Technische Universität Dortmund

Fakultät Erziehungswissenschaft, Psychologie und Soziologie

The Relationship between School Leadership and

Student Mathematics Achievement

A Comparative Study between Germany and Chinese Taipei

Dissertation zur Erlangung des akademischen Grades Doktor der Philosophie (Dr.

phil.)

vorgelegt von Dan Chen

geboren am 04, Dezember, 1986 in Xinjiang, China

Matrikelnummer 174610

Vorgeschlagener Erstgutachter: Prof. Dr. Wilfried Bos

Vorgeschlagene Zweitgutachterin: PD Dr. Ramona Lorenz

Oktober, 2018

Acknowledgements

Firstly, I want to show my greatest thanks to my advisors Prof. Dr. Wilfried Bos, and Prof. Dr. Kajsa Yang Hansen at University of Gothenburg, for their supervisions and instructions. Thanks to my professor Mr. Wilfried Bos, it's my great honor to be his first Chinese Ph.D student and I thank him for giving me the opportunity to study in Germany that is completely different to China in culture and environment, and for giving all assistances for my Ph.D study. Thanks to Dr. Heike Wendt, I appreciate all contributions she made to my Ph.D study, including her time, ideas, discussion and instructions for my dissertation. The passion and the motivation she has in research make me more confident and motivational for my research. Especially during the final stage of my Ph.D study, she gives many suggestions and feedback to this dissertation, I feel so grateful for the time she contributed. Both of them give me chance to develop my research career and teach me how to be independent in academic research, and also in my personal growth.

The feeling of four-year study in Germany is mixed and this experience makes me mature and independent. The Center for Research on Education and School Development (IFS) at TU Dortmund has contributed much to my personal and professional life in Dortmund, where I spend the most time in Germany. It gives me academic resources and I also get opportunity to learn German language that makes my life stimulating. Thanks to the members of TIMSS/PIRLS. I miss the time that we worked together so much. Regarding my study, I am so grateful for the contribution that Dr. Michael Schurig and Dr. Daniel Kasper made for helping me a lot with data analyses and statistical methodology. Meanwhile, I appreciate the kindness and the nice personality of Martin Goy, Dr. Anke Hußmann, and PD Dr. Rolf Strietholt that when I have any questions regarding my study, they are so kind to give me suggestions in searching literature about German education and school principals. For my later work, I thank Dr. Bo Ning, for giving suggestions and advices on the articles accomplished by our corporate

work. His rigorousness in research makes me have a new aspect for my prospective research and academic career.

I especially would like to show my genuine thanks to my family in China. With their support in spiritual and materially, I am able to finish my Ph.D study productively and successfully. They have been supporting me whenever I encounter the difficulties in my personal and academic life and they give me confidence and motivation to pursue my academic profession. The encouragement they give makes me to be braver and stronger when I stand in front of challenges.

I gratefully acknowledge the funding agency of China Scholarship Council (CSC) to support my Ph.D study at TU Dortmund. I'd also like to appreciate my friends, thank them for spending time with me, and encouraging me when I feel frustrated. With the help from all of you, I feel my life is so beautiful and I am contented for all what I get.

I would also like to thank the members of my disputation committee: Prof. Dr. Wilfried Bos, PD Dr. Ramona Lorenz, and Prof. Dr. Hans-Günter Rolff for many insightful questions they proposed to this dissertation. In particular, for the summary of this dissertation in final stage, I want to show my sincere gratitude to PD Dr. Ramona Lorenz, thanks so much for her rigorous attitude and careful feedback, which enable me to learn a lot.

For this dissertation I would like to finally thank Prof. Dr. Ke Yu at Shanghai Normal University and Prof. Dr. Albert Gardner at Maryland University, for their review and feedback.

My time in TU Dortmund is enjoyable and amazing. Each moment that I study in Germany is a fleeting, precious and unique time. This special experience enriches my life in better understanding of diversified culture and multicultural education.

Dan Chen

TU Dortmund, Germany

October, 2018

Abstract

School leadership acted an important function in student achievement. This study explored the relationship between school leadership of principal and student mathematics achievement in primary schools from a comparative perspective of Germany and Chinese Taipei. The author used TIMSS 2011 data collected from 3,961 fourth-grade students and 197 school principals in Germany and 4,138 students and 150 school principals in Chinese Taipei respectively, to examine the relationship between school leadership and student mathematics achievement with confirmatory factor analysis (CFA), multilevel structural equation modeling (MSEM), and to distinguish the difference in school leadership styles with latent class analysis (LCA). The comparable results revealed a negative relationship between school leadership and student mathematics achievement in Germany but a non-significant relationship in Chinese Taipei. However, the three sub-dimensions of the construct of school leadership, that is, setting vision/goal, school management, and maintain the school climate were significantly associated with student mathematics achievement in both economies, except for setting vision/goal for school in Chinese Taipei. The latent class analysis identified four leadership styles in Germany, that is, the distributed leadership style (26%), the integrated instructional and transformational leadership style (27%), the transformational leadership style (7%), and the instructional leadership style (40%), and two in Chinese Taipei, that is, integrated instructional and transformational leadership style (36%), and the mixed integrated instructional and distributed leadership style (64%). This study aimed to reveal the direct relationship between school leadership of principals and student mathematics achievement. And the results suggested that the influence of school leadership on student mathematics achievement was indirect, meanwhile, the leadership styles were firmly associated with school contexts.

Keywords: school leadership; student mathematics achievement; multilevel structural equation modeling; latent class analysis; TIMSS

Table of Contents

Chapter 1 Introduction

Student achievement is situated at a central point in education research. Researchers take examine factors affect student achievement and how these factors relate to one another. The pay great attention to those factors which seem to have a direct relationship to student achievement but less notice to those factors only indirectly influence student achievement (Darling-Hammond, Meyerson, LaPointe, Cohen, & Orr, 2009). For instance, researchers have argued that teacher quality greatly affects student achievement due to the direct interactions between students and teachers in classroom (Johansson & Bredeson; 2000). As a result, researchers have explore factors such as teachers' classroom behaviors, time spent in teaching specific subjects, instruction time for students, and education policy that improves teaching quality and student academic achievement (Day & Quick, 2009; Hallinger & Huber, 2012; Leithwood & Jantzi, 1999; Mulford, Silins, & Leithwood, 2004). Many interventions and programs have been carried out to examine if student achievement improves alongside changes in the above factors. Especially, many countries have participated in international large-scale assessment (ILSA) programs designed to evaluate what students learned in school, providing empirical evidence for researchers.

The relationship between school leadership and student achievement is still unclear as school principals are situated in a kind of "black-box" (here, the author refers to "School Matters: What the Research Says about the Importance of Principal Leadership[1]) since they do not have direct contact with students (Ross & Gray, 2006). Meanwhile, some researchers have pointed out that research findings gathered based on the relationship between school leadership and student achievement was limited with regard to statistical methodology and the sample size (Goldstein, 1997).

It is a widely held maxim *"[a]s is the principal so is the school"* (Flanigan, 1989).

---

[1] http://www.naesp.org/sites/default/files/LeadershipMatters.pdf

"leadership is second only to classroom instruction among all school-related factors that contribute to what students learn at school", *"leadership effects are usually largest where and when they are needed most',* and *"many other factors may contribute to such turnarounds, but leadership is the catalyst"* (Leithwood, Louis, Anderson, & Wahlstrom, 2004, p. 5). The task of principal is not only manage the school but also improve student achievement for guaranteeing school quality. Thus, those school leaders who are viewed as the "pilot" in schools are required to shoulder the responsibility to make the response to education reform. Some innovations focus on teaching improvement while some place the attention at curriculum development. The innovations need school leaders' assistances as set direction for school, corporate with other staff, and build a trust and comfortable school atmosphere among staff are school leaders' responsibilities.

In both Germany and Chinese Taipei, many implementations are carried out to improve student achievement. For instance, in Chinese Taipei, the reforms for teacher leadership and space leadership for school leaders began at 19th (Chang, 2010; Tang, 2013) and in Germany, develop school quality and school effectiveness became the priority to cultivate student's potentials and improve school quality (see Holtappels 2004, 2007; Holtappels et al., 2008). Stakeholders and researchers who are interested in school effectiveness research, school improvement and school leadership also noticed the comparisons across countries for examining student development. Under such a condition, some researchers, such as Leithwood, Louis, Hallinger and Heck, conducted the empirical research, and concluded that except the teaching factors in classroom, school leadership was the second most important factor in impacting student achievement while purported that leadership only accounted for one-fourth of total school-level effects (Hallinger & Heck, 1996, 1998; Leithwood & Jantzi, 2000). School leadership research confirmed that leadership acted a critical role in student achievement since the principal steers the school by spending most of his/her life in school (Day, 2014). Principals need to work with teachers, school staff, parents and

other stakeholders to promote the school effectiveness, especially the student academic achievement. As a result, the researchers questioned "Do principals make a difference?" (Ebert & Stone, 1988; Maciel, 2005; Pont, Nusche, & Moorman, 2008; Sagor, 1992), and there are several answers concerning different interests of researchers according to leadership styles, school climates, and school organization (McColumn, 2010; MacNeil, Prater, & Busch, 2009; Spicer, Bubb, Earley, Crawford, & James, 2016). However, on the one hand, little research considered the factors from the all-aspect and lacked a strong empirical foundation since the empirical research they conducted was limited to a narrow point (Hallinger & Huber, 2012). On the other hand, over the last two decades, researchers began to question whether school leadership impacted student achievement because 1) few papers or articles particularly concentrated on effective school leadership (Day, 2007), 2) the researchers had different viewpoints on the relationship between school leadership and student achievement (Wilkins, 2012), 3) under some specific conditions, researchers could not assert that school leadership affected student achievement directly or indirectly for complicated reality (Sammons, Gu, & Day, 2016) and the school itself is sometimes like a black-box (Hallinan, 2006).

According to World Bank, both Germany and Chinese Taipei are high-income economies. However, school leadership in Germany and Chinese Taipei represents two typical school leadership formats, specifically, German principals emphasize educational and instructional leadership (Huber, Tulowitzki, & Hameyer, 2017) while Chinese Taipei principals emphasize administrative leadership (Shouse & Lin, 2010). Moreover, German education system is an example of gradually improved in international ranking of student achievement after Programme for International Student Assessment (PISA) 2000 while Chinese Taipei education system is an example of consistent high-ranking system in cycles of International Mathematics and Science Study (TIMSS) surveys. In TIMSS 2011, the grade-four students in Chinese Taipei still largely outperformed their German peers in mathematics, with 34% of

Chinese Taipei students but only 5% of German students being in advanced level (Mullis, Martin, Foy, & Arora, 2012). This study aimed to enrich our understandings of the relationship between school leadership and student mathematics achievement in the two typical Asian and European contexts.

Due to the invisibility of school leadership, the author used the time allocation to principals' leading activities as a measure of school leadership in TIMSS 2011. The author expected to examine the ways in which principals' work time influenced student mathematics outcome (direct v.s. indirect, positive v.s. negative) by considering school leadership in general as well as separated leadership components in Germany and Chinese Taipei. The structrual equation modeling design in this study enabled us to control the context variables that affect the relationship between school leadership and student mathematics achievment in both economies. And then the latent class analyses provided the evidence of school leadership style differences between the two economies in detailed. The author intended to give more pragmatic implications to profound studies based upon this school leadership study.

This study was comprised by the chapters of introduction, study context, literature review, methodology, resluts, conclusion and discussion. The contribution this study made was summarized by the following points.

First, this study tended to widen further research on school leadership, school improvement, and school effectiveness research from the empirical research perspective. The methodologies the author used in this study were confirmatory factor analysis (CFA), multilevel structural equation modeling (MSEM), and latent class analysis (LCA), aiming to draw a guideline for researchers and relative stake holders based on evidenced education.

Second, in this study, the author clarified three characteristics of school principals in detailed (the later Chapter 3) and drew attention on the effect that the particular characteristics of school leadership on student math achievement in Germany and Chinese Taipei, respectively. Based on the dynamic model from Creemers (Creemers,

2010), the author compared the difference between Germany and Chinese Taipei by the same model. The results presented in later chapter (Chapter 5) might induce some relative knowledge to be added in school effectiveness research.

Third, the empirical comparative study between Germany and Chinese Taipei was rare. This study introduces school leadership in Germany and Chinese Taipei within different education system, providing the space for school principals in the two economies to learn from each other. School development and student academic achievement have been placed on the priority in each country since they are not only the reflection of what students learned but also the mirror of the education system. Each country is inspired to discover the problems of its education, aiming to further improve student attainment. As school leadership is the second most significant factor after teaching in school (Leithwood et al., 2004), it is principals' responsibilities for developing student achievement and school quality. The relevant study on principal effectiveness offers the space to improve school leadership in both Germany and Chinese Taipei.

Fourth, many countries emphasized on principals' "professionlization", such as the knowledge and the practical skills of leading the school. Leadership knowledge and leading competency are cores of school leadership as leadership knowledge is the internal embodiment and leading competency is the outward forms. Researchers know that principal's behaviors make a great devotion to creating a healthy school climate and maintaining the high teaching quality (e.g., Elliott & Clifford, 2014). This study drew attention on professional school leadership by providing the relative training and selection systems of school principals in Germany and Chinese Taipei, aiming to assist the relevant stakeholders who are interested in developing school leadership professions.

The function that school principals act is non-ignorable while great differences in school leadership existed in Germany and Chinese Taipei. To keep education equity for students and develop student achievement are accountabilities of education. The

role that principals played has changed dramatically in terms of the situation of school autonomy, accountability for outcomes, and learning-centered leadership[2]. The latest activity to improve school leadership sponsored by Organization for Economic Co-operation and Development (OECD) showed school leadership was important for effective teaching and learning, revealing that school leadership improvement becomes the priority for school quality[3]. The purpose of this study is to conduct the analysis of the overall and specific effects of school leadership on student mathematics achievement while the author emphasized identifying the relative impact of different types of leadership within different educaiton contexts (Germany v.s Chinese Taipei). The subsequent chapters comprised by the student contexts (Chapter 2), literature review (Chapter 3), methodology and theoretical framework (Chapter 4), results (Chapter 5), as well as conclusions and discussion (Chapter 6), tending to present the study in detailed.

---

[2] See the details, from http://www.oecd.org/education/school/improvingschoolleadership-home.htm
[3] See the details, from http://www.oecd.org/education/school/44612785.pdf

Chapter 2 Study contexts in Germany and Chinese Taipei

The school process is entirely embedded in the school context, meaning that the school context inevitably influences the schooling process. In particular, the particular organization of a school tends to produce specific group behaviors, such as teaching behaviors and principal management behaviors. For instance, students in a school that places high expectations in terms of learning outcomes and an orderly atmosphere tend to have better outcomes than those in less orderly and secure school environments (Hay, Ashman, & Van Kraayenoord, 1997; Marsh et al., 2001). Hence, school achievement is the product of school context and organization. The school – as one element of social organizations – is affected by organizational characters as well as the specific culture of the country. School systems and the education management system offer partial reasons to explain the differences between the management and organizational behavior of principals. The management system is influenced by organizational culture and the organizational construct, which not only affects the principal's behavior but also influences the orientation and the vision/goals for the school (Mullins & Christy, 2010). Principals are responsible for education equality, and it is also their responsibility to maintain a healthy school organization (Bol, Witschge, Branch, Hanushek, & Rivkin, 2013; Fuchs & Wößmann, 2008; Montt, 2011; Müller, Dedering, & Bos, 2008; Witschge, Van de Werfhorst, & Dronkers, 2014). Education management is embedded in the school system.

This chapter focuses on the study context, including school systems (section 2.1), management systems (section 2.2), educational inspections (section 2.3) and the selection of principals (section 2.4) in Germany and Chinese Taipei.

2.1 School systems in Germany and Chinese Taipei

School organization is the responsibility of school principals or head teachers. Principals tend to keep the original situation of schools if they lack competitors. The

school system – alongside school organization – tends to affect school principals' effectiveness and student achievement. The role that they play is like a hinge, whereby they firmly interact with the leadership and followers as well as other stakeholders. Creemers and Kyriakides posit that student learning and achievement is affected by the broader context, which includes the national/regional context, the social context as well as the school context (Creemers & Kyriakides, 2010). Hence, the differences between school systems in Germany and Chinese Taipei is the starting point of this comparative study.

The German education system is notable because it has four years of primary education (Grundschule) in most states (except in Berlin and Bremen, which have a six-year primary education). Each state has the right to make its own decision on education law and the education system, although they are guided by the Federal Education Ministry when they make the decision on education law and the school system. After primary school, the students may have different options to determine further education, such as the Hauptschule, Realschule, Gymnasium and Gesamtschule. The education system in Chinese Taipei follows the school system of the United States, in which the students spend six years in primary school, three years in junior middle school and another three years in senior middle school. After basic education, students are required to attend the national exam, which is prepared to attend high education. On the other hand, all primary schools in Chinese Taipei are all-day schools that require the principals and teachers to spend more time ensuring security while guaranteeing the safety of students in school.

In Germany, prior to the union of Western and Eastern Germany, the education system was different. In Eastern Germany, education was highly centralized and cultivated the students to be the *allseits entwickelte sozialistische Persönlichkeit* (comprehensive socialist personality) (Marsh, Köller, & Baumert, 2001) and the education system was characterized by collectivism. The education system was divided into three phases, which required students at the age of six years to attend

primary school covering grade one to three, then the students were required to continue attending grade four to six, which was in the second education phase in *Polytechnische Oberschule*. Finally, after grade six, the students were assigned to grade seven, in which they spent three years covering from grade seven to ten. All students were situated at the same level and there was no level separation according to the students' ability (Marsh et al., 2001). Compared with the Eastern German education system, the Western German education system was liberated. After the union, the Eastern German education system was removed by the new government, whereby the Western German education system became the universal education system. The early stratification of German education is attractive, while it is also viewed as the main distinction from the education systems of other countries. One of the advantages of stratification is that it provides more education equalities for students in line with their abilities and competencies. On the other hand, the students also benefit from it due to the varied requirements of the labor market. However, the early stratification also brings additional burdens and pressures for teachers and principals, given that family background is inclined to affect student achievement to a strong extent (Jencks & Mayer, 1990; Teltemann & Schunck, 2016). Consequently, the education stratification firmly reflects the students' family economic status stratification (Erikson & Jonsson, 1996; Flore & Horn, 2009).

2.2 Educational management in Germany and Chinese Taipei

Germany is politically sub-divided into sixteen federal states, each of which is responsible for the design and management of its education system, including regulations, teaching methods and management/organization. However, although it includes many different management styles, the German education system is partial to a bureaucratic style in each state (Huber, 2016). In most states, there are four levels of administration organization, such as in Bavaria, North Rhine-Westphalia and Baden-Württemberg, where education administrations are comprised by the state

education ministry, the regional administration, the school office and the school leaders of each school (Huber, 2010; Huber, 2016).

At the federal level, the *"Kultusministerkonferenz"* (conference of culture ministry) exists to connect and coordinate the work of the different education administrations. Accordingly, the federal education ministry has a limited right to legislate relevant education policy. The responsibility of *Kultusministerkonferenz* is to cooperate with other states in determining education systems and relevant education rules, while it is also responsible for affairs concerning high education and continuing education. The purpose of local education authorities such as the municipal or district education authorities is to maintain the balance of the school choice. The regional or municipal education administration has the power to recruit teaching staff. It also supervises and inspects education quality, and assists in school development through cooperation with school principals. The third level is the school office in most states, such as Bavaria, North-Rhine Westphalia and Bad-Württemberg. However, in some cities such as Hamburg, Bremen and Berlin, there are only two levels in the education management system. School leaders are situated at the bottom as the fourth level.

As one part of education management, the German education inspection system comprises five parts involving the conventional school supervisory authority, external school inspections, internal school inspection, standardized testing as well as periodical observation reports (Bildungsbericht Deutschland; Huber et al., 2006). The supervision component incorporates threes aspects, whose major focus is on academic achievement, staff in public schools and legal affairs. The external inspection is implemented by inspectors who are required to have experience in statistics, empirical research and knowledge regarding information technology (Landesschulamt und Lehrkräfteakademie, 2014). An internal inspection comprising self-evaluations by head teachers is also conducted in schools. The purpose of external and internal inspections is to promote school quality and school management, as well as school

leadership (see Hessisches Kultusministerium, 2014)[4]. As one part of the inspection system, a steering group comprising teachers, parents and head teachers (the latter are allowed to be members but not leaders of these group) aims to develop the organization with a non-hierarchical structure. The principals discuss school development profiles and problems regarding school development and they also initiate discussions among teachers and parents (Feldhoff et al., 2010). The steering group exerts influence on the school leadership via the collaboration with school staff, albeit not sharing responsibilities. The German education inspection administration is dependent, although its connection structure seems like a hierarchical structure. The members of the steering group in each school are principal, teachers and parents, but not as an entity of the inspection authority.

The following Figure 1 depicts the education inspection administration system in Germany.

---

[4] Hessisches Kultusministerium (2014). *School Inspection in Hesse/Germany*. Hesse: Germany.

Figure 1 Educational inspection administrations in Germany
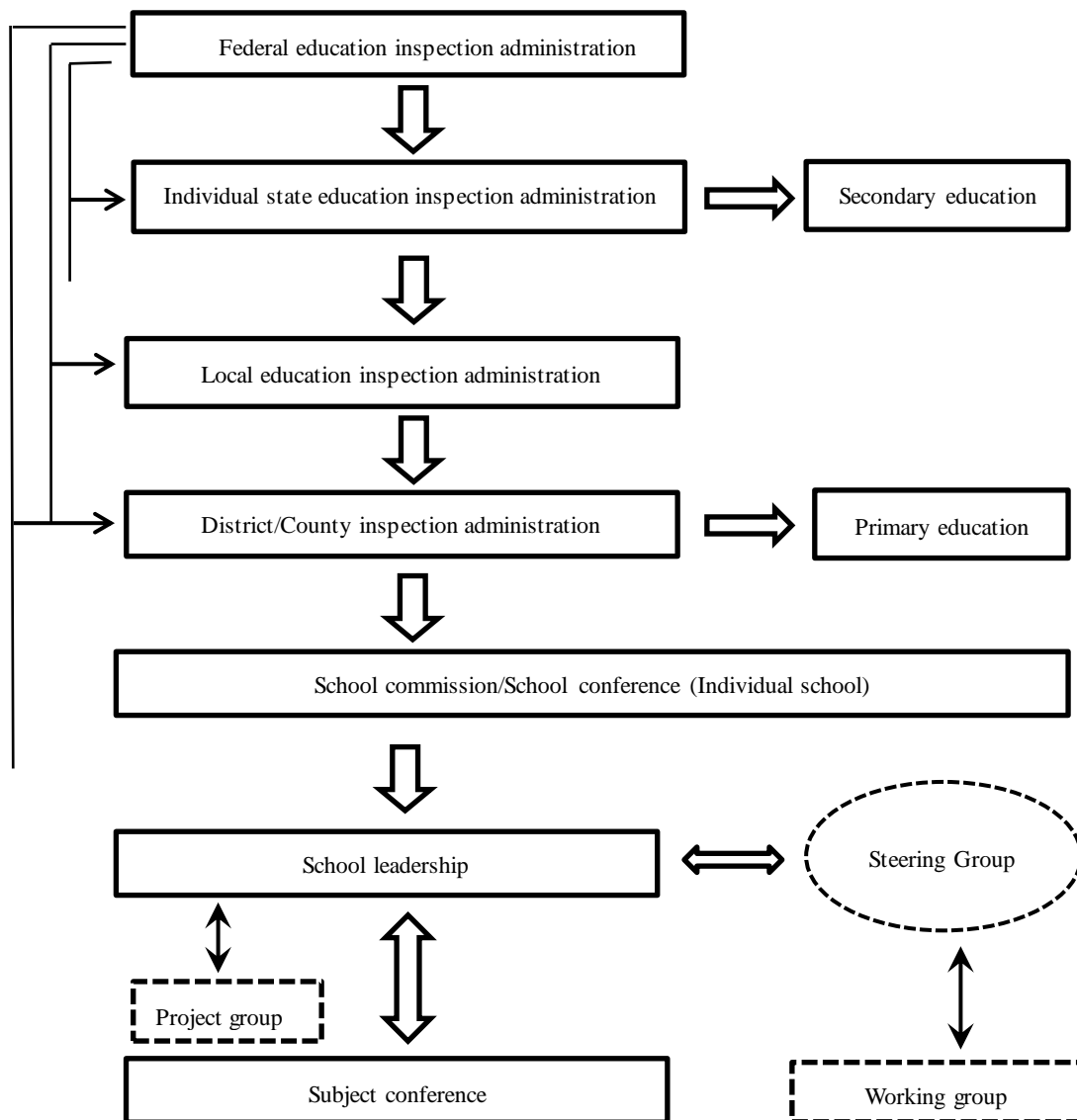
Compared with Germany, in Chinese Taipei the education administration has three levels, incorporating the central-, municipal- and county-level authority. Education inspection began to be mainstream from 1995, when principal effectiveness started to play a role in education inspection (Pan, 2004). In most cases, the three-level inspection authority is hierarchical, meaning that the central education ministry is situated in the top position and has the right to stipulate education law and supervise the local and municipal education authority. The education inspection system is separated into two aspects, namely cross-sectional and vertical. The

cross-sectional education inspection system refers to the system situated at the same level, such as the different inspection authorities located in different municipals or counties. The vertical education inspection system represents the hierarchical system, which refers to those inspection authorities located at the central education ministry, the ministry office, the municipal authority and the county authority.

The aim of school inspection is to supervise the school process to confirm whether it approaches the educational vision or goal. Besides, it also aims to gain information on school effectiveness and recognize the defects of school development. Thus, the inspection of principals becomes one part of the education inspection (Huang, 2004; Jiang, 2002). The inspection authorities in Chinese Taipei are nested in the education administration authorities, meaning that the inspection authorities are not independent. In Chinese Taipei's education inspection administration, several inspectors are situated at the inspection office at each level. The inspection office is taken as the entity in which the province/municipal inspection administration is located. The inspectors are taken by the staff who work in the education administration, who are required to be responsible for both education management and education inspections. For instance, the inspector is responsible for improving principal effectiveness and school effectiveness according to the inspection discipline.

The following Figure 2 depicts the education inspection administration system in Chinese Taipei.

Figure 2 Educational inspection administrations in Chinese Taipei

```
┌─────────────────────────────┐         ┌─────────────────────────────────┐
│      Education ministry      │  ═══▷   │ All kinds of schools except high │
│                              │         │             school               │
└─────────────────────────────┘         └─────────────────────────────────┘
              ║
              ▽
┌─────────────────────────────┐   ┌──────────────────┐   ┌─ ─ ─ ─ ─ ─ ─ ─ ─┐
│ Province/municipal inspection│══▷│ Inspection office│═▷ │  Coaching group  │
│        administration        │   └──────────────────┘   └─ ─ ─ ─ ─ ─ ─ ─ ─┘
└─────────────────────────────┘
              ║
              ▽
┌─────────────────────────────┐         ┌─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
│ County inspection            │  ═══▷   │          Coaching group          │
│     administration           │         └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘
└─────────────────────────────┘
```
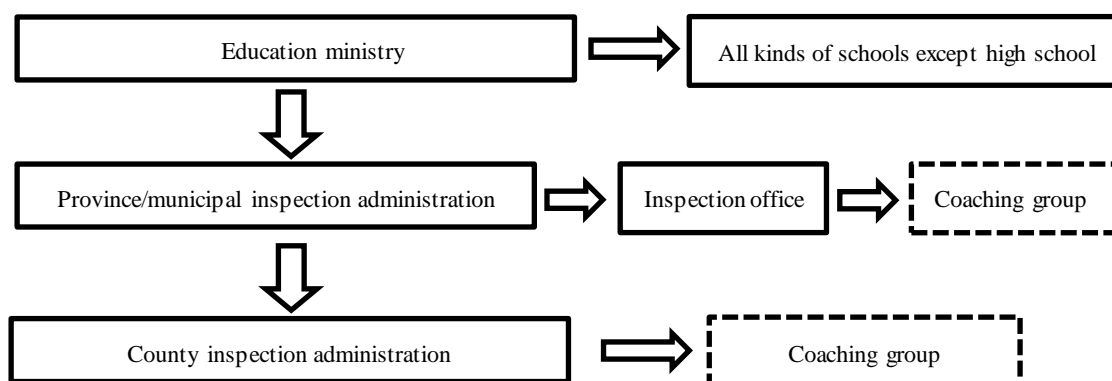
2.3 Primary school leadership in Germany and Chinese Taipei

Previous research has highlighted that setting the school's vision/goal, managing the school and maintaining the school climate as orderly and safe hold strong importance in describing the school leadership (see the details in later chapter 3). Meanwhile, the result from MSEM in the later chapter (Chapter 4) conspicuously demonstrates that principals spend more time setting and developing the vision/goal of school, whereby students' math achievement has significantly decreased in Germany but it was non-significant in Chinese Taipei.

