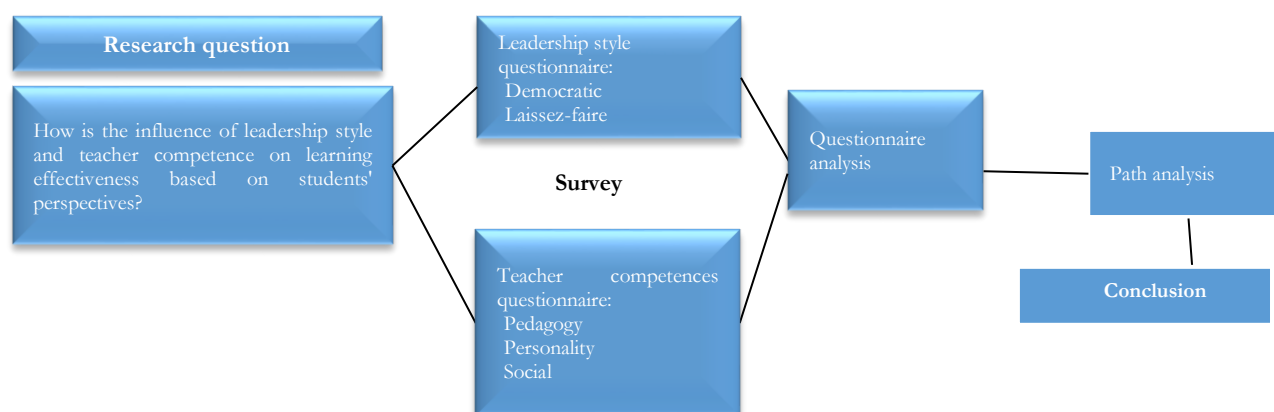

Figure 3.
Research Flowchart

Participants

The subjects of this study were high school students majoring in the science of Lampung Province, namely SMAN (Sate Senior High School) 1 Metro, SMAN (State Senior High School) 2 Bandar Lampung, and SMAN (State Senior High School) 3 East Lampung. The participants were 243 senior high school students that were selected with a random sampling technique. It's because we assumed that all the population is homogenous. Those 243 students came from several classes, namely class X IPA (Natural Science Major), class XI IPA, and class XII IPA. The distribution of research sample data is shown in table 1. The data on teacher competencies and effective learning was collected using a questionnaire with a Likert scale of 5 options and the data on leadership styles was collected using a questionnaire developed by Northouse (2011). The data analysis techniques used were the path analysis.

Table 1.
Demographic Structures of Research Subjects

Grades	Gender		
	Male	**Female**	**N**
X IPA	32	43	75
XI IPA	30	52	82
XII IPA	38	48	86
Total (N)	100	143	243

In this study, we involved 75 students of grade XI IPA, 82 students of grade XI IPA, and 86 students of grade XII IPA. With 100 male respondents and 143 female respondents. The total sample is 243 students.

Research Instruments

The authors used four research instruments, namely: demographic questions, leadership scale, teacher competence, and learning effectiveness.

Demographic Knowledge Form

To determine the distribution and characteristics of the participants, the researcher asked demographic questions. The demographic questions asked when participants filled out the research instruments included information about age, class, and gender.

Leadership Scale (LS)

The data collecting techniques used were questionnaires as research instruments to obtain data and information about leadership style, teacher competence, and the effectiveness of science learning. The leadership style questionnaire developed by Northouse (2011) was distributed to students. The questionnaire provided three subscales with 18 items measuring autocratic, democratic, and laissez-faire leadership styles.

Teacher Competence Scale

The questionnaire for teacher competence and learning effectiveness had been developed by the researchers. The questionnaire design guidelines were based on the variables of this study so that the data collection objectives followed the expected research objectives. This questionnaire used a 5-point Likert scale to mark each statement. Respondents

provided answers to each statement by clicking on the number on the Google Form based on the following scales: 5 = strongly agree, 4 = agree, 3 = quite agree, 2 = disagree, and 1 = strongly disagree and for the other scales, 5 = always, 4 = often, 3 = sometimes, 2 = rarely, and 1 = never. The construct validity criteria (items) followed the criteria of () and the reliability index followed the criteria of ($r \geq 0.70$).

