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THE CHARACTERISTICS OF TEACHERS IN EFFECTIVE SCHOOLS: A SECONDARY ANALYSIS OF TALIS

Research article

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Abstract

The purpose of the study was to determine the characteristics of teachers who were effective in classifying low- and high-performing schools in PISA 2012 for Singapore. The TALIS 2013 teacher survey was used to identify the variables, and the data were obtained from the OECD official website. All schools participating in the PISA 2012 were ranked in terms of average achievement scores and the schools in the top, and the bottom 25% were selected for analysis. Given the structure of the research data, the IDB Analyzer program was used, and the data were resolved using binary logistic regression analysis. According to the results, teachers' scores on the Classroom Disciplinary Climate, Self-Efficacy, and Teacher-Student Relations scale significantly changed in terms of the possibility of schools' success in PISA 2012. The findings of the study were also discussed within the scope of the related literature.

Keywords: Effective school, PISA, school improvement, effective teacher

1. Introduction

The digital world is progressing rapidly, and this requires students to develop more complex and multidimensional skills to keep pace with development and change. These multidimensional skills can be called 21st century skills or high-level cognitive skills or learning and communication skills. However, Wagner (2008) listed these skills as critical thinking and problem solving, curiosity and creativity, cooperation and leadership, adaptation, initiative, effective reading and writing skills, and accessing and analyzing information. The remarkable point in this definition by Wagner (2008) is that these skills do not only include cognitive but also metacognitive skills. In this case, it turns out that these skills should be handled not through a direct curriculum but with integrated and interdisciplinary disciplines using a holistic approach to support these skills. In this case, the training of individuals with the 21st century skills required by social and economic life has become the task of education systems. Education is an indispensable tool for countries that want to achieve economic and social development and change in an increasingly competitive environment (Darling-Hammond, 2012). At this point, it is important to discuss what education could do to create schools as effective organizations.

1.1. Effective School

The results of surveys on national or international scale show that the academic performance of schools with similar characteristics can be different (Coleman, 1990; OECD, 2010). This brought the concept of school effectiveness to the agenda. The concept of school effectiveness, quality, or achievement standards has been a central concern of education debates. In the post-1980s in particular, it emerged as a concept to be studied in relation to organizational effectiveness. Although this concept was first introduced in the 1930s, there is no consensus on the conceptualization and measurement of school effectiveness in the related literature. Cameron (1978) presented a model in the literature that includes variables that are considered important for school effectiveness, taking into account the criticisms of previous models

(whether or not the criteria vary from school to school or are not suitable for school, changes in time, global, or local norms, etc.). This model has become a reference for other models and has been used in the area of effective school research (Ashraf & Abd Kadir, 2012). In this model, one of the educational variables for school effectiveness is the academic development of the student. In other words, the academic development of the student and the opportunities offered by the organization to improve the academic performance of the student are criteria for school effectiveness. Despite Cameron's (1978) detailed framework, student achievement is the most commonly used measure for identifying effective schools (Reynolds et al., 2014). The most important reason for this is that student academic performance or literacy is seen as the most important output of the education system.

Students with high academic achievement have many advantages in the future in terms of going to university or finding employment (Zimmermann et al., 2015). By contrast low academic achievement negatively affects an individual's entire life and, in the long term, limits the country's innovative endeavors, production capacity and, correspondingly, its economic growth. (OECD, 2012). When these important outputs are taken into consideration, the fundamental point of focus becomes improving students' learning and success and developing education programs in accordance with student needs (Cambron-McCabe, 2002). In addition, international large-scale testing programs frequently focus on student achievement and literacy; their results affect education systems and are considered important by educational authorities (see Sjøberg, 2015). As a result, research on what makes an effective school focuses on the effects of schools and the activities carried out at school to improve students' academic development.

School effectiveness is closely related to how much it can improve students' academic achievement, literacy, and other skills. An effective school is described as an organization that provides more room for improvement in student outcomes compared with other schools having similar inputs (Sammons et al., 1995). In this case, the effectiveness of a school seems to be related to the quality of the educational experiences it offers. However, it is possible to talk of many factors that make a school effective. Some of them may be more effective than others in making a school effective. Generally, it is believed that educational development and change are dependent on the quality of both instruction and the teacher.