Setting the school vision/goal for school development involves several steps. Schools tend to have different alternatives, among which the suitable one is preferred as the final decision (Everard, Morris, & Wilson, 2004). Accordingly, school principals need to be clear about the school situation. Furthermore, the school's vision/goal is set by principals based on the particular school situation, as different school situations tends to necessitate a different school vision/goal. The requirement purported by a school principal described that:

"A school administrator is an education leader who promotes the success of all students by facilitating the development, articulation, implementation, and stewardship of a school or district vision of learning that is shared and supported by the school community." (Wilmore, 2002, p.19)

It is evident that once the school direction is clear, school tends to achieve further development (Wilmore, 2002). Once the vision/goal is set by the principals and staff members, the subsequent step is to achieve the goals, which is also called the step of "vision implementation." In Germany, most states have guidelines to assist the principals to achieve the educational goal (for more details on primary schools, see "Was Schulleiter als Führungskräfte brauchen," 2008). For instance, in order to ensure that students acquire standard skills from learning, school principals are required to confirm that the students study in an open and transparent atmosphere and enable them to gain the knowledge at the certain age[5]. Indeed, achieving the school goal/vision requires assistance, whereby only the education system can ultimately firmly realize the school quality development[6]. Setting the vision/goal is connected with agreement with the teaching staff. This aspect is one reason why principals spend more time in setting the school vision/goal, However, setting the goal/vision tends to be sensible if there are valid teaching assessments (Avenarius & Heckel, 2000; Klein, 2008; Schnellenbach, 2007). Meanwhile, school principals are required to pay attention to student achievement while allocating time to different parts in leading activities, whereby principals suffer more pressure with the increased demands from stakeholders[7].

In Germany, due to two major movements to promote school leadership to approach "modern public management," school principals are required to transfer the decision power from external to internal. Principals are responsible for the curriculum designation and assessment (Doppler & Lauterburg, 2008; Schratz, 2003). Principals might confront conflicts in leading roles, whereby especially they need shift the role from manager to administrator and need to take different roles when they handle different problems, thus allocating different time to different cases. Instead of allocating time to leading the school, teaching accountability is determined by the school size and the number of pupils. With fewer students, the principal needs to take

---

[5] The Education System in the Federal Republic of Germany 2012/2013.
[6] Qualitätsentwicklungsverordnung – QualiVO, 2006.
[7] 2011 台灣學童學習過勞情形調查發表記者會.https://www.children.org.tw/news/advocacy_detail/338.

more teaching accountability (Neumann, 2014). According to the ministry of education and culture of Schleswig-Holstein, it is claimed that "the time allocation to leading school is varying according to the number of pupils" (Ministry of education and culture, 2010). Thereby, German researchers has purported that compared with other OECD countries, the time allocated to teaching has more effects for German head teachers (Bonsen, Bos, & Rolff, 2008). The time allocation to leading the school only took 7-15 hours per week for most primary school principals, whereas they spent most time on class preparation and teaching (Bonsen et al., 2007). The fact that teaching accounts for the most time brings many advantages to students, although it means that school principals devote less time to leading activities. However, the time allocated to leading the school enables the school program to be innovated and the educational goals to be achieved (ASD, 1999). Meanwhile, in German primary schools managing school projects is prominent for headmasters, especially for the teachers who tend to apply for the principal's position, whereby the experience of leading school projects or programs holds strong importance. Leadership competency is described via leading school programs and projects to provide assistance for the local education authority to determine the candidate, as well as reflecting an effective way for them to cultivate their potentials to be principals.

The MSEM result in Chapter 4 reveal that when school principals spent more time on the maintenance of the school atmosphere such as handling the students' misbehavior, keeping an orderly atmosphere and maintaining clear rules for students and teachers, student math achievement tended to decrease. The same situation is evident for the time spent on setting the vision/goal for school, as with more time spent on these issues, students tend to have less instructional time for their study because the principal was a teacher first. In addition, the German school atmosphere places an emphasis on equity rather than hierarchy, meaning that school principals are situated in equivalent positions alongside teachers. Otherwise, when principals handle disruptive behavior in an autocratic manner, it tends to enable teachers to feel that

they are governed by principals (Schratz, 2003).

For school management, German head teachers spent more time motivating teachers to have discussions and corporations with each other (see the details in the later Chapter 4). Apparently, the discussions and corporations hold strong importance in terms of affecting teaching, and thereby student math achievement increased. This is consistent with previous research, which claimed that more collaborations and sharing pieces of advice between teachers and principals tends to make the school atmosphere more comfortable (Hindin, Morocco, Mott, & Aguilar, 2007). The previous research in the last section of this chapter introduced the notion that the school atmosphere and context significantly affect student achievement. Thus, in line with the requirement of the local authority, it encourages school principals to coordinate even beyond the federal border to build a cooperated school atmosphere (Klein, 2008). German primary school principals need to delegate the management power to staff members such as deputy principals and teacher directors due to their overburdened teaching responsibilities. However, the deputy principal then encounters conflicts between teaching issues and leading activities, coupled with the discussions concerning teaching and learning, whereby there will be more coordination and negotiations. The democratic atmosphere in German primary schools offers opportunities to school staff, allowing them to be responsible for developing student achievement through collaborations. Researchers has highlighted that it is important for principals to support or facilitate teachers in guiding teachers to achieve school goals (Schratz, 2003). Meanwhile, due to the "decentralization movement" in German education instead of authentic leadership, shared leadership alongside distributed leadership is required for a more open and productive school atmosphere. As such, what school principals need to do and what kind of school organization the school intends to maintain both depend on the power delegation. In other words, it relies on the power that the government tends to delegate. More internal teamwork and corporation are necessary to promote leadership towards achieving the goals. As a

result, school principals not only need to provide simple instructions but also opportunities to extend the platform for external dialogues and cooperation (Ministerium für Schule und Weiterbildung, Wissenschaft und Forschung, 1999).

In Chinese Taipei, school principals are required to strongly concentrate on managing the school and its atmosphere to be orderly for teaching and learning. As mentioned above, school principals are situated at professional leaders' positions, with their major focus on administrative management and public relations. It might explain the main difference in primary school leadership between Germany and Chinese Taipei, since the principals in Chinese Taipei have more time to allocate to leading the school compared with their German colleagues. However, they also confronted with certain challenges, particularly concerning the principal's leading ability. The previous chapter (chapter 1) and the prior section in this chapter have presented that school contexts mark a strong difference compared with Germany, such as the location of schools, financial support, and the students being in all-day schools.

The education authority is more centralized in Chinese Taipei, whereby the education ministry has strong power to determine the vision/goal for education, in particular for the basic education. As such, the education ministry requires management objectives for principals to strongly concentrate on, namely to "plan out school issues, promote school achievement, initiate communications, maintain the school to be orderly, assist student on learning and living, manage finance, and communicate with the community" (Zhang, 1999). Meanwhile, the priority is to maintain learning and a safe school climate for students and teachers to establish the "learning community" throughout collaborations (Lee, 2015). Similar to German head teachers, the roles taken by school principals interact due to the overlapping school tasks. Hence, school principals are required to play different roles when they lead schools, while the primary school principals need to be facilitators in implementing educational policy. However, no matter what kind of roles school principals play, in line with the educational law primary school principals are required to concentrate

more on instruction leadership (see "Report of Education Reform," 1996).

School principals need to take into account the importance of developing efficient schools. Although in recent years researchers as well as school principals themselves have been advocating decentralized power, in fact hierarchical linearity remains the authority format in education management (Li, 2010; Tung, 2003; Ye & Xie, 2013). The authority format not only regulates school principals' behaviors but also limits them. It is evident that the relationship between time allocated to "managing the school" and student math achievement was negative. The MSEM results in Chapter 4 demonstrates that when school principals spent more time monitoring teaching and learning as well as initiating discussions with teachers, student math achievement decreased. The pressure for school principals relates to all-encompassing aspects. The meaning of the vision/goal of the school for teachers and principals might be different because they adopt different roles. For principals, when they act as the executors, their responsibility is to implement education policies. When their role is as inspectors, their major focus is to inspect schooling. For teachers, students' learning is placed at the central point. As such, it causes different understandings of educational goals between principals and teachers. Besides, another point of differences in school management is the perception, whereby different understandings of the school goal/vision might bring subsequent effects. For instance, when principals share the education goal with teachers, principals are situated at the micro level but teachers stand at the micro level. The different perceptions of school goals enable or constrain their behaviors in the real school context, thus potentially explaining why student mathematics achievement is not affected by the time spent in setting or developing the school's vision/goals.

Maintaining the school climate to be orderly and safe shows a positive effect on student math achievement. Prior research has purported that students gain benefits from a safe and healthy school atmosphere (Darling-Hammond, LaPointe, Meyerson, & Orr, & Cohen, 2007). Class sizes in Chinese Taipei are much larger (usually 35

students), and thus principals needed to spend more time if they wanted to maintain a safe and healthy school climate for students and teachers. The Chinese Taipei school leadership style shows significant differences compared with Germany, in which a more democratic style is emphasized, whereas the authoritarian leadership style holds strong importance in Chinese Taipei primary schools. Principals devote much of their time to addressing disruptive students and reaffirming the importance of clear school rules (see details in Chapter 4). Besides, parents tended to prefer those schools with a high reputation, meaning that a safe and healthy school climate is likely to help schools to be placed on the list of revered ones. As such, it requires school principals to devote their attention to maintaining a healthy and orderly school atmosphere for students.

The following Figure 3 and 4 clarify the related definitions of vision/goal, the management and the school climate in Germany and Chinese Taipei, respectively.

Figure 3 School leadership in German primary schools

Time input

Setting/developing goal

Project/program management

Maintaining school climate

Evaluation (Internal and external inspection)

Managing/supervis-ing process

Output

Yes

No

Productive (Yes/No)
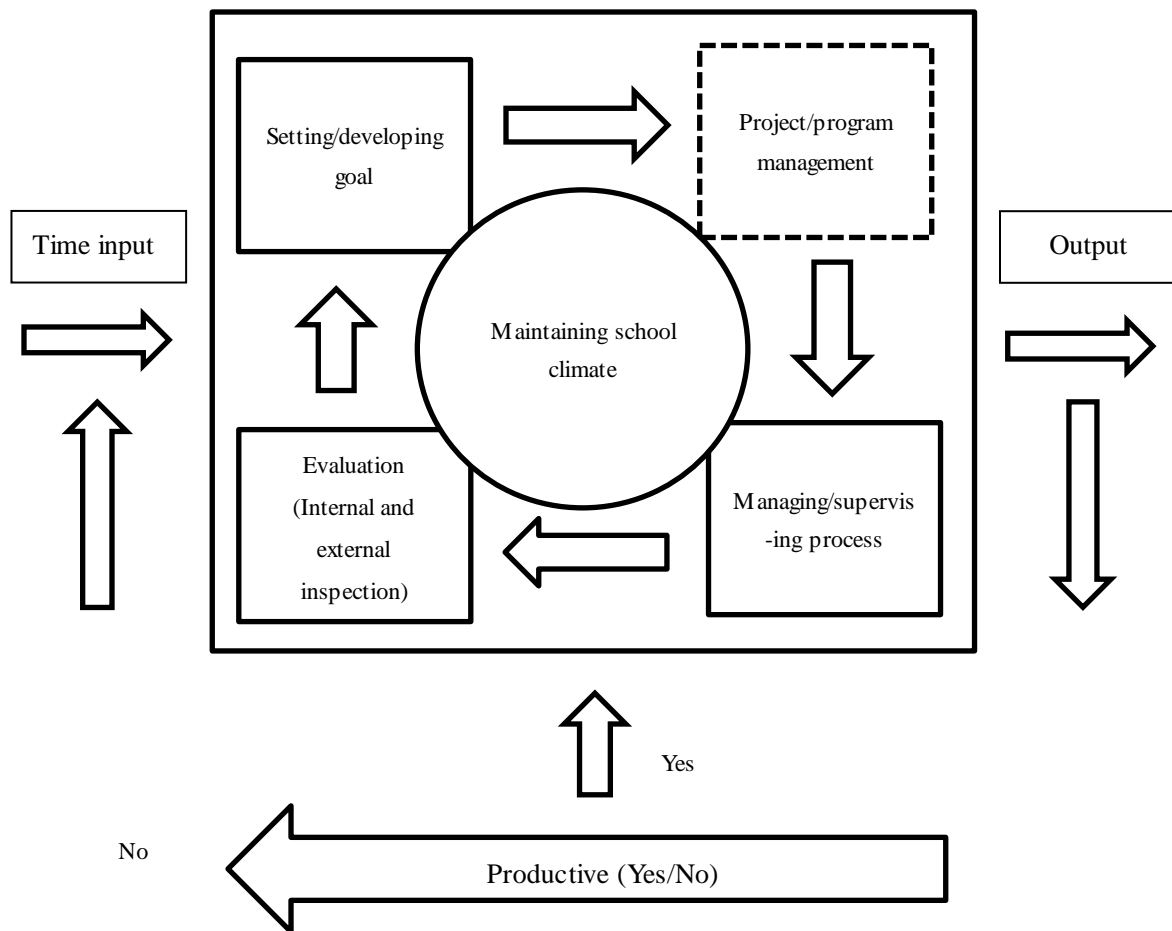
Figure 4 School leadership in Chinese Taipei primary schools
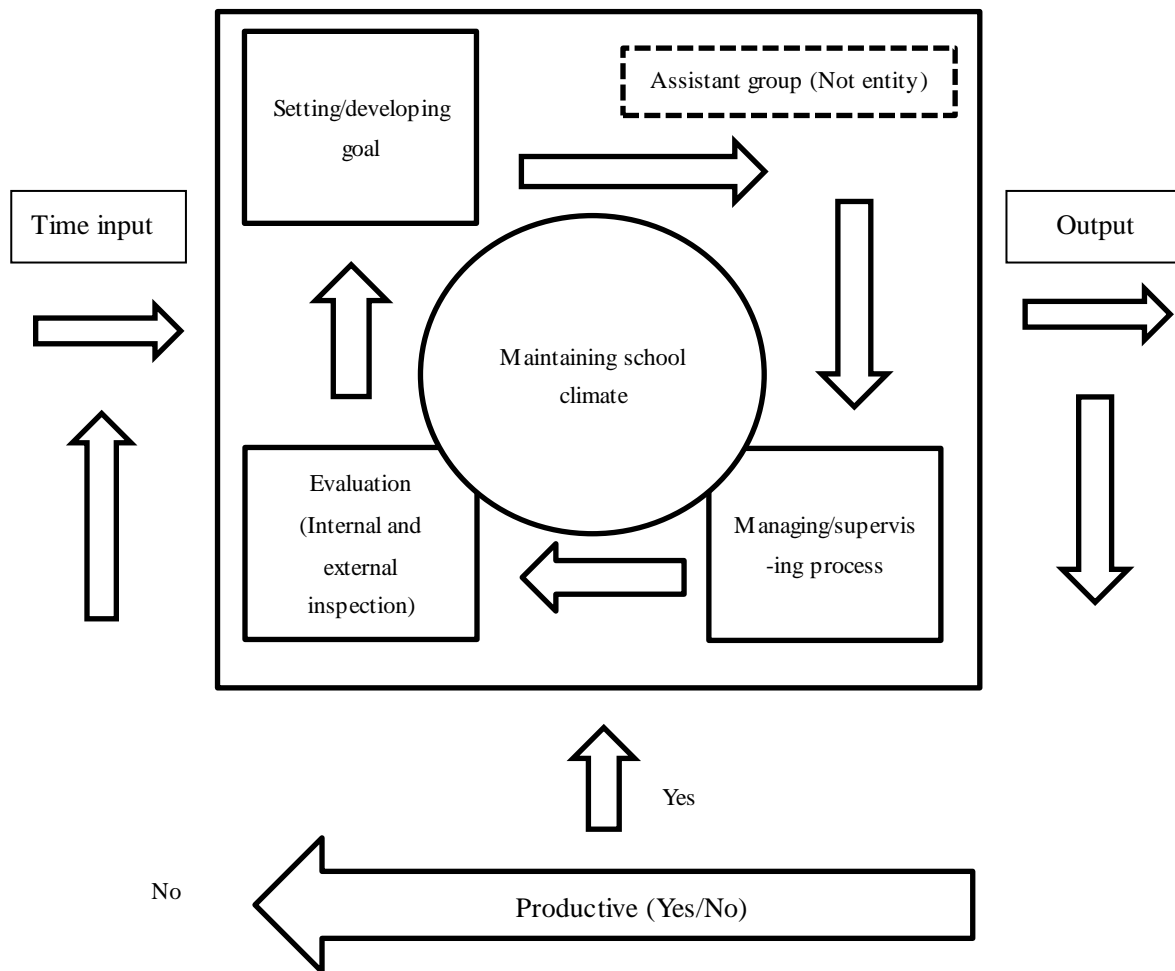
The figures demonstrate the major difference between Germany and Chinese Taipei, whereby the school steering group is viewed as an entity to inspect school quality while the assistance group in Chinese Taipei is more than a consultant but not an entity. In Chinese Taipei, the members who comprise the assistance group come from different schools and principals who gain outstanding achievements could become members. Besides, the members are changeable and have a strong degree of mobilization.

The prior section introduced the notion that school organization exerts strong influence on school management, and furthermore it affects the time allocated to school leading activities. The school vision/goal affects the school principal's management behaviors, although the assistance group is not necessarily affected by the school's vision/goal as the members come from different schools. Insights into

22

different school contexts exert an influence on school leadership, with the members usually devoting different time allocation to leadership activities. The assistance group brings advantages for the school, such as supervising and advising teaching, supporting teachers and assisting teachers when they have teaching problems. Since the school is an organization, its contexts, education systems and organization cultures coupled with the inspection systems tend to exert influence on time allocated to leading tasks for principals. Here, a simple example is that the social culture sculpts the school sub-culture because they both firmly interact with each other. Studies on school leadership account for a part of studies on human recourses, meaning that a principal's behavior, leading style and leading motivation are affected by the social environment in which they situated. The society along with the education system has its unique traits, which formulates the individual educational mechanism in each country.

2.4 Selection procedure of primary school principals in Germany and Chinese Taipei

Since the school is one part of social organizations, the factors regarding school organization should be taken into account. Hence, distinct culture is identified in terms of different locations. Different social and education organization systems affect not only school leadership but also the selection and training of principals.

In Germany, there are common requirements for principal selection, namely at least five years of teaching experience as a standard requirement across sixteen länder (states). Each state determines its education system and rules by the guideline from the federal education ministry. The federal education ministry only holds the position of a supervisor and advisor to assist each state to meet the requirements. Therefore, different education systems and rules in each state are in force by the federal constitution. For the procedure of principal selection, the requirement of teaching experience, the social cooperated ability and the planned blueprint for developing the

school hold importance to determine whether one is capable of being a principal. Each state had its own procedure and detailed requirements for principal selection.

The authority guarantees fairness for German citizens to apply for vacant principal or vice principal positions. Many states have declared that principals applicants who are business managers are admissible as applicants due to the school organization being emphasized in relation to effectiveness and efficiency, which is the same as in business enterprises (however, only Hessen state permits external applicants to apply for the principal's position). Referring to the requirements for being a principal or vice principal candidate, the federal education ministry launched a program named "pool" in 2005, incorporating the criteria for vacant positions of a principal or vice principal. Up to 2015, it had been implemented ten years (ASD, 2005). The early development programs that the applicants ought to attend are not obligatory but they are viewed as proof of the candidate's leading competency. Leadership qualifications, managerial experience, teacher qualification and success in school leadership examination are also required (ETUCE School Leadership Survey, 2012). The local authority is responsible for the selection principals and vice principals and it tends to prefer those who are outstanding in state tests. Especially in Bavaria and Hesse, the state authority emphasizes more the official state examination performance, whereas in Bad-Württemberg, Brandenburg, North Rhine-Westphalia and Saxony-Anhalt the local authority tends to observe the class to determine the final nomination. Take North Rhine-Westphalia, for example: there are four levels in the local administration organization, whereby the candidates are required to discuss or negotiate with administrators, and they are encouraged to describe the school development. The principals are encouraged to describe blueprints on how to develop the school and promote school achievement. The local authority tends to set the level, such as from level one to five to represent the score that the candidates gain. In Lower Saxony, Thuringia, Saxony, Hamburg and Berlin, the local authority pays more attention to the interview, and it is viewed as the most important part to determine the

principal and vice principal. In Schleswig-Holstein and Bremen, although the interview plays an important foundation, it is only useful if the applicants do not present their full potential during class observations (Huber, 2005; Rosenbusch, 2005). In different states, the aspects of interviews are manifold, such as the applicant's potential, the development plans for the school, programs that they attended before, and what the teams or projects they have led before. The pre-selection interview is supervised by the school board, and the formal official interview is overseen by the local committee. In recent years, several states have begun to redesign the selection methods for principal selection[8].

The states are supervised by the German federal education ministry on principal selection and the detailed manner tends to vary in some individual states. In Berlin, Bremen, Lower Saxony and Nord-Rhine Westphalia, the selection is mutated according to the criteria of state regulations and stipulations. It also regulated that the federal education ministry is not only involved in the supervision but also in redesigning the selection procedure. The training course is required in most states in Germany, although it is not mandatory. The training sessions are developed by education colleges of university or institutes. The contents also vary in terms of the individual states, whereby some states emphasize school development, staff development and leadership development, and some states tend to cooperate with external business centers or companies to encourage the school principals to work together. The common formats in a training course are seminars, workshops and discussions, and the topics covered are within the scope regulated by the local education authority. German primary school principals are required to be responsible for caring for teaching staff, running the school and initiating discussions. Some vacant positions need a long time to find a suitable candidate, such that in most primary or secondary schools the teachers tend to take the leading work of school leaders without finance compensation[9]. An assessment center (AC) is established in

---

[8] Niermann, 1999; Hoffmann, 2003; Deneckeetl., 2005; http://www.modelle.bildung.hessen.de.
[9] ETUCE School Leadership Survey, 2012.

several states, aimed at supervising principals and evaluating principal effectiveness. In Bavaria, the function of ACs is viewed as the orientation courses (Orientierungslehrgänge), while in Bremen and Hamburg it is viewed as an adjustment system. They are mandatory for the principals to attend in both cases (Klein, 2008).

In Chinese Taipei, nearly 40 years ago the principal's position was life-long. From 1970, the new discipline regarding principal selection was employed by the local authority. Accordingly, principal candidates required teaching and management experience. Thereby, it was determined whether they have outstanding achievement in terms of school management. Their performance was evaluated by an education committee and it helped to make the final determination. From 2000, new selection discipline has regulated that the education ministry is only responsible for planning the selection procedure and it received feedback from students and the school staff to evaluate whether the principal was competent.

At present, the discipline of primary school principal selection is separated into three parts according to the academic qualifications of the applicants. Applicants who have graduated from academic university, education university and education colleges require two years of management experience as a department director. For applicants who have graduated from three-year college, three years of management experience is required. Candidates without a formal academic graduation certificate are encouraged to have a minimum of two years' teaching experience and three years' management experience. Although decentralization has been gaining its popularity in recent years, the centralized authority also takes prevalence. The authority determines whether the candidates are capable of being principals via reviewing their educational qualifications. Moreover, the test is also emphasized, revealing that the candidates need to take the test under the supervision of the local education ministry. Those who achieve outstanding performance in the trial tend to be nominated by the local authority and they are encouraged to attend the training courses offered by education

universities. The training course lasts for eight weeks and its major emphasis is on knowledge regarding administration, psychology and leading skills. Subsequently, they are required to practice in the real context with the assistance of experienced principals, which lasts two weeks.

The training for principals who are in position is lacking in Chinese Taipei. It enables in-position principals to ignore the problems with which they are confronted in the real school context. Given that the practice of being formal principals lasts for only two weeks while training courses for in-position principals are rare, principals are often confused when situated in the real school context. Informal inspections and the lack of an inspection entity along with lacking assessments and training for in-position principals strongly affect their effectiveness and quality (Qin, 2006).

Chapter 3 Literature Review

3.1 Previous research on school effectiveness

School effectiveness research (SER) draws attention to education improvement. Hence, a series of problems concerning how students acquire different achievements with different characteristics emerge. It is well known that students have different kinds of logical minds (although some students gain the knowledge from the same teachers because they study in the same schools). Consequently, the ability to understand different logic styles of students who come from different families becomes the core research question as it plays a necessary function in student achievement and students' further success (Blanden & Gregg, 2004).

Previous research has highlighted that the history of school effectiveness research is short but indispensable (Brookover, 1979; Coleman et al., 1966; Creemers & Schaveling, 1985; Edmonds, 1979; Rutter, 1982; Scheerens & Bosker, 1997; Teddlie & Reynolds, 2001; Creemers, Stoll, & Reezigt, 2007). However, in recent years, especially in last three decades, as international large-scale assessments and national testing system have gained in popularity, empirical researchers have paid more attention to school effectiveness research because they intended to obtain information and characteristics of effective schools. Besides the questions of how education works as a foundation for better education quality and how to guarantee that education is further developed, especially the issue of how to put school effectiveness research theory into practice to improve student achievement has attracted researchers' attention. In other words, promoting school development has become a focus for researchers. Consequently, many researchers such as Creemers, Scheerens and Reynolds as well as Boskers have sought to find a suitable explanatory mechanism on school effectiveness (Reynolds, Teddlie, Creemers, Scheerens, & Townsend, 2000; Reynolds, 1997). In other words, it is attractive for education researchers to ascertain what affects student achievement via "applicable" factors such as school climate,

organization, school leadership, school conditions, school resources and teaching efficiency. Hence, school effectiveness research (SER) has made significant progress and contributed a lot to school improvement (SI).

The first insights into school effectiveness research come from Rutter, Coleman and their collaborators, as well as from Christopher Jencks in the United States and the United Kingdom (Rutter, 1979; Coleman et al., 1966; Jencks et al., 1972). This is why the author begins with the review from the United States and the United Kingdom on school effectiveness research. This study devotes more attention to the comparative study between Germany and Chinese Taipei, although both ecnomies take much experience from the United States and the United Kingdom in terms of school effectiveness research. In order to clarify relevant information, the previous school effectiveness research in the US and UK becomes the foundation before the argumentation.

3.1.1 SER in the United States and the United Kingdom

In the US after collecting data from 4,000 elementary and secondary schools, Coleman and his colleagues conducted multi-level (school level and individual student level) regression analyses. They concluded that *"school brings little influence to bear on a child's achievement that is independent of his background and general social context"* (Coleman Report, 1966, p. 325). They also asserted that the variations of school experience did not affect student achievement. Besides, in his report it was declared that *"Coleman's survey estimated of a figure of 9% of the variance in an achievement measure attributable to American schools has been something of a benchmark"* (Coleman Report, p. 306). Mayeske subsequently reanalyzed the data and affirmed that the variance between schools was more than what Coleman obtained (Mayeske et al., 1973). Indeed, about 37% of the variance could be explained by differing factors between the schools. Furthermore, after conducting large-scale research alongside the data from Coleman's report, Jencks and his

colleagues found that the difference in school attainment was not determined by education but rather by the knowledge (pre-knowledge) before the children started their education. Therefore, from their viewpoint, student achievement is more closely related to family background (Jencks et al., 1972). For instance, parental education, family economic background as well as students' pre-knowledge learning opportunities hold strong relevance, *"...concluding that schools do not matter much about either student achievement or financial success in later life, all of them has affected student attainment."* (Jencks et al., 1972, p.33). Accordingly, family background strongly determines students' success in school and their future incomes. Although both Coleman and Jencks initially emphasized equity for students who had the opportunities to accept education, albeit from two different perspectives, they reached the similar conclusion that student achievement is not so strongly related with school education. Moreover, Jencks evaluated the impact of home and school according to sufficient size rather than only estimating the percentage of the variance used to explain student achievement. At the beginning, they did not work for either a corresponding framework or conceptual ideas on school effectiveness, but rather only from different aspects. Although Coleman focused on sociology whereas Jencks emphasized on psychology, they reached similar conclusions.

Subsequently, in 1976 Brookover and Lwzote conducted an empirical study on relevant variables related to school that are essential for student performance. They identified eight elementary schools, ascertaining which ones were consistently improving schools and which were the schools in which student achievement declined. Thus, among the eight elementary schools, six were viewed as the consistent-upgrading schools, and the other two were taken as consistent-declining schools. The primary purpose of their study was to ascertain differences between the consistent-upgrading school and the consistent-declining schools, while they had to differentiate what difference was more important for education outcomes and school effectiveness and improvement. They analyzed data from the Michigan Education

Assessment database, which were especially for grade 4 and grade 7. Meanwhile, they visited schools and interviewed teachers to collect data. They ascertained that the emphasis on education goals, close trust, high academic expectation, teaching quality, instruction time, instructional leadership, a high-responsibility model for students and teachers' motivation were deemed to serve as the foundation in promoting student performance (Brookover, Beady, Flood, Schweitzer, & Wisenbaker, 1977).

Later, in 1982, Edmonds – who was a school board superintendent – also contributed to school effectiveness research. His study focused on school improvement, particularly emphasizing education practice. He put the school effectiveness theory into school improvement (SI), expecting that the school might achieve further development via school effectiveness research (Edmonds, 1979).

Coleman was eager to explore equity chances that students have to accept education, while Edmonds was more interested in policy-making, and further implemented a serial of relevant policies based on school effectiveness research. The difference between Edmonds, Coleman and Jencks was that Edmonds and his colleagues took urban poor schools as the focus in their research, so they subsequently conducted a compelling case study for many urban poor schools. He not only intended to obtain results from school effectiveness research but also expected to create effective schools for urban poor students. *"Progress requires the public policy that begins by making the poor less poor and ends by making them not poor at all"* and *"Inequity in American education derives first and foremost from our failure to education the children of the poor"* (Edmonds, 1979, p.15). Hence, he and his colleagues conducted empirical research of 10,000 students in 20 schools in the Model Cities' Neighborhood (most were urban poor schools), whereby 2,500 students were randomly sampled and then eight pupils were selected from each classroom in 20 schools. Meanwhile, they used math and reading achievements in standard achievement tests (SAT) as the dependent variable. Moreover, a school was termed as effective if student achievement was equal to or above the city average grade in math

and reading. In order to gain accurate results, they also took students' personal abilities and their family backgrounds (or the social economic status of students) into consideration, although it was demonstrated that student family background did not significantly affect student achievement. Therefore, in their final research, they deduced student family background as having an insignificant effect on student attainment.