The results of the validity test showed that the correlation score was greater than (0.30) which means that the questionnaire for teacher competence and effective learning was valid and can be used. The alpha value of the reliability test using Cronbach Alpha for the teacher competency questionnaire was 0.823 while the alpha value for the effective learning questionnaire was Alpha 0.815 so that these two instruments had high reliability.

Effective Learning Scale (ELS)

To determine the effectiveness of learning, the researchers compiled a scale of effective learning that consists of eight indicators and 24 statement items with five alternative answer choices (5 = always, 4 = often, 3 = sometimes, 2 = rarely, and 1 = never). The ELS used Indonesian because the participants were involved in Indonesian students (native language). The examples of statements in ELS were "I feel curious about the material to be studied", "I feel enthusiastic when the material is taught, and" I play an active role during group activities". The ELS instrument has been tested for validity with a correlation coefficient of 0.4, this figure is considered valid. Meanwhile, the Cronbach alpha obtained was 0.78.

Procedure

The researchers distributed a Google Form questionnaire which was then filled in by students as research subjects. The research data collected were the data of leadership style, teacher competence, and the effectiveness of science learning which was analyzed using path analysis assisted by Lisrel software.

Data Analysis

The collected data were analyzed using path analysis assisted by Linear Structural Relationships (Lisrel 8.80) software. Path analysis is used to see the relationship between the variables in this study. Through path analysis, authors can see both a direct relationship and an indirect relationship between variables.

Results

Questionnaire Analysis

Based on the results of the questionnaire analysis, research data on leadership style, teacher competence, and effectiveness of science learning based on students' perspectives had been obtained. The results of the data analysis are shown in Table 2.

Table 2.
Analysis Results

Variables	Subvariables	Symbol	Average Value
Leadership Style	Democratic	X1	81.47
	Laissez-faire	X2	51.76
Teacher Competences	Professionalism	Y1	67.52
	Teacher pedagogy	Y2	68.47
	Teacher Personality	Y3	69.31
	Teacher Social	Y4	69.47
Science Learning Effectiveness		Y5	89.09

Path Analysis

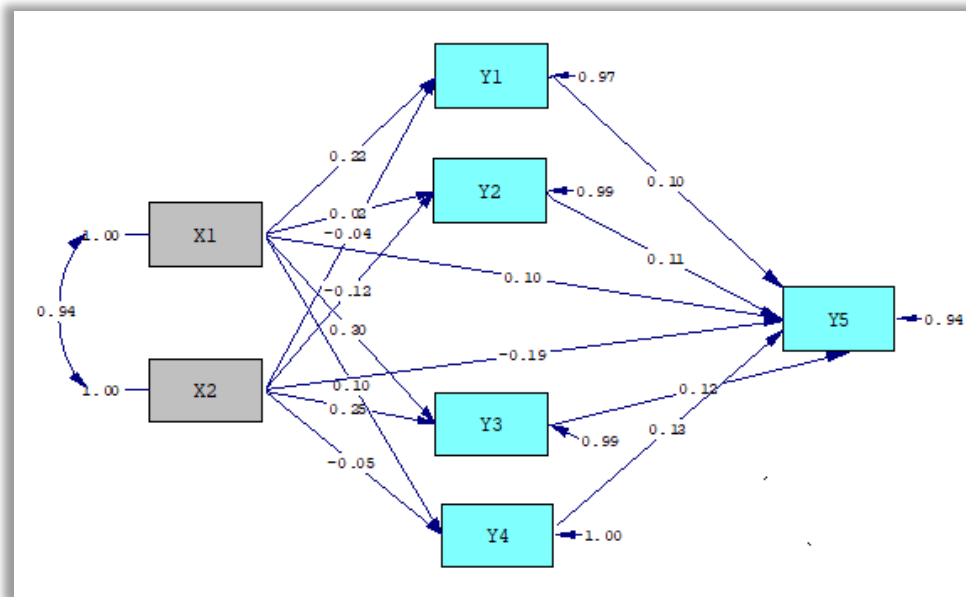The data was then analyzed by using path analysis using the Lisrel software as shown in Figure 4.