1.2. Effective Teacher

It can be seen that teachers have been the fundamental focal point of educational reform in recent years and it seems that in many countries there are efforts to train and maintain qualified teachers by providing support and incentives (OCED, 2005). Researchers and policymakers all over the world are focusing on teacher quality as a driving force to improve learning outcomes and thus elevate that country's economic competitive strength on a global scale (OECD, 2004, 2005). Research on the effects of teacher behaviors on learning outcomes has increased in recent years (Darling- Hammond, 2000). The results of these studies showed that about 15% to 25% (Van de Grift, 2014) of the differences in learning outcomes might be explained by the teacher level variables (e.g., Klusmann et al., 2015; OECD, 2005). So, the key question became "What is it that effective teachers do in class to improve student achievement?"

In the literature, there is no common definition of effective teacher. This may be due to the fact that the qualities and standards required for effective teacher are a multidimensional subject influenced by many different factors. Considering that each teacher and student has different physical and psychological features, it stands to reason that teachers behave differently or use different teaching approaches depending on their students. A teaching-related approach or practice may work in one classroom, but not in another. As a result, it becomes difficult to make a common definition of effective teacher behavior (Rivkin et al., 2005). In

parallel with these arguments, different approaches with respect to measuring teacher quality emerged in different cultures and the definition of teacher quality varied from one country to the next. Recent studies have shown that cultural roles of teachers can differ from country to country (e.g., Shimahara & Sakai, 1995; Welmond, 2002). In addition to this, the teacher's role in school and approaches to teaching are affected by the school's national organization as well as political approaches. (Zembylas, 2005).

Many recent studies address effective teacher characteristics in relation to high student achievement (e.g., Chetty et al., 2014a, 2014b; Gershenson, 2016; Rivkin et al., 2005). In natural class environments, observable effective teacher behaviors can be seen such as establishing effective class management, creating a trustworthy class environment, applying active learning through different learning strategies, and diversifying instruction (Baumert et al., 2010; Rikkert et al., 2018; Sammons et al., 1995). Accordingly, the teacher characteristics examined in this study are teacher job satisfaction, teacher-student relations, classroom disciplinary climate, constructivist beliefs and self-efficacy.

1.2.1. Teacher job satisfaction

Job satisfaction is the emotional response of the employee to his job individually (Mercer, 1997). According to this definition, job satisfaction is a concept that encompasses several positive and negative emotions that employees have about their jobs. Furthermore, job satisfaction is closely related to how individuals perceive working conditions in the workplace (Johnson & McIntyre, 1998) and is seen as a feature relating to an individual's willingness to work effectively at work (Ostroff, 1992). In conclusion, a teacher's job satisfaction has an important effect on his or her productivity in the school. Therefore, job satisfaction becomes an important topic for managers, employers, or policymakers.

Many studies on teacher job satisfaction exist and they have found that various factors such as recognition and appreciation, salary, decision-making power in the workplace, student-teacher relationships, work pressure, and school resources are closely related to job satisfaction (Klassen & Chiu, 2010; Sargent & Hannum, 2005; Song & Mustafa, 2015). Considering the important position occupied by teachers in affecting student achievement, it would not be wrong to associate better educational outputs with teachers having high levels of job satisfaction (Heat & Garrett, 2010). There are many studies in this regard showing a positive and meaningful relationship between teacher job satisfaction and student cognitive and motivational development (e.g., Banerjee et al., 2017; Shoshani & Eldor, 2016).

1.2.2. Teacher-student relations (TSR)

Teacher-student relations (TSR), comprises two dimensions, namely, “affective” and “support” (Hagenauer & Volet, 2014). The two dimensions of TSR can be defined as follows: The support dimension represents the professional relationship between students and teachers. For example, teachers and students may contribute mutually to a positive learning environment. The affective dimension relates to the degree of the relationship established between teacher and students. For example, this relationship may be based on sincerity and trust (Newberry & Davis 2008). A positive teacher-student relationship is one based on trust in which students feel like they have a voice and teachers are aware of individual differences (Cornelius-White, 2007). Conceptually, these are described as one aspect of the positive learning environment (OECD 2013a). The positive effects of positive relations on student motivation and academic output are supported in studies by Cornelius-White (2007) and Matsumura et al. (2008).