Aside from the *Coleman report and Inequality: a Reassessment of the Effects of Family and Schooling in America*, one of the most influential studies regarding school effectiveness research was the Five-factor model. It was generated from school effectiveness research and incorporated five important factors in schools to enable the school to be effective. The five factors were summarized by Edmonds as strong instructional leadership, a focus on basic skills, a safe and orderly school environment or climate, high academic expectations and frequently evaluating student achievement. The five-factor model became an efficient way to evaluate school success (Edmonds, 1979). Taking it as the foundation, Edmonds suggested that the premise of school effectiveness was strong school leadership. *"Urban schools that teach poor children successfully have strong leadership and a climate of expectation that students will learn"* (Edmonds, 1979). From ten summaries of comparative studies between 21 high-achieving school and 21 low-achieving schools, Edmonds said that *"it is notable chiefly for its reinforcement of leadership, expectations, atmosphere, and instructional emphasis as consistently essential institutional determinants of pupil performance"* (Edmonds, 1979). As the five-factor model narrowed the scope of school effectiveness research, the five-factor model became the point of focus for other researchers. Thus, the majority of researchers began to explore relevant research about the five-factor model, and they tried to find more details on school factors to explain the reasons why there were differences in student attainment via the five-factor model. As a result, it enabled school effectiveness research to achieve significant development. Until 1983, the relevant research was also circled by the five-factor model, while researchers also

aimed to widen detailed knowledge on the five-factor model, seeking to define the clear mission for school effectiveness and ascertain relevant factors in school practical operation. For instance, from the 1990s Lezotte began to continue school effectiveness research that was left by Edmonds (Lezotte, 1991). Although his focus was the same as Edmonds, however, he took more interest in school improvement. He concluded that the school improvement should be developed from a comprehensive perspective. Hence, the framework of school improvement was considered from different angles to help students to promote their attainment. The conclusion that he obtained was a response to Edmonds, which meant that his research was a development of Edmonds's research.

School effectiveness research gained significant progress during that period. Most researchers conducted a large amount of research regarding the relationship between school factors and education outcomes. For example, researchers realized that different school locations had different characteristics, while different classrooms nested in different schools had features that were marked by the schools, and they both influenced student achievement because the patterns and features of schools and classrooms play a vital role in education outcomes (Finn & Voelkl, 1993; Hoy & Sweetland, 2000; Leithwood, 2010).

In the UK Michael Rutter – the pioneer of school effectiveness research – explored relevant research from an empirical aspect (Rutter, 1979) Meanwhile, Mortimore, Sammons, Stall, Lewis, and Ecob began to pay attention to primary school effectiveness during the same period in the US (Mortimore, Sammons, Stall, Lewis, & Ecob, 1988). The research groups are separated into two groups, and they both preferred schools that were included in the International Large-Scale Assessment (ILSA). After 15,000 hours tracking every student's activity even covering sleeping time, Rutter ascertained that factors such as the values of students, teaching behaviors and organization environment significantly affected student achievement (Rutter, Maughan, Mortimore, Ouston, & Smith; 1979). Rutter focused on four aspects related

to student achievement: student behavior in school, attendance at school, examination success, and student delinquent behavior. He found that what was important for those high-effective schools were not related to school size, classroom size, as well as the school buildings. The cornerstone of an effective school was keeping the balance between intellectual students and insufficiently intellectual students. He also found that school climate, school management, and the role of teachers might positively affect student achievement. Meanwhile, the use of homework and the headteacher leadership also plays a vital role in student achievement. A democratic atmosphere was found to be helpful for principals to make decisions, manage the classroom and provide the development opportunities for teachers (Rutter et al., 1979). In addition, he also recognized that students' social background alongside their intellectual abilities were the major reasons causing differences in student achievement. Moreover, he mentioned that academic expectation, school leadership, teaching activities, the use of rewards and punishments, student personal conditions, school organization and the school/classroom environment were essential elements to affect student achievement. All factors listed above could explain why some schools are effective. Rutter identified some common factors linked with positive performance in effective schools, and then he answered the questions regarding which factors affected student attainment from through *15,000* which he spent with all students in twelve inner-city secondary schools in London.

Rutter research on school effectiveness ascertained the factors in school that affect student achievement in the real context, which helped further researchers to distinguish effective school factors. Meanwhile, his research is more persuasive for further studies due to its pragmatism and the details on daily school operation and student factors. As such, Rutter's research is taken as the foundation of school effectiveness research.

3.1.2 SER in main European countries

Following school effectiveness research in the US and UK, school effectiveness research in European countries began from 1983. As increasing attention was paid to school effectiveness research, some researchers began to criticize current results because they opined that it focused on empirical research and stressed the relationship between variables, but paid less attention to theory foundation (Creemers, 2002; Levine & Lezotte, 1990; Mortimore et al., 1988; Scheerens, 2013). Moreover, there was abundant research emphasizing testing relevant school effectiveness research theories and its mechanisms, which explained what kind of relations exist between different variables. However, it lacked a focus on how to cope with high-stake risks for school upgrading with appropriate strategies. Accordingly, without the improvement of school effectiveness research theory, it is impossible to set the pragmatic goals of improving schools and further developing school effectiveness. Therefore, Creemers, as well as Schaveling both started to summarize school effectiveness research in secondary schools (Creemers et al., 1985). Because the schools are nested states (or communities), classrooms are nested schools and students/individuals are nested classrooms, hence multi-level method became an attractive point for researchers. As such, Creemers initially was eager to obtain information from different levels, which was used to indicate school effectiveness. For instance, student ability, the social status of parents and the pre-knowledge or pre-attainment of students represent relevant characteristics at the individual student level. Meanwhile, factors strongly affecting student achievement are class instruction, school leadership, as well as school climate and school atmosphere at the school level. They all come from the class and school level. Creemers summarized the structure on school effectiveness research in secondary school located in the Netherlands, and he avoided some flaws in previous research. Subsequently, he developed a conceptual model called the "dynamic model" with multiple levels (school level, classroom level, and individual level), which stemmed from the model of Carroll (Creemers, 1991;

Scheerens, 1992; Stringfield & Slavin, 1992). However, unlike Carroll's model, Carroll initially focused on foreign language learning and training, and he gained the odds of success in school effectiveness research. In Carroll's study, student achievement was the result of the ratio between the time needed and the actual time spent learning by students (Carroll, 1963). Furthermore, he asserted that the time spent studying was influenced by students' attitude, ability and motivation (the time that the student was willing to spend learning he termed as "perseverance"), which are situated at the individual student level. Meanwhile, the factors situated at the classroom level might contribute to instruction quality and the time for learning allowed by teachers (called student learning opportunity). There were three components in Carroll's model concerning the time, quality and instruction quantity (Carroll, 1963). Based on Carroll's model, Creemers developed a dynamic model that incorporated the multi-level factors affecting student achievement (Creemers & Kyriakides, 2010). In particular, he opined that the instruction quality accounts for the most importance in student achievement. In order to further obtain the essence of instruction quality, he extended the research on some factors, such as curriculum materials, grouping procedures and teacher behaviors, aiming to analyze the factors that cause differences in student achievement. Besides, it was notable that the new model comprises not only school effectiveness but also teacher effectiveness, as well as the input-output model in school organization. Creemer's model told us the reasons why different education systems perform differently, as well as explaining why student attainment has significant gaps (Creemers & Kyriakides, 2010). As such, his study provided more information for later research, enabling more levels to be taken into account. It was a milestone leading future research on how to improve school achievement by national education policy and how to cultivate a much healthier school climate to be more comprehensive (Caro & Lenkeit, 2012; Isac, Maslowski, & Van der Werf, 2011; Marks, Cresswell, & Ainley, 2006; Mohammadpour & Ghafar, 2014; Kyriakides, Georgiou, Creemers, Panayiotou, & Reynolds, 2017) .

School effectiveness research (Schuleffektivitäts) is rather rare and unsystematic in Germany and most school effectiveness research has stemmed from the US and UK. Aurin (1989) highlighted that school effectiveness research was not placed at a unique position in the educational field, although the government and administrative ministries are strongly interested in the characteristics of effective schools and what makes schools effective. They deemed that school effectiveness research took an important function in future education study (Aurin, 1989). Fend (1986) conducted a comparative study based on the characteristics of effective and ineffective schools and he placed his focus on all factors related to schools, teachers, students and parents. Accordingly, he proposed that education quality characteristics are based upon the construct of school culture (Fend, 1986). In particular, school effectiveness research started to be attractive when Germany began to participate in international large-scale assessment (ILSA) such as TIMSS in 1995 and PISA 2000.

German school effectiveness research is based on the different definitions of effectiveness. Ditton (2000) developed a model based on the school effectiveness model, which is popular with the "input-output" model. However, Ditton included more factors such as school quality, curriculum quality into the process to make the current model enriched and distinct. Meanwhile, researchers questioned on the criterions of educational outcome. Seidel (2008) analyzed the criterions of school effectiveness during the period between 1995 and 2004 and he found that cognitive achievement is mostly taken as the criterion (82%) for judging school effectiveness (Seidel, 2008). Ditton (2000) considered that the short-term criteria to measure educational outcomes should be broadened, whereby students' motivation and affection, learning attitudes and their social behaviors should also be taken as educational outcomes (Ditton, 2000). More specifically, cognitive and non-cognitive factors were included to explain educational outcomes via the "input-output" model. With different understandings of school effectiveness, Stanat and Christensen (2006) used PISA 2003 data to report the relationship between student family immigrant

background and student literacy reading competency, which aimed to help immigrant students with effective language learning (Stanat & Christensen, 2006; Christensen & Stanat, 2007). Klieme (2010b; 2013) collected the data from students from the fifth, seventh, and ninth grades embedded in 230 lower-secondary schools with a longitudinal study to explore extracurricular activities in 2005, 2007, and 2009. He found that only using cross-sectional data is less accurate in interpreting the relationship between school effects and student achievement, while cross-sectional data could not offer the appropriate reason to explain school development (Klieme, Fischer, Holtappels, Rauschenbach, & Stecher, 2010). His study responded to Creemers, who purported that school improvement research required a dynamic process due to each phase of school improvement being unstable. He also analyzed the role of large-scale assessments (TIMSS/PIRLS, and PISA) in terms of school effectiveness and school development, finding that international large-scale assessments might assist future profound studies such as longitudinal, quasi-experiment and intervention studies with prior findings from cross-sectional studies. He also highlighted that the assumptions from the large-scale assessments study could be tested by school effectiveness due to the scales being international and the data sources being less narrow. Bonsen, Bos and Rolff (Bonsen et al., 2008) found some contradictions among school effectiveness research (Schuleffektivitäts) and school improvement (Schulentwicklungsforschung) in Germany, and as a result they merged both school effectiveness research and school improvement by integrating curriculum, quality management, and general system development. Moreover, with the requirement of individual school development and new public management, German education emphasized each individual school as the action "unit". Thus, how to improve individual school quality emerged as a critical function in German education research (Fend, 2006; 2008).

3.1.3 SER in Chinese Taipei

In recent years, as Chinese Taipei becomes more international and diversified, its education also varies according to its economic development. It is known that Chinese Taipei students have participated in many international large-scale assessments such as PISA, TIMSS and PIRLS, in which they have acquired outstanding achievements. However, researchers in Chinese Taipei do believe in the notion that *"education cannot compensate for society"* (Berstein, 1970). Consequently, they began to focus on school effectiveness from the mid-1980s. In last decade, more research has paid attention to SER, becoming an important and attractive focus. However, most researchers paid major attention to empirical research. Meanwhile, their empirical studies were separated into two aspects, emphasizing questionnaire studies aiming to find out the key factors related to school effectiveness (Chen & Liu, 2015; Pan, 1999), as well as extracting the indicators to measure school effectiveness (H. M. Li, 2006; Li, 2005; Tang, 2006; Wu, 2002; Xu, 2006; Y. H. Zhang, Yan, & Xie, 2008; Zhang, 2003). However, most school effectiveness research results are presented by doctoral dissertations or master's theses, but seldom by journal papers or articles.

School effectiveness research in Chinese Taipei has not maintained the same pace as in the US and UK. In particular, it started rather late compared with the US and UK. Besides, the primary school effectiveness research format in Chinese Taipei is focused on effective factors that have been recognized by empirical research in the US and UK. Hence, school effectiveness research in Chinese Taipei has been questioned by domestic researchers because it ignores the indigenous traits (Pan, 1997). Although school effectiveness research has made great progress in the US and UK, researchers have asserted that perhaps not all of them have been adapted to the situation in Chinese Taipei. For instance, in the US researchers has highlighted that the school principal has a strong effect on school effectiveness. However, in UK it has been found that the principal, vice principal and teachers have a stronger impact when they work together compared with the principal working alone, which means that the effect

on student achievement perhaps not only comes from the principal (Gunter & Forrester, 2009; Supovitz, Sirinides, & May, 2010; Townsend & Macbeath, 2011). By contrary, in the Netherlands researchers have found that the school leadership does not affect the student achievement as much as literature has reported (Creemers, 1996). Hence, all discrepancies of school effectiveness research were deemed as different effective factors in schools to influence student achievement under given contextual conditions.

Previous research has demonstrated that most research about school leadership research in Chinese Taipei emphasized those factors related to the school climate, school leadership and teaching quality. Especially the factors related to school administration have attracted more attention (Chen, 2002; Li, 1995; Lin, 1990; Liu, 1992; Tsay, 1993; Ye, 2005; You, 1992).

Researchers has also presented different viewpoints to describe school effectiveness research. For instance, Cheng proposed that school effectiveness research was responsible for enhancing school efficiency (Cheng, 1996). Zhang held the viewpoint that the definition of school effectiveness was to employ a leadership strategy to gain recourse from outside of school and integrate the students with school organization to satisfy individual teachers' needs and achieve school goals. Meanwhile, enabling the school organization to be further developed was another responsibility of school effectiveness (Zhang, 1996).

However, other scholars adopt different points for understanding school effectiveness. For instance, Xie concluded that school effectiveness is the result of evaluation effectiveness. In other words, he took more interest in empirical research on school effectiveness, from which he evaluated school effectiveness in the real context. Thus, it enabled policy-makers to develop policy according to the evaluation results. Meanwhile, Xie also commended the input-output model, which was employed to measure whether the recourse was scientifically used. In his study, school effectiveness was viewed as a response to the evaluation (Xie, 1997). Wu also

aligns with empirical research, proposing that the perspective of school effectiveness is comprehensive and the evaluation of school effectiveness should place emphasis on student attainment, school leadership, school atmosphere, study strategy and study skills, as well as the culture and value of school and teachers' development (Wu, 1997). Besides, he highlighted that school effectiveness is influenced by the school, teachers and individual students. As a response, similar to Creemer, he concluded that the factors related to school effectiveness came from multiple aspects (Wu, 1989).

Referring to the relationship between school effectiveness and student achievement, Zhizheng Jiang divided the school effectiveness research aspect into four dimensions, namely administration effectiveness, teaching effectiveness, student attainment effectiveness and community effectiveness (Jiang, 2000). Each point of effectiveness was evaluated separately, and then the eventual school effectiveness was the synthesis of four aspects (Jiang, 2000). Moreover, Lin agreed with Wu and Jiang admitted that the factors related to school effectiveness not only from the levels they mentioned above but also from parental-level (Lin, 2002). Furthermore, in alignment with Wu and Lin, Zhong suggested that the school climate ought to be taken into account as a part of school effectiveness (Zhong, 2004).

School effectiveness researchers in Chinese Taipei take more interest in the interacted relationships among the factors from different levels. Accordingly, researchers have placed more emphasis at multiple levels of school effectiveness research in the last two decades. However, the challenges of school effectiveness research have resulted in different definitions and understandings of school effectiveness. It is also one of the reasons why school effectiveness research in Chinese Taipei has developed in gradual steps but not in such a great process compared with Western countries in the last three decades. The early school effectiveness research strongly concentrated on the factors from the single-dimensional level. Moreover, the standard of school effectiveness evaluation is also single-dimensional because most researchers want to find the most influential

factors concerning school effectiveness (Chen, 2006). Consequently, many researchers have questioned the result because they think that the single-dimensional standard cannot evaluate school effectiveness. Accordingly, student attainment is influenced by multi-dimensional factors, which means that the factors might be from multi-level but not from the single-dimensional level. Therefore, researchers began to probe the administration, teaching and school to reconsider school effectiveness evaluation. The school organization, teaching and social recourse began to attract more attention from the early-2000s (Chen, 2001; Dai, 2001; Fan, 2002; Guo, 2001; Li, 2001; Wang, 2001; Wu, 2001; Xu, 2001; Yang, 2001; Ye, 2001). Moreover, Wu suggests that schools have their primary goal as a formal organization (Wu, 2004). How to input the resources to enable the potentials of school staff to be used to achieve school goals was the major part in school effectiveness research, while the individual needs of staff also needed to be taken into consideration (Wu, 2001).

Liu and Chen summarized the previous research and found that five dimensions were used to evaluate school effectiveness, namely administrative school leadership, teaching instruction, student attainment, school resources and community support (Chen & Liu, 2005). Thus, separated research on each dimension began to emerge, such as research on the relationship between organizational culture and school effectiveness, as well as the relationship between school leadership and school effectiveness. Besides, the relationship between teaching instruction and school effectiveness gained strong attention (Chen, 2010; Li, 2010; Shi, 2010; Wang, 2008).

Meanwhile, taking the five dimensions as the foundation, each dimension involves many sub-dimensions. Researchers began to focus on the personal traits and behaviors of school principals, which was viewed as one sub-dimension of the five-dimensional school effectiveness. Along with the professional leadership, information management and the conflict management of school principals was placed on the list of school effectiveness research. Finally, researchers found that all factors related to school leadership mentioned above had a significant influence on

school effectiveness and student attainment (Chen, 2004; Dai, 2000; Deng, 2005; Jiang, 2008; Lin, 2004; Wu, 2004; Zhang, 2007; Z. Y. Lin, 2004). Furthermore, the sub-dimensions also included the relevant knowledge on school-based management, human resource management, innovation and reforms, school climate and team interaction in relation to school effectiveness. Some researchers also took interests in teaching effectiveness and devote strong attention to studying effective factors that strongly influence school effectiveness, since they affirmed that teaching effectiveness was an important aspect in relation to school effectiveness (Jiang, 2006; M. K. Huang, 2007; Q. Z. Wang, 2005; Z. M. Wang, 2008).

School effectiveness research in Western countries such as in the US, the UK as well as Hong Kong provides the majority experience for relevant researchers in Chinese Taipei. Indeed, throughout previous school effectiveness research in recent years, as mentioned above it was apparent that they were mostly presented by masters' thesis or doctoral dissertations. The numbers of dissertations concerning "school effectiveness" amounted to 408, of which 200 took primary schools as the research focus. After probing into 200 dissertations, conspicuously most of the dissertations or theses asserted that school organization – which researchers believed related to student achievement – comes from four aspects: school leadership, organization management, teachers' performance, parents and community support. Meanwhile, it also included other sub-dimensional factors, such as the principal's traits, behaviors, and leadership styles. In particular, taking the single-dimensional standard to evaluate school effectiveness became scarcer because it was recognized that the single-dimensional standard could not adequately evaluate school effectiveness. In order to present the characteristics on school effectiveness research in recent years in Chinese Taipei, the author summarizes some points as follows.

First, most research was paid to empirical research but seldom to school effectiveness theory. As Cremeers pointed out, much empirical research on school effectiveness research became the major point, although most studies ignored the

theoretical research in depth (Creemers, 1994). Such situation enabled researchers to be outstanding statisticians but not successful educationalists.

Second, compared with the US and the UK as well as other European countries, school effectiveness research began rather late in Chinese Taipei. Therefore, it largely followed the Western countries but neglected the indigenous characteristics. Hence, school effectiveness research in Chinese Taipei was challenged by the effects on all sides such as international and domestic pressure. It needs to monitor student attainment as the central point in school effectiveness. Therefore, continuously improving student attainment is researchers' accountability. Meanwhile, the supported education policy motivates student achievement, forcing researchers to reconsider the focus of school effectiveness and gain more precise evaluations of school effectiveness.

Third, researchers have placed more attention at the school and class levels but less attention to the individual student level. To date, student attainment still plays a predominant role in school effectiveness, whereby researchers need to consider individual student needs. Students are situated at the core of education development, and thereby it is necessary to explore students' needs to discover what enables students to be motivated. Besides, although the school is viewed as one social organization, it always has discrepancies compared to business organizations. Hence, its specifics limited students given that they could not behave like the employees in an enterprise. The school is viewed as a community, in which students learn knowledge and to be cultivated as fully-developed citizens. As a response to Maslow's hierarchy theory of needs, in which he pointed out that motivation is the priority for personality development, satisfying individual students' needs became the priority to develop student achievement.

Fourth, the definition and understanding of school effectiveness are diversified among different school cultures, communities and districts in each country, and even within the same country. School effectiveness research is based on the notion that "the

school is not perfect," and therefore the meaning of school effectiveness research for each school is neither omnipotent nor useless. However, it does mean that schools have the space to improve and to be effective if school effectiveness works. Since the districts are separated in Chinese Taipei with each district having its particular characteristic, how to define and evaluate school effectiveness with unified standard are points that researchers have to consider. As such, researchers are supposed to discern the meaning of school effectiveness according to the discrete situation and work out the unified standards to evaluate school effectiveness.

Fifth, as mentioned above, previous school effectiveness research has placed more attention on single-dimensional factors. However, later research has told us that the factors affecting school effectiveness are multi-dimensional, meaning that perhaps the dynamic and comprehensive model could be an alternative for researchers.

Sixth, most reports and results on school effectiveness research have drawn strong attention to paper research but lacked practical relevance. Although there are discrepencies in the focuses of school effectiveness research, school improvement, and school leadership, researchers from Western countries and Chinese Taipei hold the viewpoint that school effectiveness and school improvement have continuously interacted with each other (Comer & Haynes, 1991; Cook, Meko, Stahle, & Cleaveland, 1999; Hopkins & Reynolds, 2001). Therefore, it requires researchers in Chinese Taipei to probe into the school improvement practice, whose aim is to further improve school achievement by using school effectiveness research.

3.1.4 Differences and similarities between Western countries and Chinese Taipei in terms of SER

There is no unified definition of school effectiveness to date since researchers hold different viewpoints. This is possible because the education requirements have been increased, whereby the concept of school effectiveness constantly varies. In addition, the factors related to school effectiveness are not placed only at the

single-dimensional level but rather at the multi-dimensional level. In other words, as mentioned above, the factors based at the multi-level have been in focus for researchers, such as the factors related to the school principal, school administration, school climate, school organization, teaching resource and curriculum, as well as the development opportunities for principals and teachers and the job satisfaction (Banerjee, Stearns, Moller, & Mickelson, 2017; Griffith, 1999; Kane, Taylor, Tyler, & Wooten, 2011; Louis, Dretzke, & Wahlstrom, 2010).

However, aside from the characteristics of school effectiveness research in Chinese Taipei summarized by the author in last section (Section 2.1.4), the author also found factors used to measure school effectiveness from a multi-level aspect in recent years. In particular, insights into the comparative study between Chinese Taipei and Western countries, the factors usually used on school effectiveness research in Western countries and Chinese Taipei are presented as follows.

In Western countries, researchers tend to pay attention to the following factors:

Codianni & Wilbur (1993)	Administration and teaching;
Sharon (1997)	School administration, school organization, school climate and employing information
Kanold (2002)	School administration and student performance
King (2003)	School administration, school organization, teaching, student performance, employing information and school environment
Bellum (2003)	Employment information

The scholars in Chinese Taipei followed this mainstream as Western countries, such as,

Minghui Zhang (2003)	Administration, teaching, student performance, employing information, school environment
Rui'e Li (2005)	School administration, school organization, teaching, school climate, school environment
Hongmiao Li	Administration, teaching, student performance, employing information, school environment
Ruixia Xu	School administration, teaching, employing information
Zhimin Tang	School administration, teaching, school climate, student performance, employing information, school environment
Yihua Zhang; Hongxin Yan; Chuanchong Xie	School administration, teaching, school climate, student performance, school environment

(2008)	

Conspicuously, what is presented above demonstrates that most researchers in Chinese Taipei have placed school administration as a priority and took it as the major point in school effectiveness research. After taking the indigenous characteristics of Chinese Taipei into consideration, researchers sumarized the factors on administration, related to the school principal, middle-level managers and teachers with administrative responsibilities, being responsible for promoting school achievement and improving school effectiveness research (Chen, 2003; Hong, 2008; Jiang, 2003; Lin, 2000; Tsai, 2005). However, some researchers asserted that the school – which was viewed as one organization – had some similar characteristics as enterprises. Therefore, school organization stood in front of diversity, empowerment, cooperation, and heterogeneity (Wu, 2003; Zhang, 1997; Liao, 2000; Lin, 2005). Because schools also need to cope with complex, challengeable and high-required goals to develop student achievement on all sides for the school organization (Lin, 1999; Wu, 2004), it is difficult to measure school effectiveness (Wu, 2004; Liu, 1993; Lin, 1994). Besides, because early researchers in Chinese Taipei devoted more effort to distinguishing effective schools but seldom placed their attention on the characteristics of social culture, most researchers questioned this and thereby suggested that the effect of local culture on school effectiveness should gain greater focus (Wu, 2004; Zhang, 2005).

It was conspicuous that researchers began to place their attention in deepening school effectiveness research since they were attracted by the points related to school principals, school administration, teaching resources, the relationship between the school and the local community, parental involvement, the role of the school principal, teachers' responsibility and what students learn. The focused points on school effectiveness research became more diversified than before, although in order to gain information for school effectiveness research regarding differences between Western countries and Chinese Taipei, the author has summarized them in Table 1 below:

Table 1 Main dimensions of SER in Western countries and Chinese Taipei

Researchers	School principals	Executive communications	The goals of teaching	The arrangement of teaching resources and curriculums	School environment and school capitals	the support of communities and parents	Professional development of teachers	The job satisfaction of teachers	Student performance
Codianni & Wilbur (1983)	√	√			√		√		
Levine & Lezotte (1990)	√			√			√		√
Elliot (1996)				√	√		√		√
Rajek (1997)					√			√	√
Chuen-rong Liu (1993)	√	√			√	√	√		√
Xiudong Zhuo (1995)	√	√		√	√	√	√	√	√
Tsay-feng Cheng (2001)	√	√			√	√			√
Shih-chang Hou (2002)	√	√		√	√	√	√	√	√
Hsiu-Lien Chung (2004)	√				√	√		√	√

Hsien-Cheng Lin (2006)	√	√		√		√	√		

Codianni and Wilbur (1983) summarized the previous research on more effective schooling and suggested that more effective schools are characterized by *"strong school leadership", "high expectation", "basic skills", "ongoing assessment", and "staff development"* (p.5.). Levine, Lezotte (1990) and their colleagues probed effective school research and summarized from more than 300 pieces of research that most research on effective school focuses on school leadership, teaching resources and curricula, the professional development of teachers, as well as student performance. Elliot (1996) disputed school effectiveness research and suggested that the school effectiveness result was not predictable, whereby he highlighted the teaching-learning process. Thus, his major point focus was on the arrangement of the teaching curriculum, school atmosphere and school capital, the professional development opportunities for teachers. Accordingly, he argued that education quality is affected by teaching factors rather than the judged result. Rajek (1997) used sources from colleges and state data to analyze the satisfactions of teachers, the community climate and school capital as well as student performance success. Liu Chuen Rong (1993) collected the data from 1,415 teachers embedded in 109 public primary schools and focused on the factors relating to the school principal, executive communications, students' learning climate, teaching and instruction, student behavior and student performance. He gained the result that the school effectiveness is firmly related to school organization and teachers' commitment, while the teachers' background and students' learning climate are linked with school effectiveness. Xiudong Zhuo (1995) collected data from 140 principals and 1,400 teachers from 140 secondary schools to analyze the relationship between school culture and school effectiveness. In his study, he placed a strong focus on school leadership, teaching and

learning, the school climate and the support from parents and community to analyze the relationship between these factors and student outcomes. Tsai-Feng Cheng (2001) paid attention to the school principals, and he conducted a survey and personal interviews with 36 primary school principals. He found that the job satisfaction of principals, the communication between principals and the community, the school climate and capital as well as teaching and learning were firmly related to principal effectiveness and school effectiveness. Shih-Chang Hou (2001) collected questionnaires from 3,024 student parents, 756 teachers embedded in 111 public primary schools and 10 private primary schools he interviewed three principals, teachers, and parents separately. He found that school leadership, teaching, student parents' expectation, support of the community, teachers' job satisfaction and student performance influenced school effectiveness, while he placed a major emphasis on the relation between student parents and school effectiveness. Hsiu-Lien Chung (2004) conducted a survey with 198 primary school principals with 1,623 questionnaires and obtained the finding that school leadership strongly influences school culture and school creativity, while he separated the sub-dimension of school effectiveness into teaching, student performance, school environment and the support of community. Hsien-Cheng Lin (2006) paid attention to primary school effectiveness evaluation. He constructed a new questionnaire with ISO quality standards, involving 105 question items used to evaluate school effectiveness. In his study, he placed his focus on teaching, community support and the professional opportunities for teachers' development, finding that school effectiveness could be assessed by three dimensions and thirteen sub-dimensions.