Figure 4.
The Path Diagram

The equation used in the analysis is as follows.
Y1 = 0.22 x1 – 0.04 x2 + 0.97e1
Y2 = 0.02 x1 – 0.12 x2 + 0.99e2
Y3 = 0.30 x1 + 0.25 x2 + 0.99e3
Y4 = 0.10 x1 – 0.05 x2 + e4
Y5 = 0.10 x1 – 0.19 x2 + 0.94e5
Y5 = 0.10 y1 + 0.11y2 + 0.12y3 + 0.13y4 + 0.94e6

Picture description:
X1: Democratic Leadership Style
X2: Laissez-faire Leadership Style
Y1: Teacher Professional Competence
Y2: Teacher Pedagogic Competence
Y3: Teacher Personality Competence
Y4: Teacher Social Competence
Y5: The Effectiveness of Science Learning

The results of the simultaneous influence are as follows:

The simultaneous influence of the democratic leadership variable (X1) and laissez-faire leadership (X2) variable on effective learning (Y5) was F = 1.777; p> 0.05 which means there was no simultaneous influence. The value of the correlation coefficient was (Rsquare = 0.15) which means that the influence of leadership style variable on effective learning was 15%.

The simultaneous influence of the professional competence (Y1) variable, pedagogic (Y2), personality (Y3), and social (Y4) on effective learning (Y5) was F = 3,200; p <0.05 which means that there was no simultaneous influence. The value of the correlation coefficient was (Rsquare = 0.51) which means that the influence of teacher competency variables on effective learning was 51%.

The Goodness of Fit Test

Pedhazur (1997) provides overall fit criteria if the Goodness of Fit Index (GFI) value is more than 0.90 and the Adjusted Goodness of Fit Index (AGFI) value is more than 0.80. If the chi-squared, RMR and standardized RMR values are equal to 0, the path analysis model possesses the perfect fit criteria.

Based on the calculation results, the value of the Goodness of Fit Index (GFI) = 0.994 (GFI> 0.90) and the Adjusted Goodness of Fit Index (AGFI) value = 0.971 (AGFI> 0.80), thus, it can be concluded that the path analysis model in this study possesses the overall fit criteria. The interpretation of the diagram is shown in Table 3.

Table 3.
Interpretation of the Path Diagram

No	Causal Relationship	Path Coefficient	Conclusion
1	X1 → Y1	0.22	Significant
2	X1 → Y2	0.02	Significant
3	X1 → Y3	0.30	Significant
4	X1 → Y4	0.10	Significant
5	X2 → Y1	-0,04	Not significant
6	X2 → Y2	-0,02	Not significant
7	X2 → Y3	0.25	Significant
8	X2 → Y4	-0,05	Not significant
9	Y1 → Y5	0.10	Significant
10	Y2 → Y5	0, 11	Significant
11	Y3 → Y5	0.12	Significant
12	Y4 → Y5	0.13	Significant
13	Y5 → X1	0.10	Significant
14	X2 → Y5	-0.19	Not Significant

Based on these results, the direct influence between variables can be interpreted as follows:

The direct influence of the democratic leadership variable toward science teachers' professional competence variable was 0.22.

The direct influence of the democratic leadership variable toward science teachers' pedagogic competence variable was 0.02.

The direct influence of the democratic leadership variable toward science teachers' personality competency variable was 0.30.

The direct influence of the democratic leadership variable toward science teachers' social competence variable was 0.10.

The direct influence of the laissez-faire leadership variable toward the science teacher professional competency variable was -0.04.

The direct influence of the laissez-faire leadership variable toward science teachers' pedagogic competence variable was -0.02.

The direct influence of the laissez-faire leadership variable toward science teachers' personality competency variable was 0.25.