1.2.3. Classroom disciplinary climate

Positive disciplinary climate is defined as a safe and organized class environment that allows teachers and students to concentrate more on lesson content with fewer class-related shortcomings (Lipowsky et al., 2009). In general, if teachers spend a lot of time creating an organized classroom environment, problems can arise about starting meaningful and effective learning (Mainhard et al., 2011). A series of meta-analysis studies showed that classroom disciplinary climate in an important factor for student achievement (Scheerens et al., 2013; Wang et al.,1993), and there are many studies that show that a disciplinary climate has a statistically meaningful and important effect on students' learning outcomes (Güzel &Berberoglu, 2005; Ning et al., 2015; Sortkær & Reimer, 2018). This relationship is more powerful in groups of more disadvantaged students in particular (Palardy, 2008).

1.2.4. Constructivist beliefs

Learning strategies based on constructivist beliefs support the student's active participation in the process of learning and constructing information (Schunk, 2008). The teacher's role in the process is to support the student in using the processes necessary to construct information. For example, student-centered instruction activates and supports a collaborative learning environment among students and between the teacher and the students. In this way, a cognitively activating lesson supports students' conceptual understanding and the formation of links between phenomena, events, and concepts and directs students to higher-order thinking (Lipowsky et al., 2009). It does this by challenging students' ideas, by creating situations in which there are no clear and certain answers, and by encouraging students to explain, use, and organize their own strategies and solutions. So, cognitively activating instruction has an important effect on learning outcomes in different lessons (Baumert et al., 2010).

1.2.5. Self-efficacy

Self-efficacy is a belief a person has in their own ability to take the necessary action to carry out a task and to do it successfully (Bandura, 1977). Instructional self-efficacy expresses teachers' own judgments about their own ability to accomplish the tasks, circumstances, and conditions necessary to achieve their education goals (Granziera & Perera, 2019). For example, the degree to which teachers believe they can improve student learning no matter how difficult the conditions are all to do with this concept. According to Bandura (1986), what people think, what they believe, and what they feel all affect how they behave and these behaviors both influence the individual's personal characteristics and are influenced by them. In the class environment, this reciprocal effect is key to understanding the relationship between teacher and student. In this regard, teacher self-efficacy is treated as a personal characteristic that can explain the differences in student learning and instructional activities (Muijs & Reynolds 2011). Therefore, teacher professional self-efficacy can influence student achievement in various ways and many studies in the related literature have found a positive relationship between teacher self-efficacy and students' outcomes (Guo et al., 2012; Maguire, 2011; Tournaki & Podell, 2005). Teacher self-efficacy also had both a direct and indirect effect on student literacy (Guo et al., 2012). In this regard, teacher self-efficacy was shown to be a meaningful and positive direct predictor of student achievement and an indirect influence on learning by increasing teacher support.

1.3. The Teaching and Learning International Survey (TALIS)

The OECD encourage policies to improve member countries' economic and social welfare (OECD, 2013b). For the OECD, the development of education is a fundamental and essential strategy for achieving these goals (OECD, 2011) and teachers play a key role in affecting this change in schools. In this regard, the Teaching and Learning International Survey (TALIS)

dataset was used in this study. TALIS, which is one of the “Indicators of Education Systems (INES) projects,” follows the educational experiences of a person from nursery to the very last completed education level by conducting large-scale surveys. TALIS is organized by the OECD at five-year intervals and focuses on the working conditions of teachers and school administrators and the learning-teaching settings in schools. This application is a wide-ranging project to compare school efficiency in member countries and targets both teachers and school administrators. Accordingly, it presents information on teacher training and school development to political decision-makers by giving information about differences between participating countries and by highlighting successful education (OECD, 2009).

1.4. The Present Study

There are few empirical studies on the relationship between teacher quality and students’ outcomes (Akiba et al., 2016). However, in this study, the characteristics of the effective teacher were viewed in the context of student achievement on an international scale. In this study, Singapore was chosen to conduct research on teachers working in schools with high academic performance for several reasons. Singapore is among the best countries in the world in terms of educational system practices and student achievement, and teacher quality is one of the most important factors that explain this success (OECD, 2018). Statistics from the past decade show that this country is among the top 10 countries in international testing practices such as the PISA, TIMSS and PIRLS (Mullis et al.,2016; Mullis et al., 2017; OECD, 2018). Almost all the students (98%) succeeded in the 6th-grade final nationwide exam (Tan & Wan, 2009).