Accordingly, factors such as the school principal, school climate, and student performance hold major interests among school effectiveness research. Additionally, due to the different focused points on school effectiveness research between Western countries and Chinese Taipei, some researchers have concluded that the conception of each indicator also differs. For instance, in Chinese Taipei, most researchers define

school effectiveness as the process through which student attainment and school effectiveness can be promoted (B. R. Wu, 1990; Liu, 1993; Lin, 1994; Luo, 2000; Wu, 2004; Guo, 2000). However, some researchers have claiming that the process of achieving goals reflects school effectiveness. As a result, due to different focused points, what kinds of schools are identified as "effective schools" has been questioned by most researchers. Indeed, the perspective viewing the school as the organization comprising principals, teachers, staff and students has been commonly held. Meanwhile, the vision/goal of the school and the school climate have played an essential role in shaping school achievement. If each element performed well, such kinds of schools could be called an "effective school." Moreover, they placed "organization" in a high position because they believed that the school organization reflects the school characteristics and the climate for teachers and students. That is also the reason why much research has taken the school organization as the priority point in Chinese Taipei (Y. Y. Lee et al., 1998). Besides, regardless of the situation, researchers have asserted that it is critical to take different standards such as achieving goals, gaining outstanding school performance, narrowing the gap of the goals between expectations and reality, emphasizing school development on all sides, gaining the characteristics of effective schools and motivating teachers' job satisfaction in measuring school effectiveness (Zhang, 1997; Tsay, 1998; Chen, 1998; Zhou, 1999; Wu, 2002; Gao, 1999; Shen, 2000; Lee, 2000; Yang, 2000; Lin, 2001; C.D. Lin, 2001; Wang, 2002; M. X. 2002; X. Lee, 2002; Xu, 2002; Guo, 2002; Yang, 2002; Ye, 2002; J. D. Chen, 2002; Dai, 2001; Fan, 2002). The author also found that school effectiveness should be measured from a multi-level since most researchers have separated the factors related to school effectiveness into different levels, such as the national, school, classroom and individual student level.

Researchers in Western countries such as Madaus, Stufflebeam, Scriven, Cheng, Guba, and Lincoln have highlighted that school effectiveness should take performance-related considerations into account. For instance, the economic reasons

enable the viewpoint of school effectiveness research to be comprehensive and diversified since the economy is essential in relation to education (Cheng, 1996b; Lincoln & Guba, 1989; Madaus, Scriven, & Stufflebeam, 1983). As a result, most research has highlighted the "input-output" model – which is framed from the economic perspective – as one of the primary evaluations for school effectiveness research. Moreover, researchers believe that students are situated in the "black-box" because the process of school quality development is obscure and invisible. Hence, most research has taken the school goal as the target to measure school effectiveness in such a "black-box" (Frederick, 1987; Purkey & Smith, 1983; Reid, Holly & Hopkins, 1987; Young, 1998). They also developed some frameworks to describe school effectiveness based on the frameworks of goal-centered, systematical resource, human relations, bureaucracy and the political model (Scheerens, 1992). Along with the relevant research, most researchers have tkane class size, resilience, time spent for student learning, school health and teaching efficacy within frameworks for measuring school effectiveness (Borman & Rachuba, 2001; Kyriakides & Creemers, 2008; Coates, 2003; Hoy & Tarter, 2004; Hattie, 2009; MacNeil, Prater, & Busch, 2009; Cattaneo, Oggenfuss, & Wolter, 2017). Conspicuously, school effectiveness research in Western countries includes more factors than Chinese Taipei, whereby the conception of school effectiveness is more diversified. Therefore, researchers have found that owing to the diversified conception and factors to measure school effectiveness coupled with increasing attention paid to school leadership research, school effectiveness research has become more comprehensive in Western countries than before (Bamburg & Andrews, 1990; Silins, Mulford, & Leithwood, 2004).

Admittedly, the author supposes that the previous research on school effectiveness and the relationship between school leadership and student achievement has some deficiencies since each study still had the space to further discuss. Hence, the author found out that some spaces that still needed to be improved based on the previous research and summarized as follows, aiming to enable this comparative

study to be objective.

On the one hand, given that an effective school also behaves considerable differently between primary and secondary schools, school effectiveness research is divided into primary school effectiveness versus secondary school effectiveness in Western countries. This is lacking in Chinese Taipei since most research on school effectiveness place the emphasis on the elementary school while ignoring secondary school effectiveness and vocational school effectiveness (Griffith, 1999; Pan, 2005). On the other hand, due to different contexts, researchers in Chinese Taipei are prone to defining school effectiveness as "the school, which gains efficiencies from multiple dimensions on student achievement, school leadership, school climate, the school culture and value, teaching skills and strategies, professional development, support from communities and parents and achieving the goal set by school, can be identified as school effectiveness" (Wu, 2003). However, they neglect concrete questions that need to be answered, especially on the relationship between school leadership and student achievement. Accordingly, it is well known that school effectiveness should be measured from a multiple perspectives, but researchers seldom focus on the linkage between principal effectiveness and student achievement. In other words, there is insufficient empirical evidence to certify the relationship between school leadership and student achievement. The policy came from the education ministry of Chinese Taipei, which presented by the core concept of Nine-Year Compulsory Education, promising every student to be well-educated by school. Thereby, student achievement inevitably became the priority in school education. However, student achievement in Chinese Taipei has been over-emphasized with limited flexibility and subjective compared with Western countries (Chen, 2010).

In short, the notion that "no school is perfect" means that there is still space to improve student achievement and promote school quality. It is also the reason for many researchers taking school effectiveness research as the solution to solve education problems. Additionally, although researchers have employed diversified

methods to study school effectiveness from different perspectives, they have mostly preferred to take student performance as the final point in both Western countries and Chinese Taipei. Hence, it is necessary to recognize what indicators of student performance have been used. It is also one branch of rational-viewpoint theory (Cheng, 2008). Indeed, the purposes of school are educating students and fully developing students, which is the reason why researchers have paid much attention to student achievement while concentrating on school effectiveness research. Hence, the question goes back its original point, namely the conception of school effectiveness. Most researchers believe that school effectiveness refers to schools that demonstrate outstanding achievement in terms of student academic achievement, school leadership, school climate, school value and school culture, teaching skill and strategy, teachers professional development, as well as the support from the community and parents. Such kinds of school have been identified as effective school (Coleman, 1973; Creemers & Kyriakides, 2005; Hernandez, 2008; Houtveen, de Jong, & Van de Grift, 1999; Ouston, Maughan, & Rutter, 1991; Rutter & Maughan, 2002; Van de Grift, 1990; Witziers, Bosker, & Krüger, 2003). Regardless of the conception of school effectiveness, the primary school plays the foundational role as only with the sound basis in the primary education are students are enabled to acquire a good starting point for the next education phases.

Hence, many questions emerge in this respect: What are effective primary schools and how do them work? Is there a sub-aspect of each effective factor from different levels of school? The author believes that in school effectiveness research almost all researchers have adhered to such questions and are prone to exhausting their efforts to finding answers. Hence, different branches concerning school effectiveness research are divided into various aspects, such as principal effectiveness research and teaching effectiveness research. However, many researchers who have concentrated on school improvement research have also linked their efforts with school effectiveness research because both school improvement and school effectiveness make a significant

contribution to promoting student achievement.

3.2 Different branches of SER: school leadership effectiveness research

School leadership research originates from school improvement (SI), which began in the 1970s in the US and the UK. As mentioned above, school improvement research was one branch of school effectiveness research, and it was also the third phase in developing school effectiveness research. School improvement research attracted attention because the researcher's aim is to find out the solution how to place school effectiveness theory into practice to further improve school quality and student achievement. Meanwhile, the factors related to schools such as the school principal, teaching efficiency, organization, and administration effectiveness are placed as core points in school improvement research. Diversified school effectiveness research has identified those factors that affect student achievement, focusing on the school principal in relation to school effectiveness research.

Indeed, the early school effectiveness research was from Brookover, Edmonds, Motimore, Rutter et al. and Sthworth (Chapter 2.1.1). They pointed out that school improvement affects student achievement whether in a direct or indirect manner (Brookover et al., 1979; Edmonds, 1982; Mortimore, 2000; Rutter et al., 1979; Southworth, 2008). It prompted education researchers to further explore principal effectiveness, which was viewed as a new domain of school effectiveness research. Indeed, Edmond set the ground for school leadership research as he stressed the first factor in his five-factor model as "strong educational school leadership" (Edmonds, 1979). Hence, it began to attract much attention on effective school leadership. Regardless from which perspective the effect of school leadership exerts an influence on student achievement, many researchers believed that the school principal played the second important role in affecting student achievement (Wahlstrom, Louis, Leithwood, Wahlstron, & Anderson, 2010, pp. 9).

As such, Bolman studied the relationship between school leadership and student achievement. He also took an interest in the factors related to teaching efficiency, and he ultimately concluded that the school principal influenced student achievement through teachers' capacity (Bolman, 1991). Louis obtained the same conclusion as Bolman and further raised the recommendation that a network used for teacher collaboration should be established. In this case, it exerts a positive influence on creating effective schools (Louis, 1994). Furthermore, Leitner stood with Bolman and Louis, and he believed the relationship between teachers, the student economic situation (SES) and the school climate affects student achievement (Leitner, 1994).

However, Cheng, Evans, and Sergiovanni deemed that compared with teaching factors, school leadership determines teachers' motivation and teaching quality (Cheng, 2002; Evans, 1999; Sergiovanni, 2001). Accordingly, school leadership research became attractive, whereby even research on school culture, the school vision and the school goal became focused points in education research.

Elmore, Peterson, and McCarthey proposed that when the school principal shared the vision and the school goal with the teachers it impelled them to be more energetic and active when teaching (Elmore, Peterson, & McCarthey, 1996). Hallinger and Heck also suggested that the relationship between school leadership and student achievement is invisible but should not be ignored (Hallinger, 1996; Heck, 1998). Subsequently, in 1998 they both suggested that a good model used to measure school leadership and the relationship between school leadership and student achievement should be indirect and invisible (Hallinger & Heck, 1998). It gradually became the theoretical foundation in measuring school leadership. After that, Wiziers, Bosker, and Krüger studied 42 surveys, among which 37 showed that the relationship between school leadership and student achievement was indirect, while five showed that it was direct. Some researchers also held the viewpoints that although the relationship between school leadership and student achievement was small, it was significant, especially in places where school leadership was needed most (Wiziers, Bosker, &

Krüger, 2003). In those "most needed places," the leadership influence was able to become stronger (Leithwood, 2005, pp.3).

By contrast, some researchers held that school leadership affects student achievement indirectly as they took some factors such as teaching efficacy, school climate, community, collaboration, principal's behaviors, and school organization as mediated factors (Leithwood, Day, Sammons, Harris, & Hopkins, 2006; Louis et al., 2010; Wahlstrom et al., 2010; Waters, Marzano, & McNulty, 2005). They mostly used a multi-level statistical method within principal effectiveness research to determine the responded model to deepen school improvement research. In the meantime, Scheerens and Creemers found that there might be some facets in former school improvement research that lacked a dynamic mechanism to describe school development (Scheerens & Creemers, 1989). They proposed concentrating on school contextual factors from a dynamic perspective. Hence, they suggested that the more effective that school principals and teachers are, the better the students' achievement (Slater & Teddlie, 1992; Creemers, 1990). The question of how school principals affect student achievement has gained researchers' interests since a multi-perspective on school leadership research began to be the mainstream in leading principal effectiveness research. As such, researchers ascertained that if the principal was not likely to willingly improve student achievement, student achievement likely declines, as shown through the study of the effective versus ineffective schools (Slater et al., 1992). Therefore, almost all researchers support the point that the school principal certainly affects school achievement.

Meta-analyses of the relationship between the school principal and student achievement lack in theory regarding the school principal, which firmly affects school effectiveness research. Under such a condition, Ladd concluded that the school principal affects working conditions (Ladd, 2009). He believed that the working condition affects teaching and thus student achievement. As such, Hirsch, Frietas, Church, and Villar interviewed teachers and they summarized that they would be

more willing to stay at the school where they feel safe, comfortable and motivated (Hirsch, Frietas, Church, & Villar, 2008).

On the other hand, the time allocation – which was viewed as one part of resource allocation – also plays an important role in school leadership, being viewed as one part of principal effectiveness (Hammond et al., 2007). From four decades ago, time allocation and the school principal's accountability have derived a strong focus, offering details on the specific domain of school leadership (Cuban, 1988; Glenn, 1975; Hallinger, 2012; March, 1978; Peterson, 1977, 1979). Accordingly, how the principal allocates his/her time is always a relevant point in developing school effectiveness (Bell, Bolam, & Cubillo, 2003; Hallinger et al., 1996; Hallinger, 2012; Leithwood et al., 2004; May & Supovitz, 2011; Witziers et al., 2003). Researchers such as Leithwood also claim that time allocation is an important ability of school principals, whereby it also influences student achievement (Leithwood, 2005).

Meanwhile, much research has assigned priority to the job tasks of the school principal because they believed that the principal's behavior affects student outcomes throughout the given condition. For instance, when principals devote more time to setting school goals for teachers and students, the student outcomes are more likely to be outstanding (Firestone & Wilson, 1985). Other researchers have found that principals who devote more time to "organization management" strongly affect student achievement, as observed among Florida principals (Horng, Klasik, & Loeb, 2010). However, some researchers intended to find out how school contexture or culture affects time allocation in leading tasks while other researchers wanted to know more about where the school principals were and what they did within the school's daily operation (Leithwood, Seashore, Anderson, & Wahlstrom, 2004; Hallinger, Bickman, & Davis, 1996). For instance, researchers have sought to learn how much time principals allocate to instruction, management, and interaction with parents. Hence, they found that due to the varying school contexture, the school characteristics affect school effectiveness within different school cultures, while they also affect

principals' time allocation (Black & Porter, 1991; Bigoness & Blakely, 1996; Blendinger & Snipes, 1996; Blendinger, Ariratina, & Jones, 2000; Hallinger, 2012; Hofstede, 1991, 2003; Hoppe, 1993; Horng et al., 2010; House, Hanges, Javidan, Dorfman, & Gupta, 2004; Ralston, Holt, Terpstra, & Kai-Cheng, 2008). For instance, in suburban schools and those were located in high poverty districts, principals devote more time to managing the school (Harris & Chapman, 2004).

Research has also found that as the principals spent more time in instruction, the students acquired more advanced achievement than otherwise (Buttram, Mead, Loftus, & Wilson; 2008; Horng et al., 2010). Thus, researchers have sought to check how time is divided into different parts by principals and how the sub-slices of time affect student outcomes. They classified time allocated to school management from five aspects, focusing on instruction, management, administration, internal relationships, and external relationships". Thus, they checked the specific time spent in such leading activities (Horng et al., 2010). Admittedly, how to allocate the time to different tasks in school management played a crucial role in school effectiveness and student outcomes (Goldring & Pasternack, 1994; Murphy, 1992; Wimpelberg et al., 1989). The relevant research into time allocation in leading schools not only enables the fragments of principals' tasks to be much clearer but also offers detailed information on how much time principals allocate to teaching, evaluating and monitoring as well as providing professional development to teachers, which are related to improving student achievement.

Besides, researchers have also advised school climate holds importance in studying principal effectiveness. For instance, Rice, Grissom, and Loeb reported that one of the main priorities of the school principal is to maintain the school atmosphere as safe and comfortable, whereby the students and teachers extend learning and teaching under such a circumstance. Meanwhile, they deemed that the time allocated to school management also refers to the competence of the school principal, in particular representing instructional school leadership (Grissom, Loeb, & Master,

2013; Rice, 2010). Some researchers have focused on principals in high-achieving schools, aiming to enable the effective characteristics of the school principal, emphasizes the teaching and learning, high expectations of students, the outstanding capacity to maintain a safe, orderly school atmosphere, as well as the capacity to aspire towards a stable school structure to be distinguished. Meanwhile, they linked such effective characteristics with student achievement, and thus explored the relationship between these factors (Grissom et al., 2013; Rice, 2010). Although principal effectiveness research cannot explicitly explain why some schools outperform others, it provides inspirations for researchers to widen their focus in principal effectiveness research.

Third, another relevant point on principal effectiveness is the role of the school principal. It is one of the points that raised researchers' given that the role of the school principal is likely to influence their behaviors, the ideas to lead the school and the teachers' work performance (Littrell, Billingsley, & Cross, 1994; Pepper & Thomas, 2001). The staff are more likely to prefer a school with a positive, motivated and productive climate, which thus positively affects student outcomes (Pepper et al., 2001). Hence, the principal is responsible for developing more interactions and initiating trust among teachers when they lead the school (Day, 2000). As a result, according to their viewpoints, the primary task for researchers is to find out the role played by school principals, although they might adopt different roles when they confront different tasks. In terms of the leadership research, four main school leadership styles are transformational leadership, instructional leadership, transactional leadership and distributed leadership (Bass & Avolio; 1994; Burns, 1978; Jantze, Leithwood, & Steinbach, 1999; Leithwood, 1992b; Ogawa & Bossert, 1995; Pounder, Ogawa & Adams, 1995; Smith & Andrews, 1989). Indeed, more leadership styles according to the different perspectives from enterprise and education should be employed when principals lead the school. However, it should be considered that education is not completely the same as enterprises, whereby it is impossible to learn

from enterprises by simply reproducing their leadership patterns. Research has also highlighted that school leadership style exerts an effect on student outcomes through teaching directly, while it also affects the school climate (Creemers et al., 2010; Harris, 2003; Heck, 1992). Because the principal is the person who mainly guides the school, as a result the leading style affects the school organization (Harris, 2003). Researchers have also advised that the school organization is dynamic and semi-open, whereby as such the school leadership style cannot be fixed as one eternal aspect[10]. Hence, many researchers have concluded that school leadership styles coupled with the principal's roles are multiple functional (Lunenburg, 2011; Rowan, 1990). Because the school organization is half-opened and complicated, principals need more leadership styles when they lead the school. Meanwhile, common sense tells us that the different leadership styles interact with each other and indeed they need varied school leadership styles under the complicated organizational contexture. For instance, sometimes the principal is a manager, an administrator or a facilitator, although under a given condition, the role of principal needs to be a provider, trainer, coordinator, allocator or assistant (Goldring & Pasternak, 1994; Lee & Hallinger, 2012; Leithwood, 1994; Silins, 1994). Most studies have proven that when the principal employs different leadership styles, the school is more productive (Bossert, 1982). In other words, the principal needs to ascertain which school leadership style and what kind of role is suitable for teachers, students and the school organization.

Fourth, many studies have demonstrated that the traits and personality of the school principal also influences leadership styles and the roles taken by principals (Bush, Glover, & Harris 2007). Therefore, the personality of the school principal – which is used in formulating the particular school leadership style – is worth further discussion, showing that a principal who has *"emotional coping, behavioral coping, abstract orientation, risk-taking, innovation, use of humor, and experience"* as their individual personalities is likely to be a transformational leader (Bass, 1990; Dubinsky,

---

[10] OECD (2009). Creating Effective Teaching and Learning Environments: First Results from TALIS. Paris: OECD. Retrieved August 07, 2009 from http://www.oecd.org/dataoecd/17/51/43023606.pdf.

Yammarino, & Jolson, 1995). Principals,who have high standards or high expectations for staff, motivate the staff to accept more challenges, initiate trust and collaboration among staff prefer transformational school leadership style. Besides, those principals who stimulate teaching and learning, initiate dcollaboration among teachers, maintain a safe and orderly atmosphere for teachers and students, highlight student academic achievement and devote more time to observing teaching are instructional principals (Ashkanasy & Tse, 2000; Blase, 1999; Glickman, Gordan, & Ross-Gordan, 1995). Hence, a clear blueprint can be drawn about the linkage between the personality of the school principal and the leadership style based on such studies.

As presented above, principals not only employ one style when they lead the school, with the same reason the role that school principal tasks vary according to the particular situation or environment. Besides, throughout the literature, the previous research on principal effectiveness research has also informed us that it firmly affects student achievement directly or indirectly. This is the reason why it is necessary to deepen the relevant research, aiming to find out more details about the linkage between school leadership and student achievement.

Chapter 4 Focus and methodology

Based on the previous chapters, this chapter focuses on the conceptual and theoretical model used in this study (section 4.1), the research questions, the problem statements (section 4.2), and the statistical methodology (sections from 4.3 to 4.6). In order to examine the relationship between school leadership and student mathematics achievement, the study used confirmatory factor analysis (CFA) and multi-level structural equation modeling (MSEM), while latent class analysis (LCA) was used to distinguish the differences in school leadership styles in this study. Additionally, in order to ensure accuracy, before conducting the model analyses the author tested the validity and reliability of the data and the construct of the scale. The details are presented in section 4.3.

4.1 Conceptual and analysis model

As described above, in line with previous research, setting and developing the goal/vision, managing the school (governance) and maintaining the school climate play an important role in school leadership. Meanwhile, they also play a vital role in measuring school leadership in this study. In order to measure principal effectiveness, it is necessary to establish an empirical model based on the theoretical framework. Because previous research GAS declared that three aspects of school leadership affected student achievement either directly or indirectly (Creemers, 2002; Hallinger et al., 1996a; Kyriakides et al., 2008; Pitner, 1988), the author presents the framework as shown in Figure 1 in the previous chapter (Chapter 3).

The conceptual model used the "input-output" framework (Scheerens, 1990) to measure the correlative relationship among each factor (as Figure 1 presented). Due to the complexities in school organization, it was not easy for researchers to determine which kinds of measurements were more suitable to measure principal effectiveness (Heck & Hallinger, 1999; Leithwood, Begley, & Cousins, 1992; Pitner, 1988). As

such, the emphasis should be placed on those areas in which school leadership could be measured. One of the dimensions of school leadership that can be measured is the time allocated to leading activities, because the time spent leading the school is obvious and measurable. According to previous research and literature studies, if someone wants to find details about the relationship between school leadership and student achievement, the relevant factors should be focused on because they enable the study to become concrete and direct. Furthermore, with the sophisticated statistical methodology, the relationship between school leadership and student achievement could be presented in more detail. In particular, regarding the process in the framework, most researchers pointed out that the school organization process was like a "black box," which meant that it was invisible for researchers (Alfeld, Hansen, Aragon, & Stone, 2006). For instance, researchers cannot see what happens regarding the emotion, motivation or the cognition of principals when they make decisions for a school since the principals themselves are human beings first. Therefore, personal traits or the cognitions on personality are beyond the scope of this work because researchers cannot gain information on humans' inner nature. Hence, the author will not discuss the motivation or the personal psychology of principals but rather only aims to place the aspect at the evaluative point and then clarify the time allocated to specific tasks, such as defining and developing the school's vision/goal, managing the school and maintaining the school climate in Germany and Chinese Taipei, respectively. At the same time, this study also highlights the role that the principals play when they allocate time to such leadership abilities, whereby student math achievement is preferred as the output to check their correlations.

Figure 5 General framework to describe the relationship between SL and SMA
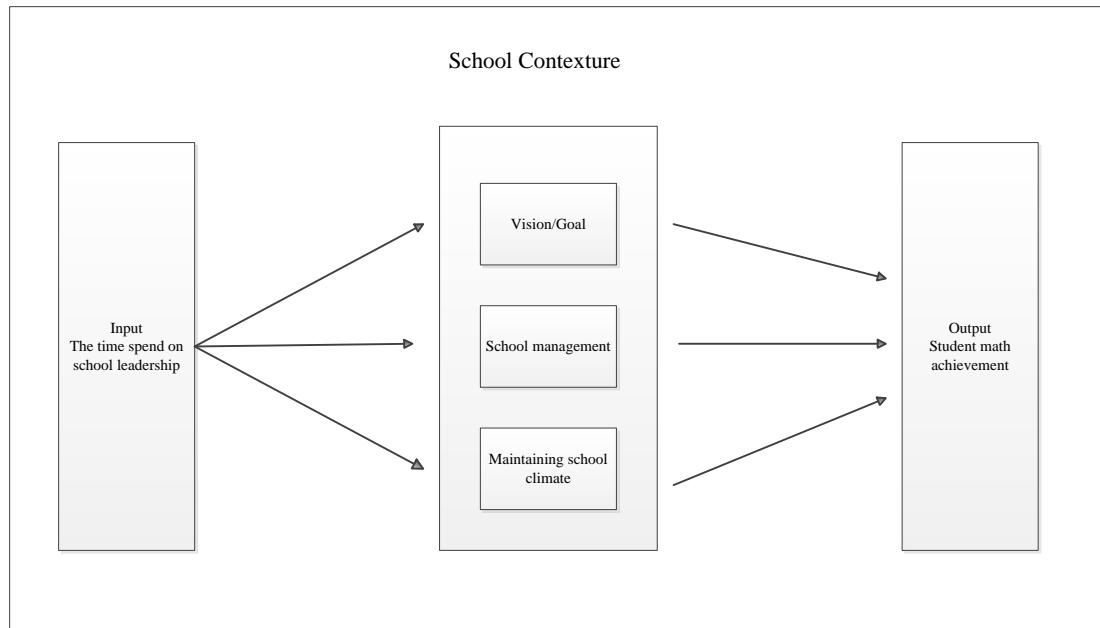
School leadership in Germany and Chinese Taipei

As presented in Chapter 2, the author summarized school effectiveness research and school leadership research based on previous work. However, due to different understandings of school leadership from different perspectives among studies, it is necessary to define school leadership in this study.

Due to different education systems and different school administration between Germany and Chinese Taipei, the author defines the school principals respectively. In Chinese Taipei, there is only one professional position offered to the principal, who is responsible for maintaining the school daily operation, and hence is situated at the top position in the school [11]. In most German primary schools, the principal's position is taken by an experienced teacher, which means that there is no particular professional position for the primary school principal. The school questionnaire of TIMSS test is accomplished by an experienced teacher, who only plays a part role in managing the school. Accordingly, it can be called a "headmaster" in Germany.

The conception of school leadership

---

[11] The National Education Law, Item 9., Chinese Taipei.

However, given that there are some commonalities between leadership and management, thereby, the author deems it relevant point out the differences between management and leadership. The function of management mainly emphasizes "doing things right", whereas leadership places an emphasis on "doing the right things". Consequently, the school principal plays the role as a **"cox"** when leading the school because they are inclined to determine the direction for school development and school improvement.

For the definition of school leadership, the author first distinguishes school leadership from school management. Chapter 2 presented that there are many leadership styles in primary schools, whereby it is impossible for principals (or headmaster) to employ only one leadership style. According to Leithwood, *"the core of leadership is direction and influence"* (Leithwood, 2006). Meanwhile, he advised that the goal of leadership is "improvement" rather than remaining stability, whose goal is "management" (Leithwood et al., 2006). Of course, the author is unwilling to defy the importance of "stability," given that after all the principal – coupled with teachers – stands in front of the volatile context whereby they are responsible for maintaining the school stability while driving school improvement. As such, improve the school while increase student achievement has become a critical point in school leadership research.

Beare, Caldwell, and Millikan (1992) agreed that in order to achieve progress in school leadership research, the clear and applicable conception of school leadership is necessary. Each definition of school leadership should not be criticized because it has different meanings for researchers. However, it is important to define school leadership according to the specific research perspective. From the perspective of behavioral science, Yule emphasized school leadership as follows:

"Most definitions of leadership reflect the assumption that it involves a social influence process whereby intentional influence is exerted by one person [or group] over other people [or groups] to structure the activities and relationships in a group

or organization." (Yule, 2005, pp. 3)

Other researchers have held different definitions of school leadership. As Bush and Glover pinpointed regarding the importance of definition of school leadership in school practice, *"Leadership is a process of influence leading to the achievement of desired purposes. Successful leaders develop a vision for their schools based on personal and professional values. ... this vision at every opportunity and influence their staff and other stakeholders to share their vision. The philosophy, structures, and activities of the school are geared towards the achievement of this shared vision."*(Bush, Glover, & Harris, 2007, p.8)

Bush and Glover emphasizes "vision," which significantly influences school achievement. However, from another perspective, some researchers differentiate between "management" and "leadership". They prefer a clearer definition of school leadership rather than "school management", as Bolman and Deal stated that *"Leading and managing are distinct, but both are important. Organizations, which are over managed but under led eventually lose any sense of spirit or purpose. Poorly managed organizations with strong charismatic leaders may soar temporarily only to crash shortly thereafter. The challenge of modern organizations requires the objective perspective of the managers as well as the brilliant flashes of vision and commitment wise leadership provides"* (Bolman & Deal, 1991, pp. xiii-xiv).

It is known that the core conception of "leadership" incorporates two aspects, namely direction and influence (Leithwood, 2006). Therefore, it is necessary to derive a clear direction and determine the way to "achieve the goal." As such, this needs the influence of leadership, which motivates teachers and students to achieve the final goal. That is what Bolman and Deal (1991) emphasize in the definition of school leadership. It is unsurprising that researchers define school leadership from other

perspectives because the initial motivation for each researcher differs in relation to their respective interests.

Another viewpoint on school leadership has also raised researchers' interest, with an emphasis on school leadership style. For instance, Harrir and Leithwood (2007) were attracted by distributed leadership, considering that the influence of leadership should be shared from top to bottom. Most researchers deemed that the more that leadership influence is distributed, the more effective that school leadership is (Cuban, 1988; Ogawa & Bosert, 1995).

Of course, the influence of school leadership is critical in leading the school and enabling other members to be self-responsible. However, other researchers have questioned this notion and offered some "new" viewpoints. For instance, Wasserberg (1999) stated that whether or not school the principal is effective depends on the personal value of the goal or vision of the school set by the school principal. Hence, the personal value that the principal holds is critical for setting the school goal/vision. After the goal or vision is set by the school principal, it becomes a mirror of the personal value and character of the school principal. As such, Day, Harris and Hadfield, Earley and Weindling elaborate that the essence of a school principal is "personal value and character." Meanwhile, they pointed out that the school principal's vision is inclined to determine the future while it also influenced the principal's practical action to a strong extent. They also believed that setting the vision for the school is also the key to determine whether the principal is outstanding or not (Day, Harris, & Hadfield, 2001; Earley & Weindling, 2004). Many researchers have questioned the importance of the school's vision/goal, possibly because they took it into consideration from different perspectives. For instance, researchers who emphasize the principal's behavior are inclined to conclude that the principal's behavior plays a key role in determining whether the principal is effective. Others who take a stronger interest in the role of school principal are more likely to state that the principal's role is critical in determining the effectiveness. Accordingly, in

different situations, principals play different roles such as a facilitator, coordinator, manager, etc. For instance, the principals situated at a school that emphasizes a democratic and free atmosphere are likely to act as a facilitator. The responsibility of the facilitator is mainly to offer help to teachers and school staff, aiming to inspire one's followers to realize their full potential.