The direct influence of the laissez-faire leadership variable toward science teachers' social competence variable was -0.05.

The results of the indirect influence are as follows:

The indirect influence of the democratic leadership variable toward learning effectiveness through the professional, pedagogic, personality, and social competence variables was 0.038.

The indirect influence of laissez-faire leadership variable toward learning effectiveness through professional, pedagogic, personality, and social competence variables was 0.010.

Discussion and Conclusion

The first finding of this study was that the variable of democratic leadership had a positive and significant effect on the science teachers' professional competencies variable. Meanwhile, the laissez-faire leadership variable had no significant effect on science teachers' professional competency variables. The democratic leadership variable had a positive and significant effect on the pedagogic competence variable of science teachers. Meanwhile, the laissez-faire leadership variable had no significant effect on the pedagogic competence variable of science teachers. The democratic leadership and laissez-faire variables had a positive and significant effect on the science teachers' personality competency variables and the democratic leadership variable had a positive and significant effect on science teachers' social competence variable. The laissez-faire leadership variable had no significant effect on science teachers' social competence variables.

Other research also found that in laissez-faire leadership, school conditions are not monitored adequately to be successful. The teachers receive little guidance that could not support them to be effective on teachers' professionalism (Stein, Macaluso & Stanulis, 2016). The laissez-faire principal who shared power with highly motivated beginner teachers allowing them to have sufficient room to develop a shared responsibility for implementing school goals and

directions (Muijs & Harris, 2007; Szeto & Cheng, 2018). Pedagogical leadership, directly and indirectly, affect teachers' development. The better the pedagogical leadership (authority, modeling, reinforcement, pedagogical affection, firmness, and sincerity), the better the growth and development of teachers by realizing the independence and the opportunity to improvise and self-development (Gewasari, 2016). Other findings also declared that transformational leadership in colleges in most situations can increase the laissez-faire leadership style (Ngussa & Mengo, 2007).

The second finding of this study was that all categories of science teacher competency variables, namely professional competency, pedagogic, personality, and social competence variables, positively and significantly affected the effective learning variable. Lalin's findings also conclude that pedagogic competence and professional competence have a positive and significant effect simultaneously on students' learning outcomes (Dewi, Suharsono & Haris, 2014).

The final finding of this study was that the democratic leadership style variable had a positive and significant effect on the effective learning variable while the laissez-faire leadership style variable had no positive and significant effect on the effective learning variable. Based on these results, it can be seen that the democratic leadership style was more effective than laissez-faire leadership for effective learning. In line with research by Fitriani's (2018), the democratic leadership style of madrasah principals covers the school principal's decision on the results of deliberation, considerate, provides opportunities for subordinate career development, always accepts subordinates' criticism, creates a family atmosphere, recognizes shortcomings and weaknesses, communicative with subordinates, and responsive to situations has been done well. Astuti, Aunurrahman & Wahyudi's research (2019) shows that there is a significant influence of the democratic leadership style of kindergarten principals on teachers' performance.

Limitations of the Study

The limitation of this study was that the laissez-faire leadership style had no significant effect on the professional competencies and pedagogic competencies of science teachers because they had mastered and were mature enough to comply with all applicable regulations. Leaders delegate full authority to subordinates by following the wishes of subordinates, limiting communication, almost no supervision of the attitudes, behavior, and activities, prioritizing personalities than the organization, organizational success becomes the responsibility of individuals, and avoiding coercion and pressure.

This research implies that through professional competencies, teachers have high expectations of student learning achievement and teachers can carry out continuous learning and cognitive, affective, and psychomotor assessment of each student to develop talents in science learning. thus, science class students can develop their talents and interests according to the competencies they have achieved.

Recommendations

This research is limited to two styles of leadership on teacher competencies and effective learning. For further studies, it is expected to see the influence of several other leadership style variables besides democratic and laissez-faire leadership on teacher competencies and effective learning. Based on the findings, it is also important for schools to pay attention to science teachers' leadership styles and competencies, teachers should have democratic leadership styles in learning.

Acknowledgments

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