In addition to its achievement in international and national testing, Singapore has a strong economy and a well-educated population. In addition, since 1997, reform initiatives have been implemented by the Ministry of Education (MOE) in Singapore with the vision of "Thinking Schools, Learning Nation" and "Teach Less, Learn More" and teacher professional development programs that have intensified since 2009. However, in Asian culture, in particular, limited analysis has been done on the practices of teaching professional development and their effects (Hairon & Dimmock 2012; Wang 2014). A few schools in Singapore have participated in both PISA 2012 and TALIS 2013 and a connection has been established between these two datasets (OECD, 2013c). Thus, in this study, while analyzing TALIS 2013 data, it was possible to classify schools using a standard criterion in terms of their academic performance.

One of the most important criteria in evaluating the effectiveness of schools and teachers is the development of students’ academic achievement. In this study, the average for school achievement was used as a measurable feature of effective school and teacher quality in accordance with the relevant literature. In this regard, it is important to reveal the qualities of teachers working in high-achieving schools in PISA to determine an effective school and effective teacher profile. In terms of professional development, teachers should be aware of effective teacher characteristics. Being aware of the effective teacher characteristics can guide and encourage teachers to develop their knowledge and skills that will improve student achievement because most of the teachers want to be an effective teacher by improving themselves in their profession. In this respect, more research is needed on effective teacher characteristics to provide data on relevant institutions at the stage of organizing appropriate educational environments that will enable the development of knowledge and skills of effective teacher characteristics, or to establish a system for teacher performance evaluation. Moreover, it is also important in terms of interfering with factors affecting the development of schools and accountability to their stakeholders to determine the characteristics of teachers that affect students' academic performance and examine them with a holistic approach. The aim of this

study is to determine the characteristics of teachers that are effective in classifying low and high performing schools in Singapore PISA 2012.

2. Method

2.1. Sample

This research analyses TALIS 2013 large-scale dataset. The teacher data were obtained through a two-stage sampling design, meaning that first of all schools were sampled and then teachers were selected from among these schools (OECD, 2013c). For the Singapore sample, a total of 4,130 teachers from 172 schools participated in the TALIS 2013, and 166 of these schools also participated in the PISA 2012. All schools participating in the PISA 2012 are ranked in terms of average achievement scores and the schools in the top and bottom 25% were selected for analysis. Other schools participating in the application were evaluated as average-performing schools in terms of success and were not included in the analysis. In the last case, the sample includes 498 teachers from 86 schools (details in table 1)

Table 1. *Descriptive statistics for the teachers in the sample*

	N		Frequency	Percent
Gender	498	Female	277	55.6
		Male	221	44.4
		Under 25	11	2.2
Age	498	25-29	81	16.3
		30-39	209	42.0
		40-49	127	25.5
		More than 50	70	14.1
Educational level	498	Below Bachelor	5	1.0
		Bachelor	2	0.4
		Master's	488	98.0
		Doctorate	3	0.6
		First year	4	0.8
Teaching experience	491	1-2	51	10.2
		3-5	85	17.1
		6-10	137	27.5
		11-15	86	17.3
		16-20	52	10.4
		More than 20	76	15.3

As suggested by Rutkowski et al. (2014) teacher sampling weights were used to regulate the possibilities for the selection of schools and teachers. Using sample weights is also important for controlling sample loss resulting from non-responders. Final teacher sampling weights are included in the TALIS dataset. The dataset was examined in terms of missing values and it was observed that the missing values ranged from 0.06% to 5.4% in all variables, which indicated no problem for analysis (Heck & Thomas, 2015). In addition, the technical report states that the data loss in TALIS data is random (OECD, 2014).

2.2. Variables

The outcome variable looks at whether or not the school is successful or unsuccessful according to PISA 2012 results. To make this classification, all schools participating in PISA 2012 are ranked in terms of average achievement scores. Schools in the top quarter of the

ranking are categorized as high-performing and the schools in the lowest quarter are classified as low-performing schools. The average success score for high performing schools is 659.34, and the average score for low performing schools is 496.64.