In this dissertation, the author is unwilling to debate such issues but only to study school principals based on previous research. As such, first the author asserts that the vision/goal set by the school principal plays an important function in school leadership. According to Beare, Caldwell, and Millikan (1992), *"[the] outstanding leaders have a vision of their schools – a mental picture of a preferred future – which is shared with all in the school community"* (p.99). In line with Fullan and Campbell, they propose that articulating the clear vision is the responsibility of the school principal as the vision is viewed as the direction and the purpose that the school should work towards (Fullan, 2003b; Campbell et al., 2003). Aside from importance of vision/goal of school, the principal is also responsible for articulating and sharing the school's vision/goal. Sharing and articulating the vision/goal is also a part of the school governance process, since the principal has to ascertain that the teachers understand what content is shared. Therefore, how to keep the staff informed is a key point for the principal to practice the leadership.

Second, the school governance – which embedded at the center of the school organization – is actualized by the school principal. A well-governed school is identified as a supportive, healthy learning community for staff. It enables teachers and students to feel comfortable and safe within such an organization. Any measure taken by principals during such a period is called "governance" or "management." For instance, sharing the goal/vision with teaching staff, the principal needs to work with teachers and then ensure that the goal/vision is informed. If the school is the community supported by the principal, the teachers will obtain the shared information with a forward motivation. In particular, a healthy and trusted community enables the

principal and teachers to be united together. Therefore, the importance of the management in principal effectiveness cannot be doubted given that sometimes it is "doing the right things" (leadership), rather than the principal needing to "do things right" (management).

Finally, the school climate should be safe and orderly maintained by principals. It is another key point for school leadership. As the author illustrated in Chapter 2, previous research has stated that the importance of the school climate accounts for school effectiveness and student achievement. Meanwhile, school performance is affected by school climate so that the capacity to maintain a safe and orderly climate for teachers and students is required for the school principal, because the school culture is identified as a mirror to reflect the situation of school health. While the culture – which is a particular form comprises values and beliefs as well as the vision of the school – exerts a profound influence in organization members, the teachers and students are required to obtain the information and read the message from the school culture, through which it enables them to exchange the information sensibly. Hence, the author suggests that school principals are responsible for maintaining a safe and orderly atmosphere for everyone. This responds to Day, who deemed that the school climate was a requirement for the principal to operate a successful school (Day, Hall, & Whitaker, 1998).

Based on previous research, the author decided to employ the concept of school leadership in terms of Hallinger and Heck, whose definition of school leadership incorporated three dimensions, namely 1) defining and developing the vision in school, 2) managing or governing the school instructional program, and 3) maintaining the school climate to be orderly and safe. Hence, the author defined the school leadership in this study as follows (Hallinger & Heck, 1996):

A school leader has the ability to set and develop a clear goal and vision for the school, manage the school instructional program, place a emphasis on student

academic achievement and promote teachers' professional development while maintaining a safe and orderly atmosphere. This is called school leadership.

By establishing the conception of school leadership, the current dissertation also adapts the viewpoint that modern school leadership research should switch to the time allocated to leading activities, whereby its effect on school achievement is likely to be specific (Cawelty, 1997; Creemers & Kyriakides, Edmonds, 1979; Teddlie & Stringfield; 1989). Besides, given that the school principal needs to answer questions from parents, politicians and governors, they are accountable for *"managing the instruction time, professional development time, SATs and a 'real' school budget"* (Whitaker, Day, Hall, & Whitaker, 1998, p.52). Hence, it is insufficient for them to only explain the vision and manage the school to be operated as normal, but also taking time allocation into consideration. Therefore, the author of this study explores the time allocation of school principals for different leadership activities according to the international scales in TIMSS questionnaire and offers details on the relationship between school leadership and student mathematics achievement in Germany and Chinese Taipei in Chapters 5 and 6.

4. 2 Statement of the problem and research questions

Much research has highlighted that school leadership plays an important role in student achievement, whereby especially many researchers have expressed that such an effect is mainly indirect. Alternatively, many researchers suggest that the effect might be direct if it is not difficult to measure (Hallinger et al., 1996; Mortimore & Whitty, 2000).

Hence, the author considers it important to recognize whether such effect is direct or indirect, and how to recognize the difference in school leadership between Germany and Chinese Taipei, before ascertaining the indicators concerning the extent to which school leadership reflects each one. In other words, the author seeks to

identify extent to which the observed factors demonstrate the aspect of school leadership. For instance, which factors are taken to demonstrate school leadership and to what extent they indicate school leadership becomes the core question in this study. Indeed, it unequivocally presents a large number of differences concerning social and cultural between Germany and Chinese Taipei. However, after narrowing the focus to school leadership between the two different school systems, the author aims to further clarify the details of such differences, as well as highlighting the relationship between time allocated to school leadership and student math achievement in Germany and Chinese Taipei. In addition, it should be further clarified whether this relation is positive or negative.

The author intends to address such issues by first putting all students at the same level and then conducting empirical research, and finally finding which factors affect school leadership, as well as identifying how such an effect influences student achievement. On this basis, the author seeks to explain the differences between Germany and Chinese Taipei with more details. In particular, taking different social contexts and organization climates alongside the education administration, which plays a major inspection role in affecting school management and the principals into consideration, it is intended to present more realities via the comparative study. In short, it is considered important to address which factors affects school leadership and how time is allocated to school leading activities. Ultimately, finding the answers to questions above is the purpose of this study. In the data analysis, the author employed the multi-level statistical method to find the relationship between time allocated to school leadership and student math achievement. Meanwhile, the relationship between the observed variables and the latent variables in indicating school leadership will also be presented (Chapter 4).

Many research studies take school effectiveness as the core point to improve school quality. However, it lacks the concrete elements to indicate school leadership. As Smith and Piele expressed, the lack of concrete elements in school leadership

research influences school leaders and policy-makers because they both require guidance from principal effectiveness research (Smith & Piele, 2006). The author found that especially from the aspect of the empirical and comparative study, it was rather sparse. Besides, as an important branch of school effectiveness research, most researchers have paid attention to the school climate, organization or education policy from the macro-level but ignored the factors from the micro-level. In other words, although there has been much research about school leadership, it seldom emphasizes the specific questions on school leadership (Holtappels 2004, 2007; Holtappels et al., 2008). Additionally, as previously mentioned, because the data sample in the previous research was small and the scale was not sufficiently international, this study uses data from the TIMSS 2011 database to address this issue in further detail. In the meantime, the author was inclined to reveal the mysterious mask of the effect of school leadership and probe how such an effect influences student math achievement in Germany and Chinese Taipei, respectively. Hence, the previous research serves as a foundation, based on which the author aims to answer the research questions in this study as follows:

1.   Which factors play an important role in indicating school leadership in Germany and Chinese Taipei via confirmatory factor analysis?

2.   What are the differences in specific tasks of school leadership in Germany and Chinese Taipei?

3.   Does school leadership in general affect student math achievement when controlling for students' background in Germany and Chinese Taipei?

4.   What kind of the relationship exists between each sub-dimension of school leadership and student mathematics achievement in Germany and Chinese Taipei?

5.   What are the differences in the latent class of school leaders between Germany and Chinese Taipei via latent class analysis?

According to the theoretical foundation, the effective characteristics of school

leaders are clarified into three explanatory variables, namely setting and developing the vision/goal for school, managing the school and maintaining the school climate (Hallinger et al., 1996a). The author will provide more details about how to clarify the scales in combination in a later chapter.

Throughout the literature review and the problem statement, the author's attention was attracted by the time allocated to specific leadership tasks, as well as its relationship with student math achievement. Hence, the author aimed to examine which specific task was allocated the most time and what kind of relationship exists between the time was allocated on such leading school activities and student math achievement (negative or positive, significant or insignificant), as well as which factors of school leadership hold more importance in Germany and which perform stronger in Chinese Taipei. Taking this as the basis, the author places a focus on the differences between the two education systems and attempts to ascertain the reasons behind such differences.

4. 3 Introduction to database, scale and the empirical model

4. 3.1 Database of TIMSS 2011

The data is from the TIMSS 2011 (The Trend in International Mathematics and Science) database, which covers the students in grades four and eight from more than 50 countries. For both grades, it incorporates not only student achievement in math and science but also information on the backgrounds of students, parents, teachers, schools, and curricular for the participating countries. There were 52 countries participating in TIMSS 2011 test for Grade 4, while in Grade 8 it had 45 participating countries.

However, for the specific comparative study between Germany and Chinese Taipei, the author only focuses on the students in grade 4 in this dissertation. In 2011, nearly 4,000 students in 198 primary schools in Germany and 150 schools in Chinese

Taipei were included in the TIMSS 2011 test. Meanwhile, after eliminating missing data, eventually there were 3,960 students in 197 primary schools in Germany and 4,138 students in 150 primary schools were kept for further analysis. Accordingly, there were 197 school principals within the school level and 3,960 students at the individual level in Germany, and 150 school principals within the school level and 4,138 students at the individual level in Chinese Taipei. The data sample is presented as follows (Table 2):

Table 2 Samples in Germany and Chinese Taipei

	Germany	Chinese Taipei
Number of schools	197	150
Number of students	3,960	4,138

4. 3.2 The indicators in TIMSS 2011 for analysis

According to the literature study, the author preferred eleven items to represent the principals', which are described as follows (Table 3),

Table 3 Indicators of school leadership used in the study

Dimensions	*During the past year, approximately how much time have you spent on the following school activities in your role as a school principal?*
Vision/Goal(S1)	Promoting the school's educational vision or goals (015A)
	Developing the school's curricular and educational goals (015B)
	Visiting other schools or attending educational conferences for new ideas (015K)
	Initiating educational projects or improvements (015L)
Management(S2)	Monitoring teachers' implementation of the school's educational goals in their teaching (015C)
	Monitoring students' learning progress to ensure that the school's educational goals are reached (015D)
	Initiating a discussion to help teachers who have problems in the classroom (015I)
	Advising teachers who have questions or problems with their teaching (015J)
Maintain the school climate(S3)	Keeping an orderly atmosphere in the school (015E)
	Ensuring that there are clear rules for student behavior (015F)
	Addressing disruptive student behavior (015G)

The scales in the TIMSS 2011 school questionnaire were used as international Likert scales to answer the question items. As a result, there were three scales – namely "no time," "some time" and "a lot of time" – that were circled to answer each question item. Throughout the theretical background and repeated principal factor analysis as well as the confirmatory factor analysis (CFA), ultimately the three first-order latent variables – which were presented above as "vision/goal", "management" and "maintaining the school climate" – were applied to represent school leadership, which was identified as the second-order latent variable.

The details about the mean and standard deviation of outcomes, control variables and question variables are described in the following table (Table 4).

Table 4 Means, standard deviations, and frequencies of outcomes, control, and question variables

		Germany (Estimated/S.E)	Chinese Taipei (Estimated/S.E)	
Full sample (students)		3960	4138	
Full sample (schools)		197	150	
outcome variables				
Math achievement		528.29(61.3)	593.93(72.26)	
student individual level control variables				
Age		10.37(0.51)	10.24(0.31)	
HB (home background)		4.74(1.92)	4.60(1.44)	
Gender		--	--	
School level variables				
x1				
Category 1	91	46.2%	42	28.0%
Category 2	94	47.7%	107	71.3%
x2				
Category 1	92	46.7%	47	31.3%
Category 2	93	47.2%	101	67.3%
x3				
Category 1	43	21.8%	78	52.0%
Category 2	116	58.9%	71	47.3%
Category 3	27	13.7%	--	--
x4				
Category 1	12	6.1%	70	46.7%
Category 2	129	65.5%	79	52.7%
Category 3	45	22.8%	--	--
x5				
Category 1	32	11.7 %	61	40.7%
Category 2	132	67.0%	88	58.7%
Category 3	29	14.7%	--	--
x6				
Category 1	25	12.7%	68	45.3%
Category 2	126	64.0%	81	54.0%
Category 3	33	16.8%		
x7				
Category 1	15	7.6%	92	61.3%
Category 2	122	61.9%	56	37.3%
Category 3	48	24.4%	--	--
x8				

Category 1	10	5.1%	84	56.0%
Category 2	123	62.4%	63	42.0%
Category 3	53	26.9%		
x9				
Category 1	80	40.6%	74	49.3%
Category 2	105	53.3%	75	50.0%
x10				
Category 1	101	51.3%	74	49.4%
Category 2	83	42.1%	74	49.3%
x11				
Category 1	95	48.2%	10	10.7%
Category 2	90	45.7%	110	73.3%
Category 3	--	--	22	14.7%

Note. The student's age and gender, coupled with student mother's education level, were taken as the background variables, and they were controlled for. As previouysly mentioned, the mother's education level of students represented parental education, which had seven levels according to the International Standard Classification of Education (ISCED)" in 2011: "1" denoted primary education, "2" referred to lower-secondary education, "3" indicated Upper-secondary education, "4" represented post-secondary non-tertiary education, and "5" referred to short-cycle tertiary education, being separated into "5A" and "5B". They both represented the first stage of tertiary education but with different qualifications. Additionally, there were other three answers, namely "Did not go to school," "Beyond level 5A first degree", and "not applicable."

For gender, "1" represented females and "2" males. Besides, the mean of student math achievement in both Germany and Chinese Taipei was defined as the dependent variable and thus eleven observed variables along with three first-order latent variables and one second-order latent variables were defined as the independent variables.

4. 3.3 Reliability test

The first step in the data analysis was test the item reliability because according to statistical principles, a reliability test is required before prior to analysis. The reliability test was presented by Cronbach's alpha, which was put forward by Lee Joseph Cronbach in 1951, becoming one of the most popular methods to test data

reliability in psychology and education research (Lee, 1951). The reliability of each item in Germany and Chinese Taipei was described respectively as follows:

Table 5 Reliability Statistics for Germany and Chinese Taipei

	Case processing summary		
	N	Percent (%)	Cronbach's Alpha
Germany	3665	92.3	0.761
Chinese Taipei	4041	94.9	0.840

As described in Table 5, Cronbach's Alpha was 0.761 and 0.840 in Germany and Chinese Taipei, respectively. The value was acceptable because according to statistical discipline, the greater the value, the strongly the reliability of the instrument. If it is greater than 0.7, the instrument that tested is competent for further analysis. Besides, if the value of Cronbach's alpha is between 0.7 to 0.8, it is identified as "high reliability," which means it is sufficient for analysis. However, when its value is below 0.35, the instrument is rejected due to "poor reliability." As such, throughout the reliability test, the author opined that the instrument used in this study was reliable and thus the final result from the data analysis also was assumed to be reliable.

4. 3.4 The KMO & Bartlett's Test

It was important to verify the validity of the scale structure. Although the TIMSS 2011 questionnaire was utilized in this study, the items were re-chosen according to the previous research and principal component analysis (which was used to reduce the dimensions of a set of factors for summarization), which meant that those preferred items constructed a "new" scale with different indicators compared with the original scale. Hence, validity test of the "new" scale became the priority in empirical research, in particular for those in education and psychology research. Besides, as presented above, four latent variables were involved, whereby all items used were indicators to represent the first-order latent variables, namely "vision/goal," "management" and "maintaining the school climate." Furthermore, three first-order latent variables were

identified as indicators to indicate the second-order latent variable of school leadership. Accordingly, confirmatory factor analysis (CFA) was necessary to analyze correlations among each variable. Before the factor analysis, a KMO & Bartlett test was employed to confirm whether the variables used are relative. As such, empirical researchers need to use the KMO & Bartlett's Test, which is applied to verify the relativity of the data and as a discipline to determine whether it is further suitable for factor analysis. Table 6 demonstrates the values of the KMO & Bartlett's Test in Germany and Chinese Taipei, respectively.

Table 6 KMO & Bartlett's Test in Germany and Chinese Taipei

	Kaiser-Meyer-Olkin Measure of Sampling Adequacy	Bartlett's Test of Sphericity Approx. Chi-Square
Germany	0.741	9302.812, sig. 0.000*
Chinese Taipei	0.801	17094.536, sig. 0.000*

Note. * refers to strong significant that $p < 0.001$.

The Kaiser-Meyer-Olkin (KMO) Test was used to prove whether the sample is adequate and the appropriateness of the data for factor analysis (needs to be significant), while Bartlett's test for sphericity was employed to compare the assumed correlation matrix with the identity correlation matrix and to check whether the study is significant by showing the validity and appropriateness of the responses of the issues addressed and if the identity matrix is factorable. When there are sharp corrections among each variable, the value of partial correlation coefficients is much lower than with simple correlation coefficients, with the value of KMO approaching close to 1. By contrast, when the correlations among each variable are small, the value of partial correlation coefficients is greater than with simple correlation coefficients, whereby the value of KMO approaches 0. Accordingly, the value of KMO ranges from 0 to 1.

Moreover, the cut point of the KMO value is 0.6. If it is less than 0.6, it might not be suitable to further conduct the factor analysis. Rather, if it is greater than 0.6 and

situated between 0.8 and 1, then it indicates that it is meritorious to conduct factor analysis. However, when it is greater than 0.6 but less than 0.7, the further factor analysis can be conducted after emendations or rectifications.

As presented in Table 6, the KMO value was more than 0.7 and the P value was less than 0.05 in both Germany and Chinese Taipei, which demonstrates that such values were significant. In particular, it was more than 0.8 in Chinese Taipei, coupled with a significant p-value ($p < 0.05$), which illustrated that the sample and the data were adequate for further factor analysis. Meanwhile, it indicated that the construct of the questionnaire was valid. Accordingly, the question items used in this study were reasonable, and the final statistical results could be interpretable.

As explained above, the relativity test (KMO & Bartlett's Test) was taken as the priority for its necessity and rigorousness in empirical research. Moreover, the test results for reliability and validity presented that the item preparation was effective and the following steps could be further conducted. Furthermore, the author intended to concentrate on establishing the model based on the question items and the previous study. Hence, the theoretical framework foundation was presented in a later section (Section 3.3).

4. 4 Structural Equation Modeling (SEM)

The data analysis role an important role in empirical research as it has become increasingly prevalent in education study in recent years. Indeed, the precision and details that the data and empirical research bring to us cannot be denied, although the challenges along with the prevalence period of great data analysis are also relevant. Hence, researchers need to use accuracy and precision when dealing with data and conducting large-scale assessments. In the light of more diversified statistical requirements, some statisticians such as Connell, Jöreskog, Bollen, and Söbom have started exploiting more advanced and sophisticated statistical methods as well as empirical models (Bollen, 1989; Connell & Tanaka, 1988; Jöreskog & Söbom, 1979).

As a result, structural equation modeling (SEM) emerged as the response under such a condition (Hox & Bechger, 1998).

Structural equation modeling (SEM) – which is based on the covariance matrix to analyze the correlations between observed variables – is beginning to gain in popularity in empirical studies. Because the estimation is based on the correlations between the variables, it is also called covariance structural modeling. As highlighted in the previous section (Section 3.4), due to unmeasured specific constructs latent variables are necessary to represent the construct based on the theoretical background. In order to measure the correlations between the variables in the theoretical construct, path analysis and regression are employed. For simplicity, SEM is a mathematical modeling that acquires correlations among the latent variables and the unobserved correlations among variables involved to simultaneously estimate them. Conventional statistical methods cannot meet the modern statistical requirements given that the independent variables cannot be admitted to deviate under given condition. However, the dependent variables have deviations regardless. For instance, when researchers are interested in the relationship between parental education and student achievement, they suppose that there is no measurement deviation when parental education is measured while ignoring the growth period of students. Accordingly, researchers hypothesize that student achievement has measured deviations. The results will be less accurate since the measurement errors of independent variables are ignored. From this perspective, SEM is able to provide support for more accurate results than conventional statistical methods. Besides, there is another advantage of SEM, which is used to analyze the different models and provide evidence for comparative research, thus assisting researchers to determine which model performs better in their studies.

SEM comprises measurement and structural models. The measurement model is used to measure the correlations between observed variables, and the structural model is employed to measure the correlations between the latent variables. For instance, in this study, the author emphasizes the relationship between school leadership and

student math achievement based on the measurable time allocation in school leading activities, while student math achievement was indicated by students' math scores. Accordingly, both school leadership and student math achievement are latent variables for their invisible specifics. Hence, SEM is supposed to offer assistance in this study. Besides, the correlations among latent variables have attracted researchers' attention because they are more willing to know the details on the correlations between latent variables, as well as the correlations between latent variables and their indicators. In other words, the information on structural model has attracted strong attention among many empirical researchers. Due to the specifics of SEM, it is supposed that SEM could provide such information on structural model for researchers.

In this study, as presented above, there were eleven observed variables included in the measurement model, while three first-order latent variables and one second-order latent variables were included in the structural model. The general formula of SEM (Bollen, 1989) is written as:

$$\eta = B\eta + \Gamma\xi + \zeta \qquad (1.1)$$

$$x = \Lambda_x \xi + \delta \qquad (1.2)$$

Where η stands for endogenous latent variables, ξ refers to the exogenous latent variables, and ζ represents the regression residual term. Both endogenous and exogenous latent variables link with the regression coefficients of $\mathbf{B}$ and Γ, while $\mathbf{B}$ indicates the regressive correlations between the endogenous latent variables, where Γ represents regressive correlations between the exogenous latent variables. The second equation is the measurement model used to measure how well the observed variables indicate the latent exogenous latent variables, which enables the observed variables to link with the latent variables, where $\mathbf{\Lambda_x}$ is the vector of factor loadings, serving as a link that enables the exogenous variable ξ to relate with observed variable x. The last component is δ, which represents the random error that cannot be explained by unobservable statistical errors.

According to Hox (2013), the formula in within-level (level-1) is specified as:

$$y_W = \Lambda_W \eta_W + \varepsilon_W$$

While the formula in between level (level-2) is written as:

$$\mu_B = \mu + \Lambda_B \eta_B + \varepsilon_B$$

By combining the within-level with the between-level, the formula is specified as:

$$Y_{ij} = \mu + \Lambda_W \eta_W + \Lambda_B \eta_B + \varepsilon_B + \varepsilon_W$$

Where $\mathbf{\mu}$ denotes the vector of the group-level means, and $\mathbf{\Lambda_W}$ and $\mathbf{\Lambda_B}$ represent the factor matrices at the within-level and between-level. $\mathbf{\varepsilon_W}$ and $\mathbf{\varepsilon_W}$ denote the residual errors at the within-level and between-level, respectively.

Despite the direct relationship between school leadership and student math achievement, the relationships between three first-order latent factors and student achievement for each economy are also examined. The formula is specified as:

$$\hat{y}_i = \beta_0 + \beta_1 X_i + \varepsilon_i$$

Where $\hat{\mathbf{y}}_i$ denotes the estimation of student math achievement, and $\mathbf{X_i}$ represents the independent variables, whereby here it represents setting school vision/goal *(S1)*, school management *(S2)*, and maintaining school climate *(S3)*, separately. $\mathbf{\varepsilon_i}$ refers to the residual terms, distributed as $\mathbf{N}(0, \sigma^2)$.

Although the following formula of the measurement model is similar to the equation presented as equation 1.2, in this study, since this study needed high-order confirmatory factors analysis the second-order measurement formula is specified as:

$$Y_{ij} = B(\Lambda \eta + \epsilon) + \delta$$

Here, the meaning of each symbol is the same as explained above. However, the only difference is that it estimates the correlations between the latent variables. In other words, the formula is used to prove the extent that the first-order latent variables indicated the second-order latent variable.

In data analysis, the estimator of robust maximum likelihood (MLR) and the weighted least square robust mean variance (WLSMV) were employed in analyzing given that the robust maximum likelihood (ML) was more appropriate to estimate the categorical variables. Besides, the sample size was sufficiently large that it was viewed as with normal distribution (Muthén, 2010).

The statistical analyses involved in SEM in this study largely concentrated on confirmatory factor analysis (CFA) and the multi-level hierarchical linear modeling (HLM), which were used to estimate the regressive relations among variables. CFA was applied to estimate the relations between the observed variables and the latent variables. In other words, it assists researchers to find what factors performed well when they indicated the latent variables, while it was also the same for those factors that did not perform so well. Subsequently, in light of the factor loadings, it enabled us to find if the factor constructs fit the conceived model. However, in this study, given that it had two levels, second-order CFA was used to check the correlations between the latent variables. Besides, multilevel hierarchical linear modeling – which means multilevel regression – was applied to estimate the relations between multi-dimensional independent variables and the multi-dimensional dependent variables while analyzes the effect of independent variables regressed on the dependent variables, which was presented by the regressive coefficients of the time allocation in leading school activities regressed on student math achievement in this study. In addition, given that there were two different groups (Germany and Chinese Taipei), the relations between the variables with mult-ilevel hierarchical linear modeling enabled the comparability between the multi-groups result to be limpid on what the differences were and the variance across groups.

In short, based on the multi-level structural equation modeling (MSEM), the relationship between school leadership and student achievement with multi-level path analysis while controlling for student background variables was examined in Germany and Chinese Taipei, respectively. As presented above, structural equation modeling had many advantages, whereby it estimates the correlations between the factor constructs while estimating the correlations between the factors themselves simultaneously. Because each latent variable was indicated by many observed variables, regardless whether for the observed variables or latent variables, they continuously interacted with each other. In order to take the interacting factors and their correlations into consideration while keeping each other independent, SEM handles such relations simultaneously. Besides, the model estimation was more flexible. Indeed, the researchers were eager to gain more accurate results in their studies, whereby it was necessary to devote attention to the model complexion because more high-order models are needed under given conditions. However, it is difficult for conventional statistical methods to estimate overcomplicated models. Hence, SEM is a powerful and functional instrument to estimate the complex models. Moreover, researchers are interested in SEM when the correlations among variables was estimated, whereby the model fit indices were presented so that it enables researchers to find how the data fitted the model and where the model should be modified according to the model modification indices (MI). As a result, in summary, SEM makes empirical education research results stronger than ever before.

Aside from the empirical model presented above, the program used in this study was Mplus, which has a powerful function in empirical research. Mplus performs much better than other statistical programs such as AMOS, LISREL, HLM or R when handling multi-level models with more complexity. In particular, the complexity also determine which kind of program should be used because some programs perform less well when the model is complicated, especially when there is non-normality data and complex survey data (Muthén, 1998; Muthén, 2010). As a result, Mplus became

the priority for data analysis in this study.

4. 5 Two-level empirical model

In this study, given that there was only one school principal in Germany or Chinese Taipei, (one experienced teacher in Germany) coupled with one class in each school situated in TIMSS test and the school principal was required to complete the school questionnaire, there were school level (principal-level) and individual-level (student level) data comprising the empirical model in this study. The author aimed to further establish the empirical model with school- and individual student-level date in the later section.

As presented in Section 3.2.2, the items used in this study have been presented in Table 4. The question items answered by school principals were ascribed to different aspects of school leadership, and they were used to indicate the school leadership. Meanwhile, those indicators further related to the principal effectiveness because the measured scales were the time allocated to school leading activities, which was a part of principal effectiveness research (Horng et al., 2011). Further, the two-level empirical model was established to estimate the corrections between the school principal and student math achievement based on the school and individual level. Besides, student math achievement was used as the dependent variable, aiming to estimate the relationship between school leadership and student achievement while finding the effect that the time allocated to school leadership has on student math achievement. Meanwhile, there were three control variables, namely students' age, gender and the home background. It is all known that students' home backgrounds strongly influence student achievement (Barone, 2006; Kane et al. 2011; Wohlstetter, Datnow, & Park, 2008). Of course, students' home background was represented by several factors, such as the economic status of students' parents, parental education, the income of students' parents as well as the home resources. However, in this study, the author applied mothers' education as the control variable since the mothers'

education of students positively affects student achievement and it has also become prevalence in education research (Glewwe & Jacoby, 1994; Halle, Kurtz-Costes, & Mahoney, 1997; Haveman & Wolfe, 1995; Magnuson, 2007; Sirin, 2005;).

As a conclusion, the author drew the two-level empirical model according to the theoretical framework and the previous literature study as follows (Figure 6):

Figure 6 Two-level empirical model
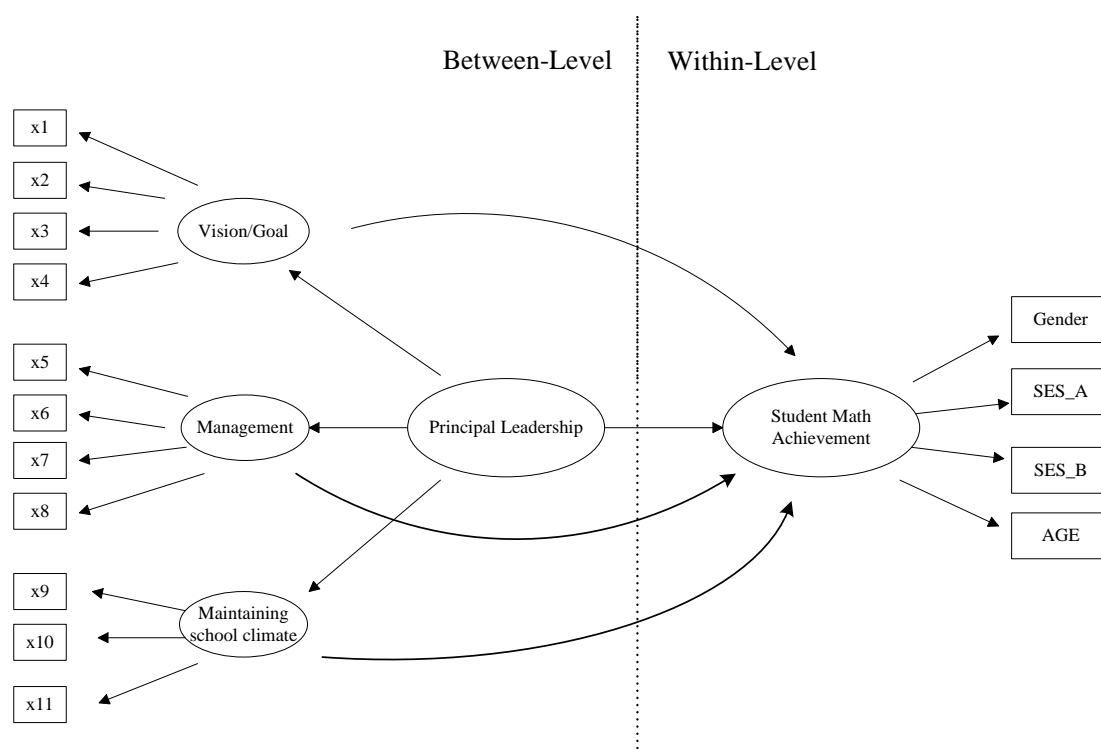
In such a two-level experimental model, as presented in Figure 6 above, the rectangle here stood for the observed variables such as gender, age and students' home background. The oval represented the latent variables, which meant that they could not be perceived directly for their invisible specificities. In order to distinguish the latent variables from the observed variables, the latent variables are also called "unobserved variables." In the empirical study, the latent variables are indicated by several observed variables, which can be measured directly. For instance, researchers usually use the terms student achievement or student outcomes, although what exactly do "achievement" or "outcomes" means? Therefore, an idiographic conception of the

"achievement" or "outcome" is necessary, which means that observed variables are needed that can be measured directly by the instrument. Hence, it appears that "math score," "cognitive score" or "reasoning score" because the score is the variable that can be evaluated directly. Because there are so many variables cannot be measured directly, particularly in empirical research, researchers need some observed variables that can be measured directly to be the indicators to represent the latent variables, and eventually to obtain the relationship between the indicators and the latent variables according to the statistical discipline (Bollen, 1989). The relationship between the observed variables and the latent variables here is called factor loadings. The values of factor loadings range from 0 to 1, whereby the greater the figure, the more representative the indicators. However, there are some debates on the cut-point (0.6, generally the role of thumb) of factor loadings. The factor loading less than the cut-point value does not mean it is non-meaningful. By contrast, poor factor loadings should also be emphasized, through which researchers are able to find details on poor factor loading and the reason why these factors perform not well enough. Therefore, the empirical research as well as the statistical interpretation is based on the sensible foundations to enable the result interpretation to be assumed as valid.

Here, as the previous section explained, in this study there were three first-order latent variables and one second-order latent variable. The three first-order latent variables indicated school leadership, while the first-order latent variables needed the indicators to be measured by observed variables. For instance, the first-order latent variable was setting the school's vision/goal, and it was indicated by four observed variables that could be measured directly. As a conclusion, the empirical research model presented above showed that the observed variables – which ranged from x1 to x11 – were the question items used to be measured directly (showed on Table 4). Meanwhile, the variables on school leadership were situated at the school level, while the control variables and student math achievement were situated at the individual level.

4. 6 Latent class analysis (LCA) for school leadership

As the previous section has demonstrated, the author addressed the issues on the relationship between school leadership and student math achievement as well as whether each sub-dimension of school leadership was related to student math achievement. The previous section displayed that although the school leadership was not related to student achievement in Chinese Taipei, each sub-dimension made a contribution to student math achievement in both Germany and Chinese Taipei, with exception of setting vision/goal in Chinese Taipei, which showed no relation with student math achievement (p > 0.05). Meanwhile, the findings reveal strong differences in school leadership between Germany and Chinese Taipei. For instance, in order to gain the further difference details in school leadership, the author deployed latent class analysis for school principals to analyze the unobserved subpopulation in Germany and Chinese Taipei separately.

Latent class analysis (LCA) was used to exploit the unobserved heterogeneity in the school principal's population (Muthén, 2000), while the similar or the different populations in their responses to measure school leadership's variables were found by LCA. As its name implies, the sub-population that belong to which class was unknown in advance in latent class analysis. Analogous to exploring factor analysis (EFA), the number of classes that needed to be explored is unknown. Much social and behavioral science research has used latent class analysis to uncover the further information of the unobserved heterogeneity and obtain qualitative or quantitative differences in latent class. Given that this dissertation focused on the comparative study of school leadership between Germany and Chinese Taipei, the author determined to conduct latent class analysis for school leadership based on factor mixture modeling (FMM), which is generally used to display the unobserved heterogeneity with a combination of classic latent class analysis and common factor model. The common factor model comprises one or more specific classes, although the factor mixture model is employed to assign the school leaders who are most likely

to belong to. For instance, researchers who study student's overdrinking after their final examination, they separate the overdrinked students into three groups, namely, high, medium, and low. Throughout collecting the data from question items, they aim to find which latent class that the students belong to. Here, in this dissertation, because the previous section showed that it had three latent variables and eleven observed variables, the author wanted to know the potential class differences in school principals' responses to question items. However, this section of FMM and LCA did not focus on comparing which latent class is much better than the other ones, but rather it had a strong focus on obtaining the information of the heterogeneity in school leaders for further comparative information.

Figure 1 demonstrated that with the latent class, which denoted by **c**, there were three latent variables, namely setting school vision/goal, school management, and maintain school climate. It had the same construct as the previous section of structural equation modeling introduced, which comprised eleven observed variables.

Figure 7 Path diagram of the factor mixture model
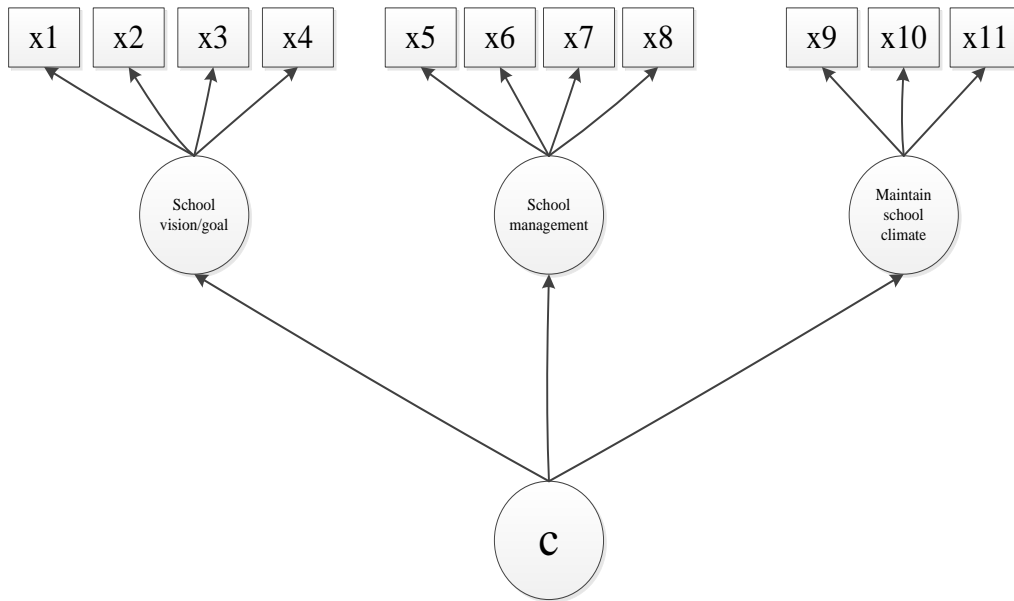
It was hypothesized that the data was collected from different sub-groups of school leaders in both Germany and Chinese Taipei, while the sub-groups were unobserved. Here, **c** represents the latent class. Three latent variables were interpreted as introduced in the previous section, namely school vision/goal, school management, and maintain school climate. Each latent variables had more than three observed variables, while the modeling was similar with factor analysis as demonstrated in the previous section. Here, looking at the latent variable **c**, the name of modeling differed according to the kind of latent variable **c**, whereby in turn if **c** is categorical, then the model would be entitled "latent class analysis", and if **c** is continuous the model is called "latent profile analysis". Combined with the aforementioned notion that the outcome variation in terms of **c**, in latent profile analysis it refers to the mean of each outcome varying, while in latent class analysis the probability of each outcome would variate (Muthén, 2009). However, three latent variables were not allowed to variate in terms of **c**. Looking at this framework, it created a new latent class **c**, combined with three latent variables to construct one latent class. In terms of Muthén (2009), if the latent class **c** was assumed to have K class, then the equation is written as:

$$u^{*}_{ik} = \Lambda_k \eta_{ik} + \varepsilon_{ik}$$

$$\eta_{ik} = \alpha_k + \zeta_{ik}$$

$\boldsymbol{\zeta_{ik}}$ distributed as N $(0, \ \Psi_k)$, and

$$u_{ij} = \begin{cases} 0, & \text{if } \tau_{ik} < u^{*}_{ij} \\ 1, & \text{if } u^{*}_{ij} \leq \tau_{ik} \end{cases}$$

As Figure 1 showed, the factor mean varied across the latent class, specifically, with the exception of the factor mean variation, although other parameters were imposed on the similar restrictions.

Latent class analysis could be taken as a special case of factor mixture model (FMM) with fixed factor covariance. Generally, the latent class analysis began with 1 class analysis and then increased until six-class analysis. Subsequently, the problem emerged concerning in which phrase the latent class would be the "best" for the model. Thus, the estimation of latent class model fit indices is needed. The indices such as AIC, BIC, a-BIC, entropy, p values of Lo-Mendell-Rubin test (LMR) (Lo, Mendell, & Rubin, 2001) and Bootstrap Likelihood Ratio Test (BLRT) (Peel & McLachlan, 2000) are used to evaluate the model fitness. The model fit indices were in favor of lower AIC, BIC and a-BIC, while the higher entropy indicated that the model fits the data better. P values of LMR and BLRT represented the improvement of the model that increased one class. In other words, it demonstrated that the model achieved an improvement when one more class increased (i.e. three-class vs. two-class, four-class vs. three-class). Until the "best" fit is fixed, combined with factor analysis, the interpretation of latent class becomes realistic. For instance, if the model fit indices demonstrated that increasing the number of classes does not improve the model, thus it perhaps required more factors to be added according to the theoretical background until the "best" solution is provided. Details about model fit information and the result of latent class analysis are displayed in Chapter 5.6.

Chapter 5 Data Analysis and Findings

5.1 Construct of the indicators

According to the previous statement of this study (Chapter 3), there were several observed variables that indicate each latent variable. However, a critical issue regarding measurement was to differentiate the answer items that belong to the sub-questions items. Therefore, in order to make the model clear and straightforward, those categories that performed too poorly in indicating the latent variables were expunged (role of thumb is 0.6 generally), whereas those that performed well were ultimately kept as the indicators.

Besides, since the items used in this dissertation were already presented above, the author used the question items to explain what it meant to combine the scales. The author assumed that the principals who preferred to answer the questionnaires in Germany and Chinese Taipei had different answers, given that the principals (headmasters in Germany) had different leadership experiences and understandings. Consequently, the percentage that each answer item accounted for was expected to present differently. For instance, some principals opined that ten to twenty per cent of time should be spend setting school goal. However, other principals perhaps deemed ten to fifteen per cent of time should allocate for this purpose. The percentages of time allocated to different activities are summarized and presented in Tables 7 and 8, followed by the details on the combination of categories.

Table 7 Percentages of each item in Germany

	No time (Estimated/S.E)	Some time (Estimated/S.E)	A lot of time (Estimated/S.E)
Promoting the school's educational vision or goals	1.03(0.73)	52.79(3.56)	46.17(3.66)
Developing the school's curricular and educational goals	1.94(0.95)	50.49(3.88)	47.57(3.87)
Visiting other schools or attending educational conferences for new ideas	25.5(3.33)	59.28(4.22)	15.21(3.90)
Initiating educational projects or improvements	6.25(2.16)	66.73(4.72)	27.02(4.70)
Monitoring teachers' implementation of the school's educational goals in their teaching	11.94(2.97)	71.61(3.71)	16.44(2.33)
Monitoring students' learning progress to ensure that the school's educational goals are reached	12.90(3.15)	61.75(3.87)	25.35(3.35)
Initiating a discussion to help teachers who have problems in the classroom	8.39(1.55)	64.60(3.44)	27.01(3.39)
Advising teachers who have questions or problems with their teaching	7.27(2.81)	65.02(4.29)	27.71(3.38)
Keeping an orderly atmosphere in the school	2.85(0.81)	36.72(4.07)	60.42(3.13)
Ensuring that there are clear rules for student behavior	3.09(1.18)	45.39(4.28)	51.52(4.29)
Addressing disruptive student behavior	1.29(0.82)	45.57(4.16)	53.14(4.23)

Table 8 Percentages of each item in Chinese Taipei

	No time (Estimated/S.E)	Some time (Estimated/S.E)	A lot of time (Estimated/S.E)
Promoting the school's educational vision or goals	0.26(0.26)	28.76(6.50)	70.98(6.50)
Developing the school's curricular and educational goals	0.00(0.00)	25.89(5.65)	74.11(5.65)
Visiting other schools or attending educational conferences for new ideas	1.09(1.09)	52.64(8.94)	46.27(8.96)
Initiating educational projects or improvements	2.32(1.36)	48.10(6.46)	49.58(6.44)
Monitoring teachers' implementation of the school's educational goals in their teaching	0.13(0.13)	38.17(6.87)	61.70(6.87)
Monitoring students' learning progress to ensure that the school's educational goals are reached	0.85(0.70)	41.50(6.77)	57.65(6.67)
Initiating a discussion to help teachers who have problems in the classroom	1.09(1.09)	52.64(8.94)	46.27(8.96)
Advising teachers who have questions or problems with their teaching	2.32(1.36)	48.10(6.46)	49.58(6.44)
Keeping an orderly atmosphere in the school	2.73(1.71)	61.98(6.30)	35.29(6.30)
Ensuring that there are clear rules for student behavior	7.65(5.16)	58.92(7.05)	33.53(5.61)
Addressing disruptive student behavior	15.48(6.43)	72.56(6.24)	11.96(3.34)

The question used for analysis was as follows:

During the past year, approximately how much time have you spent on the following school leadership activities in your role as a school principal?

As presented above, the first aspect of school leadership here was "setting the vision/goal for the school" and the sub-questions here to be the observed indicators are:

1) Promoting the school's educational vision or goals.

2) Developing the school's curricular and educational goals.

3) Visiting other schools or attending educational conferences for new ideas.

4) Initiating educational projects or improvements.

Each answer had three scale items: "No time," "Some time," and "A lot of time." For instance, the descriptive statistic demonstrated that the percentage of the principals who answered "no time" only accounted for 1.03 on promoting the school education vision or goals. Thus, because the value of the answer percentage of "No time" was less than 5, this scale was combined with other two scales according to the statistical doctrine. Eventually, there were only two scales to answer this sub-question, namely "No time or Some time" and "A lot of time."

As with question item 1), the answer scales of question 2) had to be combined given that the percentage of the answer scale "No time" was less than 5. However, for the question items 3) and 4), the percentage of each answer scale was more than 5 and thus all answer scales were retained.

The second aspect of school leadership was "managing the school," which was indicated by the following question items:

5) Monitoring teachers' implementation of the school's educational goals in their teaching.

6) Monitoring students' learning progress to ensure that the school's educational goals are reached.

7) Initiating a discussion to help teachers who have problems in the classroom.

8) Advising teachers who have questions or problems with their teaching.

The scales were all kept as the percentage of each scale accounted for more than 5 to answer the above four questions.

The final aspect of school leadership was "maintaining the school climate," which was indicated by three question items as outlined below:

9) Keeping an orderly atmosphere in the school.

10) Ensuring that there are clear rules for student behavior.

11) Addressing disruptive student behavior.

The answer scales to the question items were also retained, since it showed unambiguously by the descriptive statistic that the percentage of each answer scale met the statistical requirement mentioned above, namely the percentage of each scale accounted for more than 5.

In Chinese Taipei, given that the same question items were involved, it only needed the descriptive statistics to give the specified percentage of each scale accounted for. Since the percentage of each answer scale of "No time" was less than 5, all of the answer scales of four question items that represented setting and developing school vision/goal were combined into two scales, namely "No time or Some time" and "A lot of time."

Meanwhile, all answer scales of the question items that indicated "managing the school" were also combined into two scales, namely "No time or Some time" and "A lot of time," since the percentage of answer scales of "No time" was also less than 5.

Finally, the answer scales of question items that indicated the "maintaining the school climate" were kept due to the percentage of each answer scale being more than 5, except question item 10) whose answer scales were combined into two scales: "No time or Some time" and "A lot of time."

5.2 Confirmatory factor analysis (CFA) for school leadership

After the scale combination, the next important step is to prepare the data for data

analysis. The data on some schools was deleted for missing elements. At the same time, there was one school principal and one class was preferred in Germany. However, there were two classes preferred per school in Chinese Taipei. Hence, in Chinese Taipei, one class in each school was randomly preferred. According to the literature theoretical background, principal factor analysis was conducted on many occasions when three exploratory items were sorted to represent the empirical model to measure school leadership here.

Before analyzing the two-level structural equation model, the relationship between the first-order latent variables and their indicators was verified in eleven measurement models. In the previous chapter (Chapter 3), the measurement models were already introduced. More details about the measurement models is displayed as follows:

$$x_1 = \lambda_{11}\xi_1 + \delta_1, x_2 = \lambda_{21}\xi_1 + \delta_2, x_3 = \lambda_{31}\xi_1 + \delta_3, \ x_4 = \lambda_{41}\xi_1 + \delta_4;$$
$$x_5 = \lambda_{52}\xi_2 + \delta_5, \ x_6 = \lambda_{62}\xi_2 + \delta_6, \ x_7 = \lambda_{72}\xi_2 + \delta_7, \ x_8 = \lambda_{82}\xi_2 + \delta_8;$$
$$x_9 = \lambda_{91}\xi_3 + \delta_9, \ x_{10} = \lambda_{101}\xi_3 + \delta_{10}, \ x_{11} = \lambda_{111}\xi_3 + \delta_{11};$$

Where x_1, x_2, x_3, x_4 are the indicators of ξ_1, which is one of the first-order latent variables or can be called an exogenous variable. Moreover, x_5, x_6, x_7, x_8 are the indicators of ξ_2. Finally, x_9, x_{10}, x_{11} are the indicators of ξ_3.

The measurement models were particularly studied by confirmatory factor analysis (CFA) to confirm the construct that it was designed to measure. Because it was hypothesized that the factors were loaded on manifest variables based on the theoretical background, all factors in the model were fixed. In other words, the factor loadings were fixed to be loaded on the specific variables according to the theoretical foundation and the EFA result. For instance, the variables of x_1, x_2, x_3, x_4 were fixed to be only loaded on ξ_1, and for x_5, x_6, x_7, x_8 and x_9, x_{10}, x_{11}, it was the same, whereby they loaded on ξ_2 and ξ_3. Thus, the CFA was deemed as the

foundation of structural equation model (SEM) to measure the relationship between the indicators and the latent variables.

It already was proposed that there was one second-order latent variable, which was supposed to take the percentage of the first-order latent variables. In other words, the second-order latent variable of school leadership was explained by accounting for the percentage of the first-order variables (vision/goal, management and maintaining the school climate). Those three first-order latent variables were the representatives of school leadership. Consequently, the three first-order latent variables were the indicators to represent the second-order latent variable, and they were viewed as the endogenous indicators in second-order CFA. The factor loadings of the second-order latent variable represented the linkage or the relationship between the first-order variables and the second-order latent variable, while the second-order latent variable (school leadership) was viewed as the exogenous variable.

Besides, as with the first-order order CFA, the indicators could not fully explain the latent variables. As a result, the residual terms appeared. However, the doctrine that worked in first-order CFA also worked in second-order CFA. The hypothesized diagram is displayed as follow:

Figure 8 Path diagram of school leadership

5.3 Model identification

Hence, the following tables displayed the model fit information of CFA, as well as the factor loadings to indicate each latent variable in Germany and Chinese Taipei in Tables 9 and 10.

Table 9 Model fit information of CFA in Germany and Chinese Taipei*

Groups	CFI	TLI	RMSEA	90 percent C.I.
Germany	0.867	0.822	0.115	0.110 0.119
Chinese Taipei	0.905	0.876	0.145	0.141 0.149

Note. * represents the original model that is not modified yet.

Table 10 Model fit information of CFA in Germany and Chinese Taipei

Groups	CFI	TLI	RMSEA	90 percent C.I.	
Germany	0.939	0.910	0.08	0.077	0.086
Chinese Taipei	0.951	0.931	0.10	0.106	0.114

Table 10 demonstrates the model fit information prior to model modification. However, the modification indices in Mplus program enabled us to discover the information on modification, which was used to modify the model. This does not alter the model construct but only improves the model fit information. Hence, after the model modification, the model fit information is presented accordingly in Table 10.

In Table 9, the fit information presented that the model fitted the data less well given that the CFI/TLI were less than 0.9, while the RMSEA was greater than 0.1 in both Germany and Chinese Taipei. Therefore, the rigorous model did not fit the data sufficiently well. As such, the model needed to be modified through correlating the residual terms with each other according to the modification indices given by Mplus output. For instance, the error covariance in each item of the first-order latent variables was set as the free parameters, such as x1 with x2, x3 with x4 when the model was estimated. After model modification, Table 10 demonstrates that the model fits the data better due to the better CFI and TLI (>0.95), although the RMSEA in Chinese Taipei was slightly higher than 0.1. Here, what information described the model fitted the data was the indices value of CFI and TLI, whereby if they both were greater than 0.95 it demonstrated that the model fitted the data well. Meanwhile, the RMSEA was also an important model fit index: in other words, the model deemed that fitted the data well when it was less than 0.08. Here, the model fit information above presented that the model fitted the data was acceptable in line with the statistical doctrine (Steiger, 1990; J. C. Wang & X. Q. Wang; 2012; Thompson & Melancon, 1996; Bagozzi & Edwards, 1998; Bandalos, 2002; Hau & Marsh, 2004).

Additionally, the factor loadings of each latent variable were displayed as follows (Tables 11 and 12). As previously mentioned, the factor loading represented the extent

of the linkage between the manifest variables and the latent variable. The indicator was identified as "poor" if its factor loading was less than 0.6 (J. C. Wang & X. Q. Wang, 2012). However, this does not mean that those factor loadings less than 0.6 should be expunged because it only described to what extent that the manifest variables indicated the latent variables or the extent that the first-order latent variables linked the second-order latent variables. Hence, its function was to assist researchers to exploit the findings with the "poor" factor loadings rather than abandoning them. By contrast, for the factor loadings that were more than 0.6, it was supposed that such indicators performed well when they were identified as the indicators.

Here, the factor loadings of the latent variables are presented as follows. Conspicuously, in Germany, almost all factor loadings performed well and most of them were more than 0.6, except the factor loadings of the manifest variables of x6, x7, and x8 when they indicated the first-order latent variable "management." Meanwhile, the factor loading of the first-order latent variable "maintain the school climate" when it indicated the second-order latent variable "school leadership" was less than 0.6, which meant that such indicators perhaps did not perform sufficiently well. However, from a macro perspective, it demonstrated that almost all of the indicators were sufficiently strong to indicate the latent variables.

Regarding, the meaning of the factor loading here, for instance, the value of item x1 was 0.75, which meant that if the time allocated to "Promoting the school's educational vision or goals" increased one unit, the value of the first-order latent variable "vision/goal" increased 0.75 unit corresponding. Furthermore, the relation between the first- and second-order latent variable had the same manner; for instance, when the time allocated to "setting and developing the vision/goal for school" increased one unit, the school leadership increased by 0.821 unit. On the other hand, in Mplus 5.0 the calculation was based on the MACS by default and thus the estimation produced the intercepts or thresholds simultaneously. For example, in Germany, the threshold value of item x1 was 0.027, which meant that it was supposed

that if the time allocated to "Promoting the school's educational vision or goals" was zero, the "vision/goal" increased by 0.027 unit. At the same time, the percentages of variance in first-order latent variables explained by second-order latent variable were 68, 98 and 28, separately. It represented that aside from the third first-order latent variable of maintaining the school climate, the remaining provide a good explanation for the second-order latent variables. In addition, according to Schmid and Leiman, if it is required to probe into assessing the relationship between the first-order latent variables and the second-order latent variable, the total item variance is prone to be separated into two aspects. Thus, one aspect involved the variance that was explained by the first-order latent variables, and the other one was the variance explained by the second-order latent variables (Wolff & Preising, 2005). For instance, the result showed that the question item x1 regarding which percentage of total variance that explained by the first plus second-order factors was 56.3 and for the item x2 its value was 40.2.

In Chinese Taipei, it seemed that all of the factor loadings performed well. In the same manner, the factor loading of item x1 was 0.512, which meant that when the time allocation in "setting and developing school's educational vision or goal" increased one unit, the first-order latent variable "vision/goal" increased by 0.512 units. Moreover, when the time allocation in "setting the vision/goal for school" increased by one unit, the school leadership was likely to increase by 0.962 units corresponding. In particular, the percentages of variance in first-order latent variables explained by second-order latent variables are 93, 98 and 44, respectively. Accordingly, it offered a good explanation for the second-order latent variable (school leadership), aside from the proportion of variance of the third first-order latent variable, which was "maintaining the school climate." Meanwhile, the percentages of total variance explained by the first and second-order factors for items x1 and x2 were 26.2 and 40.2, respectively (Table 14). In others words, in both Germany and Chinese Taipei, the results demonstrated that with more time allocated to such leading

activities, the school leadership became much stronger.

In the following part, the factor loadings in both Germany and Chinese Taipei (Tables 11 and 12) are presented, while more details on the proportions of variance explained by the first- and second-order factors in Germany and Chinese Taipei are demonstrated as follows (Table 13).

Table 11 Factor loadings of CFA in Germany

The factor loadings of the latent variables in Germany						
		factor loadings (Estimated/S.E)	P value	factor loadings (Estimated/S.E.)	P value	
Vision/goal (S1)	x1	0.750(0.023)	0.00	0.821(0.025)	0.00	School leadership (SL)
	x2	0.634(0.022)	0.00			
	x3	0.507(0.021)	0.00			
	x4	0.688(0.019)	0.00			
Management (S2)	x5	0.663(0.020)	0.00	0.989(0.001)	0.00	
	x6	0.534(0.020)	0.00			
	x7	0.506 (0.022)	0.00			
	x8	0.571 (0.021)	0.00			
Maintaining school climate (S3)	x9	0.804(0.014)	0.00	0.529(0.020)	0.00	
	x10	0.975(0.013)	0.00			
	x11	0.712(0.016)	0.00			

Note. The variances of the latent variables S1, S2, S3 and SL are 0.595, 0.344, 0.639 and 0.351, while $P< 0.001$.

Table 12 Factor loadings of CFA in Chinese Taipei

The factor loadings of the latent variables in Chinese Taipei						
		factor loadings (Estimated/S.E)	P value	factor loadings (Estimated/S.E)	P value	
Vision/goal (S1)	x1	0.512(0.020)	0.00	0.962(0.013)	0.00	School leadership (SL)
	x2	0.634(0.016)	0.00			
	x3	0.785(0.012)	0.00			
	x4	0.741(0.013)	0.00			
Management (S2)	x5	0.735(0.010)	0.00	0.991(0.000)	0.00	
	x6	0.642(0.011)	0.00			
	x7	0.988(0.007)	0.00			
	x8	0.850(0.008)	0.00			
Maintaining school climate (S3)	x9	0.750(0.010)	0.00	0.665(0.014)	0.00	
	x10	0.702(0.009)	0.00			
	x11	0.888(0.015)	0.00			

Note. The variances of the latent variables S1, S2, S3 and SL are 0.269, 0.515, 0.555, and 0.240, while

$P < 0.001$.

Table 13 Proportions of variance that explained by the latent variables in Germany/Chinese Taipei (Percentage)

Germany			Chinese Taipei		
	R-SQUARE (Estimated/S.E)	P value		R-SQUARE (Estimated/S.E)	P value
x1	56.3(3.4)	0.00	x1	26.2(2.0)	0.00
x2	40.2(2.8)	0.00	x2	40.2(2.0)	0.00
x3	44.0(2.7)	0.00	x3	54(1.5)	0.00
x4	28.5(2.2)	0.00	x4	41.3(1.4)	0.00
x5	64.6(2.2)	0.00	x5	56.4(2.5)	0.00
x6	95.1(2.5)	0.00	x6	49.3(2.1)	0.00
x7	50.7(2.2)	0.00	x7	78.9(3.3)	0.00
x8	25.6(2.2)	0.00	x8	97.7(1.4)	0.00
x9	32.6(2.4)	0.00	x9	72.3(1.3)	0.00
x10	25.7(2.1)	0.00	x10	61.6(1.9)	0.00
x11	47.4(2.6)	0.00	x11	54.9(1.9)	0.00
S1	67.4(4.0)	0.00	S1	92.5(2.4)	0.00
S2	97.7(0.1)	0.00	S2	98.1(0.1)	0.00
S3	28.0(2.2)	0.00	S3	44.3(2.1)	0.00

The confirmatory factor analysis above (Tables 11 and 12) was used to ensure that the question items which represented the school leadership were adequately reliable. Thus, the relationship between school leadership and student math achievement employing two-level SEM claimed the high ground in the CFA, as previously mentioned. It demonstrated that the factors performed sufficiently well to indicate the first- and second-factor latent variables. Accordingly, it was ensured to conduct the further step, focusing on the relationship between school leadership and student math achievement.