In this study, data from the TALIS teacher survey were used for teacher characteristics relating to schools being successful or not in PISA. Many items in the TALIS survey were combined as factors representing latent constructs. To do this, transformation and scaling processes were made using the Item Response Theory approach and index values were obtained that fit the structure (OECD, 2014). In this study, the index values of predictor variables are used. Brief explanations about the predictor variables of the study are given below (OECD, 2013c):

2.2.1. Teacher job satisfaction

This scale provides information on the teacher job satisfaction scale within the current work environment using four items (e.g. "I would like to change to another school if that were possible," " I enjoy working at this school") and satisfaction with the profession using three items (e.g. "I regret that I decided to become a teacher," "If I could decide again, I would still choose to work as a teacher"). Response categories on a four-point scale varied from "strongly disagree" to "strongly agree." Some items with negative statements were reverse coded.

2.2.2. Teacher-student relations

This scale provides information on teacher-student relations and there are four items (e.g., "Most teachers in this school believe that the students' well-being is important", "In this school, teachers and students usually get on well with each other)" in this scale. Each item in the scale had four response categories varied from "strongly disagree" to "strongly agree."

2.2.3. Classroom disciplinary climate

Teachers answered four items measuring the classroom disciplinary climate (e.g., "Students in this class take care to create a pleasant learning atmosphere," "I lose quite a lot of time because of students interrupting the lesson"). Each item had a four-point scale from "strongly disagree" to "strongly agree." Some items were reverse coded as they had negative statement.

2.2.4. Constructivist beliefs

The index of constructivist beliefs was measured by four items (e.g., "My role as a teacher is to facilitate students' own inquiry," "Students learn best by finding solutions to problems on their own"). The items were measured on a four-point scale from "strongly disagree" to "strongly agree."

2.2.5. Self-efficacy

This scale had three sub-scales – efficacy in classroom management (e.g., "Control disruptive behavior in the classroom," "Make my expectations about student behavior clear"), efficacy in instruction (e.g., "Craft good questions for my students," "Use a variety of assessment strategies") and efficacy in student engagement (e.g., "Get students to believe they can do well in school work," "Help my students value learning"). All three sub-scales had a four-point scale. Response categories were "not at all," "to some extent," "quite a bit," and "a lot."

Cronbach Alpha coefficients are above 0.70 for all scales. The metric invariance analysis from cross-cultural data showed that the highest level of invariance established for the scales. Descriptive statistics for the variables are given in Table 2.

Table 2. *Descriptive statistics for the variables in the study*

	N	Minimum	Maximum	Mean	Std. Deviation
Teacher Job Satisfaction	495	4.47	14.98	11.52	1.57
Teacher-Student Relations	495	4.18	16.49	12.92	1.74
Classroom Disciplinary Climate	471	5.56	14.40	11.15	1.96
Constructivist Beliefs	496	7.63	16.50	13.31	1.94
Professional Collaboration	492	5.38	14.55	9.71	1.58
Self-Efficacy	488	3.92	16.58	10.95	2.10

2.3. Analytic Procedure

Binary logistic regression analysis was used to analyze the data. However, before this analysis was done, it was tested to determine whether or not a multivariate analysis was needed. Firstly, the unconditional model with no predictive variables relating to outcome was tested and variance components originating from teacher and school were examined. Intraclass correlation (ICC) was calculated to evaluate the variance between schools and this value was used to calculate the design effect coefficient (deff). deff = 1 + [(average cluster size) – 1] * ICC formula is used to calculate deff (OECD, 2014). If the value is below 2, it shows that single-level models are suitable for the analysis of data (Peugh, 2010). ICC value showed that 8% of differentiation in terms of outcome variable is due to differentiation between schools. In other similar studies conducted using TALIS data, the variance explained by the schools was below 10%. (e.g., Doğan& Yurtseven, 2017; Fackler & Malmberg, 2016; OECD,2014). As is known, there is no clear breakpoint for the interpretation of ICC (Scherbaum & Ferreter, 2009), but an ICC value higher than 10% can be considered suitable for multilevel analysis (Kahn, 2011). Lastly, considering the ICC value and other relevant research and the fact that the deff value (1.37) was below 2, it was appropriate to analyze the teacher level variables using logistic regression models.

Before the analysis was made, the assumptions of analysis (multiple connections, extreme values, and model data compatibility) were checked. Taking the TALIS sampling structure into account, the research data were made using the International Database (IDB) Analyzer (Version 3.1.17) developed by the International Association for the Evaluation of Educational Achievement (IEA). This analysis program possesses several advantages in terms of being suitable for the use of complex plausible value technology and handling appropriate to such survey sampling designs as TIMSS, PISA, or TALIS. Thanks to these advantages, more accurate standard error predictions are obtained (The IEA International Database Analyzer, 2013).

3. Results

First, the weighted descriptive statistics obtained during the study were calculated; Table3 shows the composite variables examined in this study.

Table 3. *Weighted descriptive statistics for the variables in the study.*

Composite variables	N	Minimum	Maximum	Mean	Std. Deviation
Teacher Job Satisfaction	987	4.47	14.98	11.41	1.53
Teacher-Student Relations	987	4.18	16.49	12.91	1.75
Classroom Disciplinary Climate	932	5.56	14.40	11.00	1.98
Constructivist Beliefs	989	7.63	16.50	13.25	1.89
Professional Collaboration	981	5.38	14.55	9.68	1.57
Self-Efficacy	972	3.92	16.58	10.80	2.11

Six predictors were included in the logistic regression analysis to determine the variables in estimating whether or not the schools were successful in PISA 2012. However, three of them made a statistically significant contribution to the probability equation to predict whether or not schools were successful in PISA 2012. The β parameters of logistic regression analysis and Wall statics, degree of freedom, significance levels, and the Exp (β) (odds ratio) values of these parameters are given in Table 4.

Table 4. *Logistic regression analysis results*

Predictor	ß	SE_β	Wald's χ^2	df	p	eβ(odds ratio)
Constant	-6.445	1.51	7.71	1	0.05	0,01
Professional Collaboration	-0.12	0.09	1.89	1	0.168	0.89
Classroom Disciplinary Climate	0.14	0.06	4.89	1	0.027	1.15
Constructivist Beliefs	-0.02	0.06	0.09	1	0.753	0.98
Teacher Job Satisfaction	-0.01	0.08	0.04	1	0.949	0.99
Self-Efficacy	0.19	0.06	9.86	1	0.002	1.21
Teacher-Student Relations	0.17	0.07	5.49	1	0.019	1.19

According to Table 4, teachers' scores on the Classroom Disciplinary Climate, Self-Efficacy and Teacher-Student Relations scale significantly changed the possibility of schools being successful in PISA 2012. As the β coefficients are positive for these predictive variables, the increase in the scores of these variables increased the likelihood of teacher achievement. In other words, the higher the Classroom Disciplinary Climate, Self-Efficacy, and Teacher-Student Relations score, the more likely the school will achieve in the PISA. Accordingly, a one-unit increase in Classroom Disciplinary Climate scores resulted in a 15% increase in the teacher's odds of achievement in PISA 2012. In other words, the increase in the score that teachers obtained from the Classroom Disciplinary Climate scale increased their probability of

working in a successful school by 1.15 times ($p < 0.05$). A one-unit increase in teachers' Self-Efficacy scores resulted in a 21% increase in teachers' achievement at school, which means high Self-Efficacy scores for teachers increased the probability of success at school by 1.21 times ($p < 0.05$). Finally, a one-point increase in the scores that teachers obtained from the Teacher-Student Relations scale led to a 19% increase in their odds of achievement. In other words, the high scores of the Teacher-Student Relations scale increased the probability of being in a successful school by 1.19 times ($p < 0.05$). According to the standardized beta coefficients, the most important variable that increases the probability of teachers' achievement is the points that teachers get from the Self-Efficacy scale. This was followed by Teacher-Student Relations and Classroom Disciplinary Climate, respectively. According to Nagelkerke R^2 statistics, the relevant variables explained 13% of the variance in school performance.

3.1. Evaluations of the Logistic Regression Model

Some statistics were calculated to evaluate the statistical quality of the established logistics model and these statistics are given in Table 5.