Although Tables 11 and 12 display the factor loadings of each latent variable in Germany and Chinese Taipei, it was necessary to conduct the measurement invariance and structural measurement invariance to conclude that the instrument used to measure school leadership had the same meaning across the two groups (Bollen, 1989a; Hayduk, 1987; Jöreskog, 1971b; Sörbom, 1974). Accordingly, the factor loadings could not be compared between Germany and Chinese Taipei directly and only after the invariance measurement could they further be compared because statistical principle required that the necessary phase in advance tested the invariance for the multi-group study.

The invariance measurement – which involves factor loading pattern invariance, factor loading invariance, the intercept/threshold invariance of the manifest variable, as well as the residual variance/covariance invariance (e.g., Brown, 2015) – needs to be tested to determine the compared result as being meaningful. As such, it primarily aims to ensure that the scale of the two groups is the same in the case of biased results in a later comparative study (Horn & McArdle, 1992; Wang, 2012). Given that the factor construct is more like a "black-box" that cannot be observed directly, the invariance measurement becomes necessary when researchers intend to discover the details on the differences across two groups. In light of the statistical principle, there are four aspects in measuring invariance, namely configuring invariance, weak invariance, strong invariance and strict invariance. However, the functions of

measurement invariance depend on the researcher's intentions. For instance, the configural measurement invariance is placed first given that it ensures that the pattern of fixed and freed the factor loadings is the same across two groups, whereby they have the same number of factors as well as the same free parameters, which are not restricted. In addition, it requires that the parameters in both groups are without restrictions so that they can be tested out whether the number of factors and the pattern across groups are the same or not. The weak invariance becomes the second invariance test phase, which focuses on the invariance of factor loadings that are loaded on the second-order latent variables. As mentioned above, the factor loadings explain the linear linkage between the observed indicators and the latent variables. Hence, it required that the latent variables that were intended to measure had the same meaning across two groups. If the factor loadings are invariant, the comparison of the latent variable in the two groups is meaningful, and its result can be interpretable. Furthermore, the third phase of measurement invariance is test the invariance of the factor loadings while the intercepts of latent variable indicators also need to be invariant across groups, which are referred to as scalar invariance. Scalar invariance requires that the factor loadings and the intercepts remain invariant simultaneously. Under such a condition, the factor means can be compared in a sensible manner (Metric Equivalence，see Horn & McArdle, 1992; Van de Vijver & Leung, 1997; Wang, 2012). However, in the specific study, given that the scalar invariance measurement depends on the research foundation to a great extent, it is an option for the researchers to determine whether the scalar invariance is measured or not. Overall, the configural and metric (also called weak invariance measurement) invariance measurement are required if anyone intends to conduct a comparative study across groups (Muthén, 2015). Finally, the strict invariance measurement is seldom employed in the real study because it has the parsimonious requirement for the factor loadings and the intercepts are required to be equal while the residual invariance is also required to be invariant across groups. Consequently, the requirement for strict

measurement is more parsimonious whereby researchers seldom use it, except someone who takes an interest in the item reliability across groups (Schmitt, Pulakos, & Lieblein, 1984; Wang, 2012).

It is known that one of the requirements of a good model is simplicity and clearance. Therefore, this comparative study intended to measure the configural and metric invariance for the first-order latent variables and then parceled the items to conduct the configure and metric invariance to directly compare the observed indicators and school leadership across two groups, thus aiming to make the model simple and direct. Hence, in the following part, the model fit information is demonstrated in Table 14.

Table 14 Model fit information of configural and metric invariance measurement for the first- and second-order latent variables

	CFI	TLI	RMSEA	90 percent C.I.
Configurable invariance measurement	0.947	0.911	0.07	0.067 0.073
Metric invariance measurement	0.936	0.902	0.073	0.074 0.080

Table 14 illustrates that the model fitted the data well. In other words, the first- and second-order latent variables – which were "setting and developing the vision/goal for school", "management the school", "maintaining the school climate", and "school leadership" – could be further meaningfully compared given that both the CFI and TLI are more than 0.9, while the RMSEA was less than 0.08. Overall, the model performed sufficiently well. In Tables 11 and 12, the factor loadings that described the relationship between the observed variables and the first-order latent variables were much higher in Chinese Taipei than in Germany, except the items $x1$, $x9$, and $x10$, whose factor loadings were lower in Chinese Taipei. Accordingly, the items "promoting the school's educational vision or goals", "ensuring that there are clear rules for student behavior", and "addressing disruptive student behavior" loaded on the latent variables of $S1$ and $S3$ were lower than in Germany. As presented above,

it is known that the items from *x9* to *x11* indicated that maintaining the school climate in leadership activities. Perhaps the primary reason was the different working climates, which is suggested to be strongly influenced by the organization system. Given that in Chinese Taipei the major responsibility of a professional school principal is to ensure that students and teachers have a safe and orderly climate, school principals devote more time to constructing such a climate. Additionally, compared with Germany, the school system is also different in Chinese Taipei, since almost each primary school is an all-day school, which meant that students and teachers spent more than eight hours in a school day. However, most primary schools in Germany are half-day schools. When the teachers and students spend the whole day in school, it places a greater burden on principals, who needed to spend more time and energy maintaining the school under a safe and orderly climate. As a result, it is more closely linked with the time allocated to leadership activities in Chinese Taipei.

These standardized factor loadings in Tables 11 and 12 indicate that the four latent variables were properly constructed in the two economies. For instance, the factor loadings from the observed variables *x1*, *x2*, *x3*, *x4* to the latent variable *S1* were 0.75, 0.634, .785, and 0.688 in Germany and 0.512, 0.634, 0.785, and 0.741 in Chinese Taipei, all of which were larger compared to the threshold value of 0.6 (rule of thumb). Meanwhile, the standardized factor loadings from each observed variable to the first-order latent variable were similar, revealing similar conceptual constructs in both economies. Likewise, the standardized factor loadings from the first-order latent variables *S1*, *S2,* and *S3* to the second-order latent variable SL were relatively large and similar between Germany and Chinese Taipei (S1: 0.821 vs. 0.962; S2: 0.898 vs. 0.991; S3: 0.529 vs. 0.665), suggesting that the conceptual construct of school leadership was similar in both economies. Generally, management was the most important conceptual component of school leadership, followed by setting a vision/goal for the school and finally maintaining the school climate. This conceptual construct was much closer to the previous studies on school leadership, indicating the

strong importance of school management in school leadership (Day, Gu, & Sammons, 2016).

5.4 Relationship between time allocation to school leadership and student math achievement

As previously mentioned, the relationship between school leadership and student math achievement was based on the multi-level SEM model (MSEM), which involved the school level and individual student level. Before the multi-level data analysis, it was indispensable to calculate the intra-class coefficient (also called ICC), which is taken as a guideline for researchers to determine if it is necessary to conduct multiple-level data analysis. In this study, since the ICC in both Germany and Chinese Taipei was greater than 0.08 (its value was 0.159 and 0.155 in Germany and Chinese Taipei, respectively), the multiple level was used for the vast differences in student math achievement among different schools in Germany and Chinese Taipei. In terms of explaining the difference in student math achievement between schools, it is well known that the school climate strongly affects student achievement, which is why the students in the same schools were prone to performing some common behaviors. In other words, the difference in student achievement was perhaps affected by the particular traits of schools located in the same districts or communities. The value of ICC in this study demonstrated that there were major difference in student math achievement between schools and thus stratification was required when the data was handled.

Indeed, even the value of ICC was small but it also played an important role in assisting to design the model (Muthén, L., 1999; Muthén & Satorra, 1995; Heck & Thomas, 2015). Therefore, the multi-level data analysis was based on the substantial value of ICC in this study.

In the following tables, the multi-level model results of the relationship between time allocation in school leadership and student math achievement are presented for

Germany and Chinese Taipei, respectively (Tables 15, 16, 17, and 18).

Table 15 Result of the relationship between overall SL and SMA in Germany

Within Level		
MAT01 ON	Estimated (S.E.)	P value
Gender	0.116(0.023)	0.000
Age	-0.153(0.022)	0.000
Home Background	0.272(0.027)	0.000
Between Level		
S1 BY		
x1	0.931(0.034)	0.000
x2	0.870(0.055)	0.000
x3	0.775(0.072)	0.000
x4	0.878(0.054)	0.000
S2 BY		
x5	0.904(0.047)	0.000
x6	0.812(0.069)	0.000
x7	0.781(0.082)	0.000
x8	0.824(0.068)	0.000
S3 BY		
x9	0.935(0.036)	0.000
x10	0.974(0.026)	0.000
x11	0.897(0.044)	0.000
SL BY		
S1	0.804(0.105)	0.000
S2	0.858(0.114)	0.000
S3	0.589(0.101)	0.000
MAT01 ON		
SL	-0.258(0.121)	0.032

Note. In gender analysis, "1" represented girls, "2" represented boys.

Table 16 Result of the relationship between sub-dimensional SL and SMA in Germany

Within Level		
MAT01 ON	Estimated (S.E.)	P value
Gender	0.116(0.023)	0.000
Age	-0.151(0.022)	0.000
Home Background	0.272(0.027)	0.000
Between Level		
S1 BY		
x1	0.922(0.035)	0.000
x2	0.867(0.056)	0.000
x3	0.779(0.072)	0.000
x4	0.880(0.053)	0.000
S2 BY		
x5	0.887(0.045)	0.000
x6	0.790(0.077)	0.000
x7	0.808(0.072)	0.000
x8	0.845(0.062)	0.000
S3 BY		
x9	0.921(0.041)	0.000
x10	0.975(0.026)	0.000
x11	0.896(0.045)	0.000
SL BY		
S1	0.777(0.102)	0.000
S2	0.868(0.111)	0.000
S3	0.623(0.102)	0.000
MAT01 ON		
S1	-0.495(0.184)	0.007
S2	0.435(0.218)	0.046
S3	-0.291 (0.142)	0.041

Note. in gender analysis, "1" represented girls, "2" represented boys

Table 17 Result of the relationship between overall SL and SMA in Chinese Taipei

Within Level		
MAT01 ON	Estimated (S.E.)	P value
Gender	-0.005(0.014)	0.734
Age	0.094(0.019)	0.000
Home Background	0.252(0.017)	0.000
Between Level		
S1 BY		
x1	0.870(0.115)	0.000
x2	0.909(0.095)	0.000
x3	0.868(0.084)	0.000
x4	0.892(0.066)	0.000
S2 BY		
x5	0.951(0.046)	0.000
x6	0.892(0.063)	0.000
x7	0.980(0.027)	0.000
x8	0.935(0.047)	0.000
S3 BY		
x9	0.975(0.014)	0.000
x10	0.962(0.021)	0.000
x11	0.917(0.038)	0.000
SL BY		
S1	0.851(0.097)	0.000
S2	0.999(0.001)	0.000
S3	0.573(0.099)	0.000
MAT01 ON		
SL	-0.154(0.120)	0.199

Note. In gender analysis, "1" represented girls, "2" represented boys.

Table 18 Result of the relationship between sub-dimensional SL and SMA in Chinese Taipei

Within Level		
MAT01 ON	Estimated (S.E.)	P value
Gender	-0.005(0.014)	0.734
Age	0.096(0.019)	0.000
Home Background	0.252(0.017)	0.000
Between Level		
S1 BY		
x1	0.880(0.111)	0.000
x2	0.913(0.093)	0.000
x3	0.862(0.088)	0.000
x4	0.892(0.067)	0.000
S2 BY		
x5	0.949(0.044)	0.000
x6	0.892(0.061)	0.000
x7	0.981(0.026)	0.000
x8	0.933(0.047)	0.000
S3 BY		
x9	0.978(0.014)	0.000
x10	0.962(0.021)	0.000
x11	0.911(0.040)	0.000
SL BY		
S1	0.862 (0.136)	0.000
S2	0.985(0.090)	0.000
S3	0.582(0.096)	0.000
MAT01 ON		
S1	0.488 (0.373)	0.192
S2	-0.846 (0.402)	0.035
S3	0.369(0.181)	0.042

Note. In gender analysis, "1" represented girls, "2" represented boys.

In order to gain more precise results, the author conducted a Harman test to examine the collinearity. The result showed that the relationship between time allocation in school leadership and student math achievement was negative and significant in Germany ($p < 0.05$), whereas it was negative but non-significant in Chinese Taipei ($p > 0.05$) (Table 17). At the same time, in SEM, the factor loadings of the first- and second-order latent variables worked sufficiently well. Meanwhile, due

114

to all answer items being categorical, the author declared all of the observed variables as the categorical variables.

In Germany, conspicuously as presented, boys reported much higher math achievement than girls (β= 0.116, p< 0.01), while older students had lower achievement in math compared with the students in the normal situation (β= -0.153, p< 0.01). Accordingly, when a student's age increased one unit, the math achievement significantly decreased by 0.153 units. The last control variable – mother's education level of students – demonstrated the same result as in previous research, namely the higher level of the mother's education, the much better student math achievement was, with an estimated coefficient 0.272 and a significant p value (p< 0.01). Accordingly, when a student's mother's education level increased one unit, the student's math achievement increased by 0.272 units.

Regarding the effect of principals, it has shown that when the principal's allocated time to leadership activities increased by one unit, the school average math achievement declined by 0.258 units. Meanwhile, the relationship between the time allocated to setting and developing the vision/goal for the school and student math achievement was negative and significant in Germany, while it was the same for the relationship between the time allocation in maintaining the school climate and student math achievement. From the tables depicted above, when the time allocated to setting and developing the vision/goal for school increased by one unit, the students' average math achievement declined by 0.495 units, while when the time allocated in maintaining the school climate increased by one unit, the student math achievement declined by 0.292 units. Principals spending time managing the school positively and significantly affected student math achievement. Specifically, when time spent managing the school by principals increased by one unit, the student math achievement increased by 0.435 unit.

In Chinese Taipei, principals' time spent setting and developing the vision/goal did not previously affect student math achievement, with a p> 0.05. The school

leadership influenced student math achievement positively and significantly throughout, maintaining a safe and orderly school atmosphere for students and teachers, because when the time spent in maintaining school climate increased by one unit, the student math achievement also increased by 0.369 units. It was also apparent that when the principals spent more time managing the school, the students reported poorer achievement, and it affected the students' math achievement significantly ($p<$ 0.01). When the time spent managing the school increased by one unit, the students' math achievement declined by 0.846 units. It was non-significant for the relationship between the time spent setting and developing the vision/goal for the school and students' math achievement, with a p value greater than 0.05 ($p>$ 0.05). Accordingly, regardless whether the principal's allocated time to setting and developing the goal/vision for the school increased or decreased, it did not affect student math achievement.

It was found that different school system and the education policy system demonstrated differences when principals arranged time in leading school activities. As a result, more comparative research was necessary, such as comparisons on the factor loadings of the observed variables and the first latent variables. Hence, the subsequently section (Chapter 4.5) focused on describing the explicit factors differences through the comparative study across two groups by employing the multi-group CFA.

5.5 Potential class analysis of school leadership in Germany and Chinese Taipei

The previous chapter (Chapter 4.6) introduced the latent class analysis (LCA) and the factor mixture model (FMM). In this section, the author places a focus on latent class analysis with handling data, and displays the result of the potential class of school leadership in Germany and Chinese Taipei separately. The previous section concluded a relationship between school leadership and student math achievement,

while it has been shown that school leadership largely differs between Germany and Chinese Taipei. As such, the aim of this section is to obtain details about the school leadership differences between the two economies.

As the previous section has demonstrated, the issues on the relationships between school leadership coupled with the relationship between each category of school leadership tasks and student math achievement was addressed. It was illustrated that although school leadership is not related to student math achievement in Chinese Taipei, each category of school leadership makes a strong contribution to student math achievement in the two economies. However, with the exception of the difference in factor loadings between German school leadership and their colleagues in Chinese Taipei primary schools, school leadership in Germany and Chinese Taipei separately with latent class analysis (LCA) was also examined. According to Jung and Wickrama (2008), the LCA models were checked with the recommendations of the mixture modeling.

The following Tables 19 and 20 displayed the model fit information of the latent class analysis (LCA) for the latent variables setting the school vision/goal *(S1)*, school management *(S2)*, and maintaining school climate *(S3)* in Germany and Chinese Taipei. Due to the unobserved characteristics of each latent variable, the indicators of each latent variable were used to test models based on factor mixture modeling (FMM). Generally, six classes analysis is necessary, whereby one class analysis is conducted initially, and subsequently up to six classes are added. According to the previous introduction, the latent class **c** was used to be examined how many classes of school leaders in Germany and Chinese Taipei, the model was checked that finally the following Plots 1 and 2 showed the latent class of school leadership in Germany and Chinese Taipei separately.

Table 19 Latent class analysis of school leadership in Germany

Latent classes	AIC	BIC	a-BIC*	Entropy	LMR	BLRT	Latent classes probability
1	3151.496	3232.140	3152.956	1	--	--	1.00
2	2926.566	3020.112	2928.259	0.787	0.00	0.00	0.36 0.64
3	2871.692	2978.141	2873.619	0.801	0.00	0.00	0.42 0.28 0.30
4	**2836.836**	**2956.189**	**2838.996**	**0.819**	**0.04**	**0.00**	**0.26 0.27 0.07 0.40**
5	2825.445	2957.700	2827.839	0.818	0.05	0.00	0.39 0.21 0.07 0.07 0.25
6	2815.626	2960.784	2818.253	0.766	0.61	0.04	0.23 0.18 0.07 0.08 0.21 0.23

Note. a-BIC refers to the value of adjusted BIC.

Table 20 Latent class analysis of school leadership in Chinese Taipei

Latent classes	AIC	BIC	a-BIC*	Entropy	LMR	BLRT	Latent classes probability
1	2283.823	2346.905	2280.446	1	--	--	1.00
2	**1960.100**	**2035.199**	**1965.081**	**0.91**	**0.00**	**0.00**	**0.36 0.64**
3	1925.350	2012.464	1920.687	0.872	0.16	0.00	0.25 0.17 0.59
4	1873.595	1972.725	1868.290	0.847	0.08	0.00	0.29 0.21 0.18 0.31
5	1851.637	1962.783	1845.689	0.850	0.14	0.00	0.20 0.15 0.14 0.20 0.32
6	1846.480	1969.642	1839.889	0.883	0.25	0.03	0.13 0.12 0.13 0.09 0.18 0.36

Note. a-BIC refers to the value of adjusted BIC.

Figure 11 The proportion of principals in each type who responded that they allocated time to leading activities in Germany
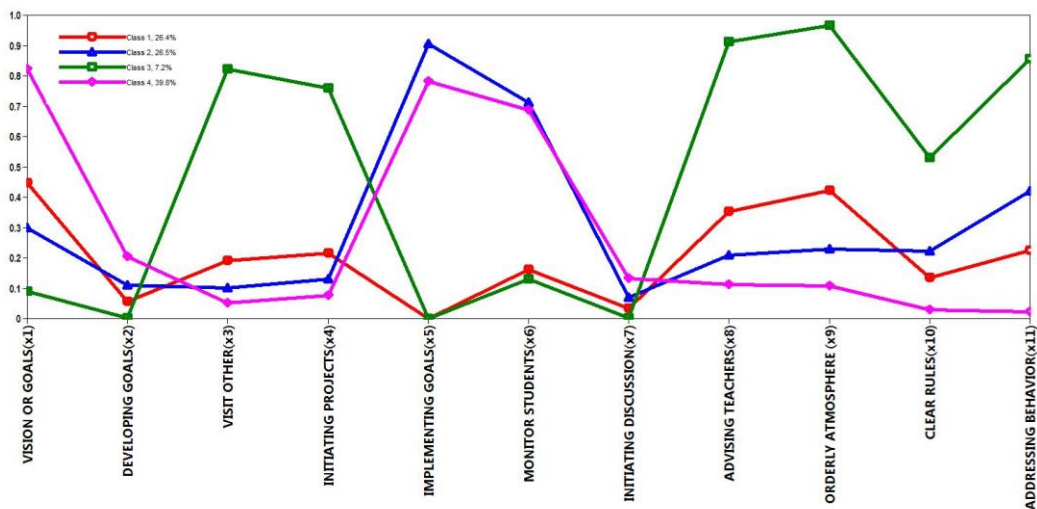
Figure 12 The proportion of principals in each type who responded that they allocated time to leading activities in Chinese Taipei
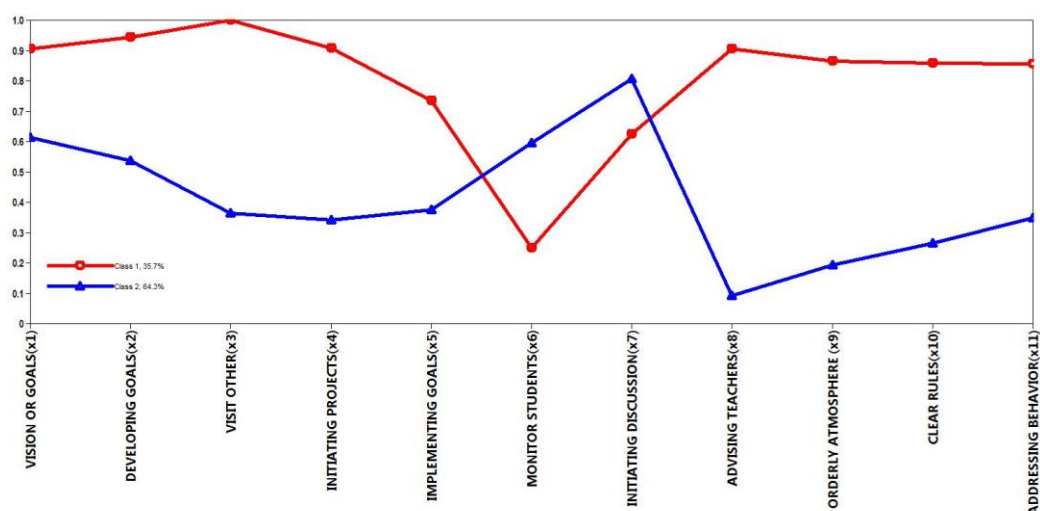
Following the recommendations of Nylund, Asparouhov, and Muthén, the lower the values of AIC, BIC, and a-BIC, the better that the models fit the data (Nylund, Asparouhov, & Muthén, 2007), while the model is in favor of the higher entropy value. Meanwhile, for the sake of accuracy, the P values of the Lo–Mendell–Rubin (LMR) and Bootstrapped Likelihood Ratio Test (BLRT) are required to be significant (p value <0.05). The fit indices in Tables 19 and 20 showed that the four-class of German school principals fit the data well with an entropy of 0.819, AIC = 2836.836, BIC = 2956.189, a-BIC = 2838.996, and p values of LMR and BLRT < 0.01, while on the same ground two-class of Chinese Taipei school principals fit the data well with an entropy of 0.91, AIC = 1960.100, BIC = 2035.199, a-BIC = 1965.081, and p values of LMR and BLRT < 0.01.

According to the prior leadership studies, the author identified four typical styles of school leadership, namely instructional, transformational, integrated, and distributed leadership (Bogler, 2001; Diamond & Spillance, 2016; Hallinger, 2005; Leithwood, Leonard, & Sharratt, 1998; Louis et al., 2010; Marks & Printy, 2003; Nguni, Sleegers, & Denessen, 2006; Pietsch & Tulowitzki, 2017; Supovitz, Sirinides, & May, 2010; Thoonen, Sleegers, Oort, Peetsma, & Geijsel, 2011). These typical school leadership styles can well cover the Germany and Chinese Taipei situations.

Figure 11 shows the four leadership styles of principals in Germany, namely the distributed leadership style (26%), the integrated instructional and transformational leadership style (27%), the transformational leadership style (7%), and the instructional leadership style (40%). First, the principals in **class-1** were identified as the distributed leadership style. The relatively high probabilities of the frequency of leading time were devoted to visiting other schools or attending conference for new ideas *(x3)*, initiating projects or improvements *(x4)*, and advising teachers *(x8)*, aiming to encourage coordination via group or organization activities to improve the school. Second, the principals in **class-2** were identified as the integrated instructional and transformational leadership style. The majority of school principals had higher probabilities of the frequency of leading time on monitoring teachers' implementations of the school's educational goals *(x5)* and students' academic progress *(x6)*, while trying to dedicate more time to clearing school rules and addressing students' misbehaviors *(x10)*. In particular, their leadership activities reflected an integration of instructional and transformational leadership in considering that they emphasized student academic achievement and inspired school to achieve remarkable results simultaneously. Third, the principals in **class-3** belonged to the transformational leadership style, as the probabilities of the frequency of time were absolutely higher for visiting other schools for new ideas *(x3)* and initiating school projects *(x4)* as well as maintaining the school climate *(x8-x10)* to ensure a healthy learning community for teachers and students. Fourth, the principals in **class-4** tended to behave as instructional leaders, as the probability of the frequency of leading time was higher in terms of setting the school's vision or goals *(x1)*, emphasizing the implementation of teaching goals *(x2)*, and monitoring students' academic progress *(x6)*.

Figure 12 shows that the Chinese Taipei principals utilized integrated leadership most frequently, with one group being specified as the integrated instructional and transformational leadership style (36%) and another specified as the integrated

instructional and distributed leadership style (64%). The principals in **class-1** had absolutely higher probabilities of the frequency of leading time on setting the vision or goals for the school *(x1)* while emphasizing motoring teachers' implementation of educational goals *(x5)* and maintaining school climate to be orderly *(x9-x11)* as well as visiting other schools *(x3)*, initiating educational projects *(x4)* and discussions among teaching staff. Therefore, they appeared to use an integration of instructional and transformational leadership styles. On the same ground, the principals in **class-2** had higher probabilities of the frequency of leading time on monitoring students' academic progress and initiating discussions to help teachers, which reflected an integration of instructional and distributed leadership styles.

Figures 11 and 12 disaggregate the average proportion of the principals in terms of the time spent on the survey items by each latent class in Germany and Chinese Taipei (showed on x axis). The figures show the differences in school leadership in Germany and Chinese Taipei across the survey indicators by each sub-group. This study was consistent with the previous studies on German school leadership, highlighting that instructional leadership is prominently used by school principals (Huber, Tulowitzki, & Hameyer, 2017). Meanwhile, distributed leadership and integrated leadership were equally utilized by school principals with similar probabilities. Transformational leadership was only employed by a minority of school principals. School principals in Chinese Taipei emphasized integrated leadership, while instructional leadership gained equal attention. Figure 12 reports that instructional leadership predominated in two leadership styles, namely the integration of instructional and transformational leadership, and the integration of instructional and distributed leadership.

Additionally, the latent class analyses (LCAs) revealed that in both Germany and Chinese Taipei challenging school circumstances existed by examining the probability scales in Germany and Chinese Taipei (Tables 21 and 22).