Table 5. *Statistical quality of the established logistics model*

Test	χ^2	df	p
Likelihood ratio test	1169.71	6	< 0.001
Hosmer and Lemeshow	12.13	8	0.145
Cox & Snell $R^2 = 0.09$, Nagelkerke $R^2 = 0.13$			
Kendall's tau-α = 0.20. Goodman-Kruskal gamma = 0.41. Somer's Dxy = 0.40. c-statistic = 70.3			

The likelihood ratio test compares the model with all predictors to the null model with all predictors removed. The test yielded a $\chi^2_{(6)}$ of 1169.71 and was statistically significant ($p < 0.001$; see Table 5). This shows that the formed logistic model is better than the null model. The second test is the Hosmer-Lemeshow, which calculates the chi-square statistic for the frequencies expected and observed in the model. The chi-square value for this test is $\chi^2_{(8)}$ of 12.13 and this value is not statistically significant ($p > 0.05$; see Table 5). This shows that the model fits the data well. (Hosmer & Lemeshow, 2000). Goodman-Kruksal, another method uses to evaluate the formed logistic model, controls the gamma value. This value is related to the model's predictive ability (Adeyemi, 2011). The value for the logistic model was calculated as 0.41 and this can be interpreted as 41% fewer errors being made in predicting success with the model rather than predicting school achievement by chance alone (see Table 5). Another statistic that shows the model's predictive ability is the c statistic, which was calculated as 0.703. This value indicates that the model correctly assigned a higher probability to those who were successful than for those who were not 70.3% of the time (see Table 5). The Goodman-Kruskal gamma and c statistic show that this formed logistic model works in predicting school achievement.

4. Discussion and Conclusion

Many countries participate in international tests and receive feedback on their country's education systems and despite many criticisms, the impact of these tests on education systems is gradually increasing. Therefore, predicting student achievement continues to be an important research area. This study looked at Singapore, a highly achieving country in international tests, to predict school achievement. We used PISA 2012 results to examine effective teacher

characteristics in classifying schools as successful and unsuccessful. Accordingly, the most prominent features of teachers in the most successful schools were revealed in PISA 2012. According to the results of the study, the increase in the scores of teachers on the self-efficacy scale increased the chances of schools being successful. This situation shows the positive effects of teacher's self-confidence on students' outcomes/achievement. Many studies have results that are consistent with this study's findings and have shown that teacher self-efficacy has a positive effect on students' learning outcomes (e.g., Chong & Ong, 2016; George et al., 2018; Malmberg et al., 2014). This situation can explain the differences in classroom behavior and beliefs between teachers with high self-efficacy and other teachers because there are research findings that support this explanation (Miller et al., 2017; Skaalvik & Skaalvik, 2007). For example, there are research findings that show that teachers with high self-efficacy use more positive strategies, particularly in controlling undesirable student behavior, and are generally more positive and sensitive toward their students and clash less with them (e.g., Almog & Shechtman, 2007; Wertheim & Leyser, 2002). The humanist behaviors of teachers with high self-efficacy in classroom management and controlling student behavior makes it easier to form a teacher-student relationship based on trust and a more supportive classroom environment in terms of teaching; as a result of this, student motivation and achievement all improve (Lipowsky et al. 2009). Furthermore, TSE has a positive effect on teachers' classroom management strategies (Martin & Sass, 2010). As was highlighted earlier, effective classroom management can positively contribute to learning outputs (Lipowsky et al. 2009) and involves maximizing the time for learning and teaching and minimizing disruptive student behavior (Künsting et al., 2016). In this case, it is not surprising that the teachers in the most successful schools in PISA 2012 have high self-efficacy.

According to the results of the study, the other characteristics that distinguish successful schools from unsuccessful schools in PISA 2012 are related to the learning environment (relationship between teacher and student and the classroom management environment in the classroom). According to Vygotsky's (1978) theory of learning, student learning cannot take place independent of the learning environment. Therefore, an organized learning environment may be considered a fundamental precondition to improve student learning. Consistent with the findings of this study, many studies have shown that learning environments have an important effect on learning outcomes (Creemers & Kyriakides, 2010; Guo et al., 2018; Ning et al., 2015; Opdenakker & van Damme, 2006, 2007). In this research, the first variable discussed in the context of the learning environment is the teacher- student relations. The results of this research have shown that teachers in successful schools establish a more positive and trust-based communication with their students than those in less-successful schools. This is an expected situation and there is a positive relationship between teacher and student in successful schools. Considering that students spend most of the day at school, it is inevitable that the quality of communication between teacher and student has an impact on student outcomes. There is extensive empirical evidence on the significance of positive teacher-student relationship for students' learning outcomes (see Roorda et al. 2011). More specifically, this shows that classroom activities that support a cordial teacher-student relationship is closely related to learning outcomes (Connor et al., 2005). This situation can be explained by the direct and indirect impacts of the teacher-student relationship on student achievement. For example, students' attitudes towards teacher may affect cognitive learning. Also, a positive teacher-student relationship can improve student attitudes, which in turn can improve cognitive learning (Bloom et al., 1971). In addition, the study by Day and Gu (2014) showed that genial and cordial relationships between teacher and students form a work context that helps teachers cope with the difficulties of the teaching profession. This is further evidence of the indirect effects of teacher-student relations on learning outcomes.

Another variable addressed in the context of the learning environment is the discipline environment. According to the results of this research, teachers in successful schools can form a classroom environment where students feel safe. In classrooms with set rules, the likelihood of behavioral problems emerging in the classroom is reduced and academic achievement and effort become more important both for the teacher and the student. However, in different studies made using PISA data, it was pointed out that the relationship between classroom discipline and student achievement differs from country to country (Ning et al., 2015). For example, a study of classroom discipline and literacy made by Güzel and Berberoğlu (2005) using PISA 2000 data showed a positive relationship in Japan, a negative relationship in Brazil, and no significant relationship at all in Norway. Another study made using PISA 2003 data showed that a positive disciplinary classroom environment produced a positive effect on students' math performance in the United States, Japan, and Korea (Shin et al., 2009). Similar results were obtained in another study of Ma et al., (2013) for East countries like Hong Kong, Taipei, and Japan made using PISA 2009 data. These research results revealed the need to take into account sociocultural variables at the school and student level when interpreting the relationship between classroom discipline and student performance (Ning et al., 2015; OECD, 2010). This situation was also highlighted in the PISA 2009 report (OECD, 2010). This report showed that schools with a more disciplined classroom environment demonstrated only partially better performance because these schools tended to have more students with advantageous socioeconomic backgrounds and it was stated that these students demonstrated partially better performance because positive socioeconomic backgrounds support environments more conducive to learning.

4.1. Limitations and Future Directions

There are several limitations of this study. First limitation of the present study refers to its research design. The conclusions are based on data without the use of experimental research design; therefore, a causality concerning teacher quality and student achievement cannot be established. Accordingly, there is a need for longitudinal or experimental studies that will explore the reciprocal effects between the characteristics of an effective teacher and students' outcomes.

A further limitation is the criterion used to identify successful schools. As was stated earlier in this study, schools were classified according to PISA 2012 achievements. Many studies (see Richardson et al. 2012) showed that non-cognitive factors (motivation, social relationships, stress) have a positive effect on students' learning outcomes. In this regard, it is suggested that while evaluating the effectiveness of schools, research models should be established that consider other criteria besides student achievement. Effective school research also offers broader criteria when evaluating the effectiveness of schools.

The fundamental criterion for effective schools in this study was student achievement as measured by large-scale international applications such as PISA. For future studies, research models could be formed at a national level that pay attention to such variables as gender and socioeconomic level, which are known to have both a direct and indirect effect on learning outcomes. In this way, it will become possible to debate the effect of these variables within the scope of effective school research.

4.2. Practical Implications of the Study

The current study also has several significant implications for teacher training, educational policy makers, and principals. The overall results of this study provide scientific support for

the claim that the characteristics of teachers is an important issue to consider in both research and practice.

According to the results of the study, teacher self-efficacy has a positive effect on students' learning outcomes. So, if the principal aims at fostering self-efficacy in the teachers, the principal could periodically screen teachers' self-efficacy and provide professional support for those teachers with low self-efficacy and take care of the particular needs of a more challenging school environment. In the same way, easy access to professional development is necessary so teachers can improve in their professional experience and better evaluate their own educational needs.

The results of this research have shown that learning environments have an important effect on learning outcomes. At the practice level, it is suggested that get support from school psychologists and to develop cooperation between school psychologists and teachers in order to enable teachers' knowledge about their students' personal characteristics and academic ability.

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