Table 21 The probability scales of four latent classes in Germany

	Class 1	Class 2	Class 3	Class 4
x1				
Category 1	0.370 (0.083)	0.178 (0.109)	0.022 (0.029)	0.899 (0.068)
Category 2	0.630 (0.083)	0.822 (0.109)	0.978 (0.029)	0.101 (0.068)
x2				
Category 1	0.447 (0.067)	0.299 (0.096)	0.090 (0.069)	0.822 (0.067)
Category 2	0.553 (0.067)	0.701 (0.096)	0.910 (0.069)	0.178 (0.067)
x3				
Category 1	0.055 (0.021)	0.109 (0.043)	0.003 (0.003)	0.204 (0.048)
Category 2	0.754 (0.040)	0.789 (0.035)	0.174 (0.111)	0.745 (0.041)
Category 3	0.191 (0.045)	0.101 (0.037)	0.823 (0.113)	0.051 (0.021)
x4				
Category 1	0.073 (0.022)	0.126 (0.040)	0.007 (0.005)	0.209 (0.048)
Category 2	0.711 (0.039)	0.743 (0.035)	0.233 (0.118)	0.715 (0.039)
Category 3	0.216 (0.044)	0.131 (0.041)	0.760 (0.122)	0.076 (0.026)
x5				
Category 1	0.019 (0.025)	0.673 (0.082)	0.012 (0.025)	0.625 (0.081)
Category 2	0.981 (0.025)	0.327 (0.082)	0.988 (0.025)	0.375 (0.081)
x6				
Category 1	--	0.905 (0.062)	--	0.783 (0.076)
Category 2	1 (0.000)	0.095 (0.062)	1 (0.000)	0.217 (0.076)
x7				
Category 1	0.161 (0.066)	0.711 (0.055)	0.131 (0.106)	0.687 (0.056)
Category 2	0.839 (0.066)	0.289 (0.055)	0.869 (0.106)	0.313 (0.056)
x8				
Category 1	0.034 (0.017)	0.069 (0.026)	0.002 (0.002)	0.134 (0.036)
Category 2	0.612 (0.070)	0.723 (0.048)	0.085 (0.088)	0.754 (0.037)
Category 3	0.354 (0.081)	0.208 (0.059)	0.913 (0.090)	0.112 (0.034)
x9				
Category 1	0.017 (0.009)	0.042 (0.020)		0.097 (0.034)
Category 2	0.560 (0.072)	0.729 (0.064)	0.034 (0.035)	0.796 (0.037)
Category 3	0.423 (0.077)	0.229 (0.075)	0.965 (0.035)	0.107 (0.037)
x10				
Category 1	0.133 (0.046)	0.078 (0.039)	0.021 (0.015)	0.443 (0.094)
Category 2	0.732 (0.052)	0.701 (0.053)	0.450 (0.103)	0.528 (0.08)
Category 3	0.135 (0.036)	0.221 (0.064)	0.529 (0.115)	0.029 (0.019)
x11				
Category 1	0.014 (0.015)	0.006 (0.006)	0.001 (0.001)	0.149 (0.053)
Category 2	0.763 (0.055)	0.574 (0.103)	0.142 (0.103)	0.829 (0.042)
Category 3	0.224 (0.056)	0.421 (0.104)	0.857 (0.104)	0.022 (0.028)

Table 22 The probability scales of two latent classes in Chinese Taipei

	Class 1	Class 2
x1		
Category 1	0.095 (0.045)	0.385 (0.054)
Category 2	0.905 (0.045)	0.615 (0.054)
x2		
Category 1	0.057 (0.038)	0.464 (0.057)
Category 2	0.943 (0.038)	0.536 (0.057)
x3		
Category 1	--	0.637 (0.060)
Category 2	1.000 (0.000)	0.363 (0.060)
x4		
Category 1	0.093 (0.042)	0.658 (0.060)
Category 2	0.907 (0.042)	0.342 (0.060)
x5		
Category 1	0.266 (0.074)	0.625 (0.052)
Category 2	0.734 (0.074)	0.375 (0.052)
x6		
Category 1	0.008 (0.005)	0.038 (0.019)
Category 2	0.250 (0.070)	0.596 (0.053)
Category 3	0.743 (0.073)	0.366 (0.054)
x7		
Category 1	0.011 (0.008)	0.160 (0.037)
Category 2	0.625 (0.075)	0.807 (0.039)
Category 3	0.364 (0.078)	0.033 (0.019)
x8		
Category 1	0.095 (0.063)	0.909 (0.037)
Category 2	0.905 (0.063)	0.091 (0.037)
x9		
Category 1	0.135 (0.074)	0.806 (0.043)
Category 2	0.865 (0.074)	0.194 (0.043)
x10		
Category 1	0.142 (0.073)	0.735 (0.046)
Category 2	0.858 (0.073)	0.265 (0.046)
x11		
Category 1	0.143 (0.060)	0.652 (0.051)
Category 2	0.857 (0.060)	0.348 (0.051)

Looking at Tables 21 and 22, The indicators $x8$ to $x11$ suggested that the principals had to deal with challenging school circumstances, since the indicators of

advising teaching, keeping an orderly school climate, clearing rules, and addressing students' misbehavior problems were predominant within challenging school circumstances. In Germany, the author found that the principals using the leadership styles classified as distributed, integrated, and transformational leadership had restively higher probabilities of the frequency of leading time on the above four tasks. The school leadership using the leadership style classified as instructional leadership conspicuously has relative lower probabilities of time on these tasks, whereby here the author illustrated one example by taking the indicator $x8$, distributed (class-1), integrated (class 2), and transformational leadership (class 3) had definitely higher probabilities on scales "some time" and "a lot of time" (96.6%, 93.1%, and 99.8% of the total, respectively). Meanwhile, the principals in challenging school circumstances using leadership classified as transformational leadership, the majority of school principals allocated "a lot of time" to visit other schools for new ideas while initiate educational projects to improve school (82.3% and 76%, respectively). By contrast, the principals in less challenging schools using leadership styles distributed, integrated, and instructional leadership allocated less time to such activities, since the probabilities of the frequency of leading time were lower in terms of visiting other schools and initiating educational projects. The indicators $x5$ and $x6$ represented the time that the principals devoted to monitoring the implementation of goals and evaluating the students' learning progress, whereby the author found that the principals who utilized leadership styles classified as integrated leadership and instructional leadership had absolutely higher probabilities of the frequency of "no time" on monitoring teachers' goal implementation (67.3% and 62.5% of the total, respectively), while the principals who utilized leadership styles classified as distributed leadership and transformational leadership had higher probabilities of the frequencies of "some time or a lot of time" on these activities (98.1% and 98.8%, respectively). Clearly, aside from the leadership style classified as instructional leadership, the principals in challenging schools had higher probabilities of the

frequency of leading time on monitoring teaching goals' implementation and evaluating students' achievement.

Compared with Germany, the Chinese Taipei principals using a leadership style categorized as a combination of instructional and transformational leadership styles were most likely to deal with the challenging school circumstances, as they had the highest probabilities of the frequency of "some time or a lot of time" on aforementioned maintaining school climate activities and the probabilities of the frequency of leading time were also higher on teachers' goal implementation but lower on evaluating students' learning progress. By comparison, the principals using the leadership style classified as a combination of instructional and distributed leadership had relatively lower probabilities of the frequency time on such leading activities. Meanwhile, according to the principal's time allocated to visiting other schools for new educational ideas and initiating projects to improve the school, represented by indicators $x3$ and $x4$, the principals in challenging school context were inclined to have higher probabilities of the frequency of leading time on these activities compared with the principals embedded in less challenging school circumstances. The principals in challenging school circumstances – for instance, the principals who belonged to class-1 – had definitely higher probabilities of the frequency of "some time or a lot of time" for these activities (100% and 90.7%, respectively) while the principals belonged to class-2 in less challenging school circumstances had lower probabilities of the frequency of leading time on the above-mentioned leading tasks (36.3% and 34.2%, respectively). These findings in the principals' responses regarding time allocation to the activities significantly further detail the differences behind the heterogeneous populations.

Chapter 6 Conclusions and discussion

6.1 Conclusions

This dissertation offers relatively comprehensive and comparative information on school leadership in Germany and Chinese Taipei. Meanwhile, the comparative information provides an answer to the question "Does school leadership affect student achievement? If so, how does it work?" This study focuses on the school leadership from different perspectives, emphasizing three critical sub-dimensions of school leadership and the effect exerted on student math achievement. The effect that each sub-dimension of school leadership exerted on student math achievement was examined and it was demonstrated that there were differences in school leadership between Germany and Chinese Taipei via factor loading analysis and multi-level structural modeling. Thus, the latent class analysis provides support for answering the question "Is there any difference in school leadership between Germany and Chinese Taipei? If so, what is the difference and how does is difference demonstrated?" Such debates still exist that quite a lot research takes them as the focus in school leadership research, especially in the comparative study. Besides, exact differences in school leadership are shown with the assistance of latent class analysis.

The results described above demonstrate that the relationship between time allocated to leadership activities and student math achievement differed across groups, although some items had negative effects on student math achievement in both groups. Aside from the direct relation between the spent time in leadership activities and student math performance, the relationship between each category of leadership activities and student math achievement showed that almost each first-order latent variable affected student math achievement significantly, except for the item "setting and developing the vision/goal for school" in Chinese Taipei, which was not related to student math achievement ($p = 0.181$). Based on the confirmatory factor analysis (CFA) and structural equation modeling (SEM), the factor loadings found that they

differed in school leadership between Germany and Chinese Taipei. Based on the existing differences in school leadership, latent class analysis showed that perhaps the difference in school leadership resulted from the different latent classes of school leaders in Germany and Chinese Taipei. Accordingly, from the empirical research results from this dissertation, the author would like to briefly summarize based on the perspective of the conceptual construct of school leadership in Germany and Chinese Taipei, the relationship between school leadership and student math achievement, as well as the latent class differences in Germany and Chinese Taipei, separately.

The conceptual construct of school leadership in Germany and Chinese Taipei is similar

The previous chapters have displayed that the construct of school leadership in Germany and Chinese Taipei was similar as the importance of three sub-dimensions of school leadership were placed in the same situation, whereby in turn the primary school principals more strongly emphasized school management and setting school vision/goal. Maintaining school climate contributed less to school leadership compared with the other two sub-dimensions. The standardized factor loading of leading school activities in previous tables (Tables 12 and 13) showed that the three first-order latent variables entitled "vision and goal *(S1)*", "school management *(S2)*", and "school learning climate *(S3)*", as well as the second-order latent variable entitled "school leadership *(SL)*", were properly constructed in both Germany and Chinese Taipei. Meanwhile, the standardized factor loading of each observed variable to the first-order latent variable was very similar between Germany and Chinese Taipei, which reflected very similar conceptual constructs in both economies. Likewise, the standardized factor loadings of the first-order latent variables *S1, S2,* and *S3* to the second-order latent variable *SL* were relatively large and very similar between Germany and Chinese Taipei (*S1*: 0.821 vs. 0.962; *S2*: 0.989 vs. 0.991; *S3*: 0.529 vs. 0.665), indicating similar conceptual constructs of school leadership in both economies. The only exception was *S3* in Germany, which indicated that statistically

maintaining a school climate contributed slightly less compared to other two factors to construct the conception of school leadership. German principals largely differed in terms of time spent on three categories of leadership tasks compared with their Chinese Taipei colleagues, possibly because the principals in Chinese Taipei are embedded in full positions but German primary school principals are responsible for teaching while they address school leadership issues. Meanwhile, as the previous section introduced, there are many students who have immigration backgrounds in Germany whereby the principals actually confront more complicated school contexture such as language (German) study and cultural conflicts. Many such issues need them to separate time to address. On the same ground that the principals have less time to address management issues in Germany, the principals in Chinese Taipei seem to perform better compared with their German colleagues. Another aspect worth mentioning is S3, which was entitled as "maintaining school climate", whereby the standardized factor loadings seem to perform more well for German school principals but less so in Chinese Taipei. The explanation for this perhaps can be attributed to different understandings of "school climate". For instance, German principals are inclined to view more "keep an orderly and health atmosphere" and "ensuring that the school to get the clear rules and disciplines for student behaviors" as the better school climate for teachers and students, whereas Chinese Taipei principals are prone to view "addressing disruptive student behavior" as more important when they define "well-disciplined school climate".

The relationship between school leadership and student math achievement strongly differ between Germany and Chinese Taipei

The results in the previous chapter (Chapter 5) reveal that school leadership is negatively associated with student math achievement in Germany but no significant effect is found in Chinese Taipei. The following graphs described the relationship between time allocated to leadership activities and student math achievement in Germany and Chinese Taipei, respectively (Figures 9 and 10).

Figure 9 The relationship between SL and SMA in Germany
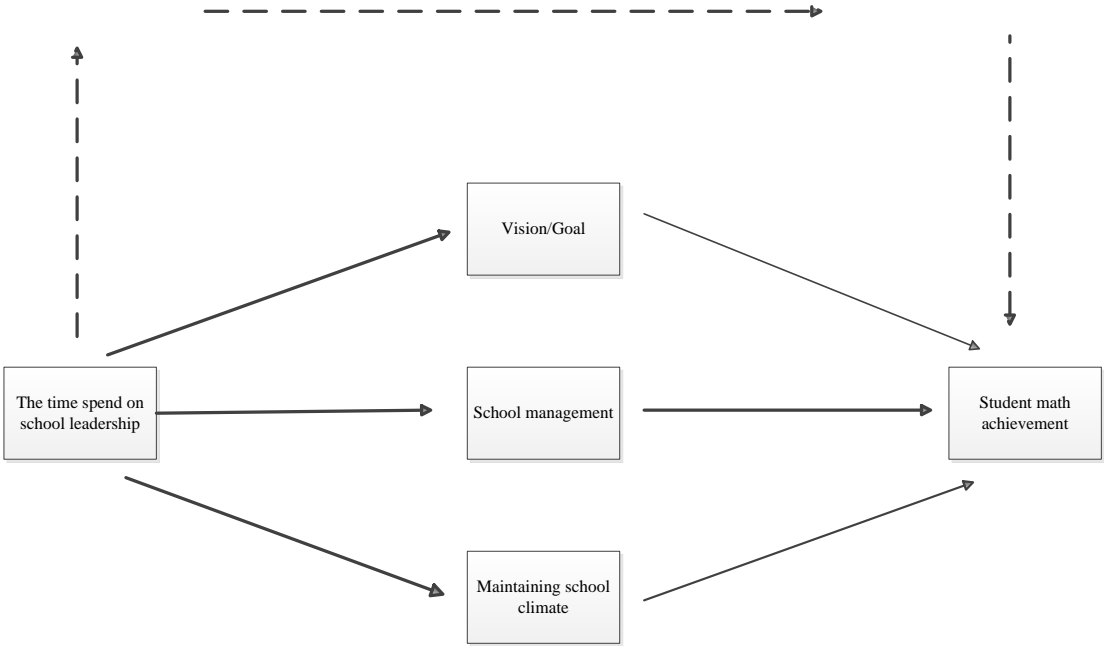
Note. Bold line = significant positive relationship

Solid line = positive relationship

Dotted line = negative relationship

Figure 10 The relationship between SL and SMA in Chinese Taipei
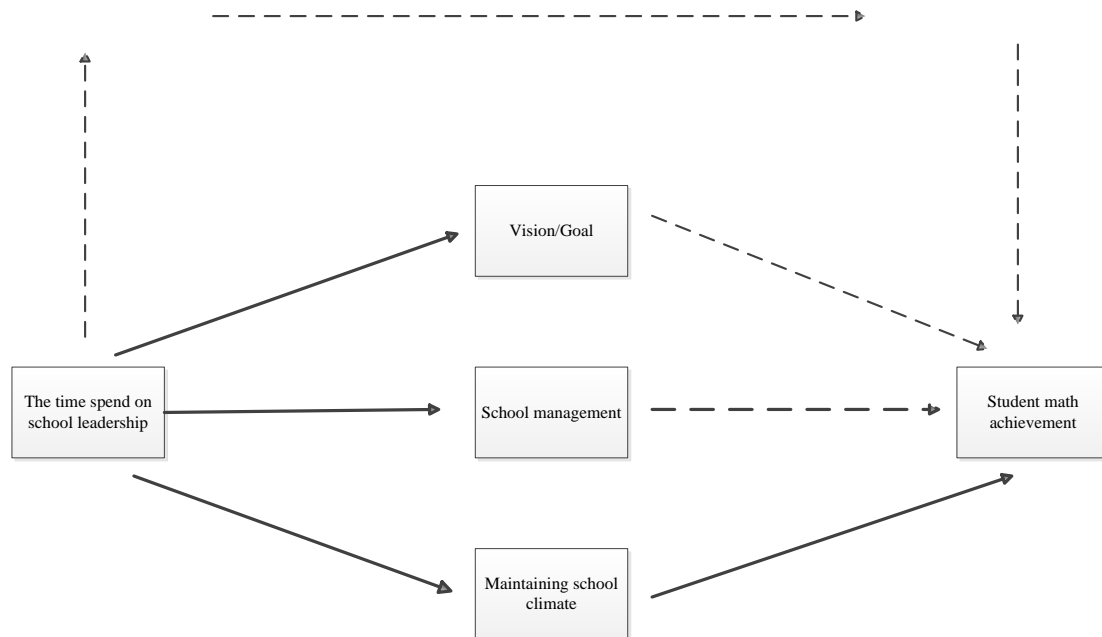
Note. Bold line = significant positive relationship

     Bold dotted line = significant negative relationship

   Light dotted line = insignificant relationship

The figures skeletonizes the clear relationship between the time allocated to leadership activities and student math achievement as well as the relationship between each category of leadership activities and student math achievement (i.e. positive or negative; significant or non-significant). The details were drawn in the previous chpter (Chapter 5).

The author intends to highlight that regardless of the kind of relationship between school leadership and student outcome, it is strongly affected by the national contexture, school origination, school climate and school atmosphere (Freiberg, Driscoll, & Knights, 1999; Hoy & Hannum, 1997; Kober, 2001; Loukas & Robinson, 2004; Norton, 2008; Shindler, Jones, Williams, Taylor, & Cadenas, 2016). Meanwhile, the national educational policy, social mechanism, school system, as well as school organization affect the principal's and teacher's behavior (Wertsch & Tulviste; 1992),

while it is known that the principal's and teacher's behaviors further play a critical role in affecting student achievement (Louis et al., 2010). The author drew attention to situational differences since the differences of school leadership in Germany and Chinese Taipei are firmly related to the national context and educational policy mechanism. For instance, principals in different countries and even in the same country behave differently such as regarding teaching issues handled by principals. When teachers are motivated and well prepared for curricula, principals are inclined to allocate less time to observe classes, devoting strong attention to the poor performance of teachers. Accordingly, they would take more time to considering how to improve teachers' poor performance. Hence, it could be seen that the principals were willing to provide assistance for those teachers who performed less well at the beginning of their teaching career. Especially the principals arranged the experienced teachers to help the new teaching staff, aiming to guide them to be mature in teaching, whereby all practice needs time allocation to provide assistance.

Besides, anyone situated in society is sculptured by the society's culture, organization and mechanism. In other words, the human is the product of the entire society, which means that he/she is influenced by social stereotypes, while the society enables or constrains the perceptions of individuals. The effect on school organization development and school staff is inherited from the social and historical mechanism. For instance, the national history and culture are able to determine the concepts and ideal of education (Richter, Lewis, & Hagar, 2012). In Chinese Taipei, as presented above, most families and parents believe that the students who gain outstanding scores are inclined to be the elites. Thsi is why most parents and students were not willing to prefer vocational schools. Furthermore, the teachers, parents and students more strongly emphasize more ordinary education from primary school to senior-middle school. Hence, Chinese Taipei has gained an outstanding ranking in international large-scale assessments. However, the German education system is considered attractive not only due to its early stratification but also due to its well-performing

vocational schools. German education pays similar attention to the vocational school since it pursues different educational purposes for education stratification. Under a given condition, it enables better understanding of the differences in school leadership across two groups.

Lewin (1936) found a firm interaction between environment and individual personality, obtaining the following formula:

$$B = f\,(P,\,E)\;\text{(Lewin, 1936, p. 12)}$$

In his equation, "B" represents behavior, "P" denotes personality, and "E" referrs to the environment. It demonstrates that it is impossible to study individual behavior without a given situation. Thereby, how individuals behave and why they act in a certain way under a given condition depends on the situation. For instance, when two principals handle the same disruptive students, they are prone to behave differently in terms of different situations. Perhaps one emphasizes moralism whereas the other one is more willing to criticize disruptive behavior. It could not be concluded which kind of principal's behavior was right or wrong, because both of them behaved appropriately according to the school situation and social value.

After Lewin's situation interaction study, the following person-situation theory became prevalent because it was recognized that people always interact with the situation within which they find themselves (Horstmann & Ziegler, 2016). Therefore, the situation shapes people's personality, behavior as well as their ideas and conceptions in relation to the current situation. Meanwhile, the social mechanism, education system along with the school origination were taken as instruments for researchers to study principals' behavior, leadership, and principal effectiveness. In other words, the interaction between the person and the situation is invisible, whereby it needs the medium to load the interaction, and thus to provide the evidence to widen relevant study in social science. Individuals' behavior and perception could not be

measured without an exact situation description.

This study is rooted in the time allocated to school leadership activities, in which the education system, education management system, as well as the education inspection system account for strong importance in explaining what and how they did in a given context. For example, when the education system determines the goals for the school, the principal is required to accomplish those goals. Accordingly, time allocation is necessary to achieve the goals in terms of the importance of each goal as perceived by principals. Hence, it is not difficult to understand why the principals allocated different time to different goals because some goals are emphasized by the education government but others could be postponed. Thereby, the education government affects the goal achieving situation, which further influences principals' behavior and time allocation to leadership activities. Meanwhile, it could not be denied that the personal traits, psychology affection and inclination affect the time allocation, whereby in different situations different results would occur. Therefore, what the principal perceived depends on the situation in which they find themselves, thereby the time allocated to leadership activities relied on their perceptions across the situations.

It was found that the school situation incorporates not only the education mechanism, education organization, education management, as well as education inspection system but also the school culture, school climate and school atmosphere. As such, this comparative study is based on the differences in education systems, education management and inspection systems, school organization, school climate, and school culture, aiming to provide evidence for the differences in school leadership across Germany and Chinese Taipei and offer more detailed information on such differences.

The potential latent in school leadership strongly differs between Germany and Chinese Taipei

As the latent class analysis depicted in the previous chapter (Chapter 5), the latent

class of school leaders strongly differs between German and Chinese Taipei primary schools. The major difference is that German primary school principals were classified into four potential classes, whereas two classes were employed for Chinese Taipei primary school principals. To the author's knowledge, the reason why German school principals are separated into four classes is that the German school context is more complicated than Chinese Taipei. As introduced in the previous section, German schools not only have many immigrated students but also have major differences in school culture. Chapter 2 compared the school context, school atmosphere, and school culture between Germany and Chinese Taipei, from which the author gained information on these differences. For instance, in Chapter 4.6, the author drew attention to challenging schools, which gained different understandings such as in Chinese Taipei, whereby principals embedded in challenging schools are more likely to spend more time maintaining school climate but less time on monitoring teaching goal and students' study. By contrast, principals embedded in less challenging schools would like to spend more time communicating with teachers to monitor their teaching goals and track students' learning progress. In Germany, it is more complex that four kinds of school principals presented different time allocation to leadership activities. However, the common differences are also found among the challenging schools and less challenging schools. The less time spent on maintaining school climate, the more time devoted to setting the school vision/goal, whose aim is to depict the blueprint of school development. By contrast, principals embedded in challenging schools are inclined to devote less time to set school vision/goal, since maintaining school climate is the priority for school principals situated in challenging schools. Meanwhile, principals who devote a lot of time to maintaining school climate are prone to visiting other school more often. Similarly, in Chinese Taipei, when this kind of school principals spend more time on maintaining school climate, more time is allocated to visiting other schools and initiating projects or improvements. On the same grounds, the author concludes that facing challenging school circumstances enables school

principals to draw attention to communicating with other schools, aiming to exchange relevant information and learn other principals' experiences.

The school context, atmosphere and culture are the long-lasting points in education research. They are the primary impetus when school principals address school issues. Different potential classes of school leadership are sculptured in Germany and Chinese Taipei, separately, suggesting that it might help for principals to adopt different responses when they prioritize their leadership activities. For instance, principals are likely to maintain school climate to be orderly and healthy when there are many disruptive students. By contrast, principals would like to allocate more of their leading time to monitoring teaching and learning when the school climate is stable for teachers and students. One example in Germany is in Wuppertal, in which a relatively high proportion of unemployment families can be found (Riedel, Schneider, Schuchart, & Weishaupt, 2010), whereby the students from these unemployment families are more likely to enforce school principals to take different leading time allocation responses than those who come from high or stable economic status families.

6.2 Discussion, limitations and future prospect

This current comparative study of school leadership between Germany and Chinese Taipei was based on existing empirical research on the relationship between school leadership and student achievement. Perhaps due to different culture between the Western and Eastern context and the fact that many factors exert important influence on student math achievement rather than one single factor, the comparative study of empirical research between Germany and Chinese Taipei is rare. Besides, Germany has a unique education system and complicated education context, whereby it is difficult to assert which standard is better. Based on the prior empirical study, the author intended to grab this "luck" to initiate this current study, which resulted in not achieving a universal result. In this current study, this study specifically contributed to

the relationship between school leadership and students' math achievements, while offering particular information on the conceptual construct of school leadership between Germany and Chinese Taipei. Simultaneously, it makes a unique contribution to the leadership style study via latent class analysis based on principals' leading time distribution. This information might be provided to the relevant stakeholders and researchers who take an interest in the comparative study between Western and Eastern contexts as well as for policy-makers concerned with education equality and decent education that should be granted to students. Although this study used data from the international database of TIMSS 2011, however, the author did not interview the principals on their actual school life. Thus, this leads to the problems of how much time principals actually spend on school leadership and what school principals do in their actual school life. Therefore, the current findings raise issues concerning how useful the data is for practitioners. Another issue raised by the current findings is the latent class analysis. Given that the data used to latent class analysis is not longitudinal, the latent classes of school leadership style in Germany and Chinese Taipei is not perpetually fixed. More specifically, the leadership style would vary in line with the data format. Principals are inclined to employ different styles in different contexts, whereby either leadership styles or leading behaviors change to inure to contexture. Finally speculation comes from the author's perception of school leadership by principals in Germany and Chinese Taipei. This finding shows that the conceptual construct of school leadership is similar but largely differs in each item of leading tasks in both economies. Thus, this implicates that perhaps the principals perceive school leadership in a different manner. Nevertheless, these findings provide less influential evidence to practitioners due to the little information available on the actual school context and the perception of individual school leaders.

However, everything has two sides. The findings of this current study offer detailed information about school leadership in Germany and Chinese Taipei. Despite the school context difference, German school principals emphasize maintaining an

orderly and healthy school climate for teachers and students, while they devote strong attention to instruction. In other words, German school leaders are likely to be instructors compared with their Chinese Taipei colleagues. Curriculum development is embedded in the core of education research (Rolff, 2015), while it is firmly related to instruction. Thus, the understanding of the curriculum may assist principals to be involved in teaching and learning, which would be influential for student achievement. Compared with German school leaders, the school leaders in Chinese Taipei are prim and proper, which is possibly due the centralized education policy and education system simplifying the school context. On the other hand, the fixed Asian culture narrows the leadership style, whereby in turn the rigorous matriculation education format limits the scope of school leadership style in Chinese Taipei. Besides, the school leaders in Chinese Taipei obtain a relevant high perception to school leadership. In other words, they are likely to link their leading behaviors with school leadership when they address school leading issues, resulting from the professional occupations that bring the sense of identity for Chinese Taipei school leaders.

Although these current findings offer much empirical evidence, some deficiencies should be remedied in further studies. From the author's perspective, she intended to raise some questions that might gain attention from other researchers to work such problems out together.

First of all, since there are major differences between Germany and Chinese Taipei in terms of education systems, along with the socio-cultural differences, the comparative study proved challenging and confusing to a given extent. It is well known that education problems are a part of social problems. As a result, those education problems that are waiting to be addressed eventually become social problems. Furthermore, due to the socio-cultural differences, it allows the school culture and school climate to be distinguished from each other. Meanwhile, it also takes much influence in education organization, involving principals, teachers and students, which influences the management ideas and behaviors of principals. This is

why school climate as well as the organization structure are strongly reflected by centralization in Chinese Taipei primary schools but more decentralized in German primary schools. On this note, it is necessary to point out that under such majorly different conditions, the school contexture and school system become the major points used to analyze the difference between Germany and Chinese Taipei. Thereby, it enables the comparative study to be more challenged. Even among the individual states in Germany, there are also different education policies, allowing the comparative study to be more arduous.

Second, due to different education policies in determining students' access to higher education, this enables the principals to understand education and student achievement differently. For instance, although German students need to complete the "Abitur" test, which is like the graduation examination in Chinese Taipei, in Chinese Taipei students not only need to take the test but also achieve outstanding performance to access to the university. Based on such grounds, it enables principals – in particular at primary school – to have different understandings of "outstanding education," whereby an emphasis is placed on exam orientation. Moreover, the expectations of parents also vary according to their conceptions of an "outstanding student," which consequently highlights the requirements for principals. However, given that relevant information in TIMSS questionnaire is limited, this study cannot pay attention to either the relation between parents and principals or the specific comments from parents to principals. As a result, the author cannot gain information from either the national level or state/city level, which thus restricts the details or comments for principal effectiveness research. As such, it enables this study from to be more confused to some extent at the macro-level.

Third, since the questionnaire was for school principals, or in other words for schools, it was completed by principals. Accordingly, the results tended to be unclear due to the principals' self-evaluation. As a result, lacking feedback from teachers, and parents alongside students allowed the result in this study less accurate because the

evaluation should be all-encompassing rather than only from the principals. In order to enable the results to be more useful, several interviews should be conducted in a further study. Addionally, the interviews should not only be for principals but also for parents, administrators and students, so that the information comes from all aspects and enables the evaluation to be more objective.

Fourth, the individual perception of principals should be involved in the discussion as major differences in school organization caused the deviations of the perceptions for time allocation. For instance, if principals in Chinese Taipei primary school worked for four hours (a half day), they might perceive that they did not allocate sufficient time to school leading activities. In turn, in Germany, the principals probably perceived that the four hours meant a great deal time that was assigned to leading the school. However, in the TIMSS questionnaire, there were only three scales for answering questions, namely "A lot of time," "No time" and "Some time." This might cause confusion for the principal to answer such questions. Therefore, in a future study, the author suggests that such item scales warrant more attention. Whether the item scales are changed to those more particular and detailed scales, it should be taken into account that they need to be add more specific items. For instance, more information on principals' behaviors, their perceptions, their leading styles, and conceptions of leadership, along with the school contexture should to be added into the study. Because the leading flexibility was influenced by school contexture as well as by leadership style, the information on the perception of individual principal led to a better understanding of the leading activities. Additionally, regarding the time allocation, the principals also place strong emphasis to construct the school as the community for teaching and learning as it is principal's accountability. However, keeping such a learning community safe and healthy means that more time needs to be allocated to leading activities. Besides, the learning community also means that more feedback needs to be collected because it is able to help principals to gain clear information on their leading activities. Such a procedure

can be the virtuous path if the principals employ it properly and indeed all accompanied support is required to assist the principals to achieve such goals, which means that the detailed information should be further exploited in a further study.

Fifth, the author employed listwise deletion to deal with the missing data because TIMSS is an international test with a sufficient sample. In other words, given that a large amount of data was employed in this study, as a result, the influence of missing data was less relevant. On the other hand, given that the database was oversized, it was slightly difficult to handle the data problem in data analysis. Thus, it required a more sophisticated statistical methodology to address statistical issues, and thereby the statistical method should be further developed to improve the statistical model.

Sixth, in order to compare the factor loadings to describe the difference of time allocation in leading school activities, here the author employed item parceling, which meant that there might be missing information. In other words, a more accurate and skilled analytical method should be employed by researchers who are interested in principal effectiveness research. The author aims to highlight that in this study two-level structural equation modeling was employed, which enabled the experimental result to be complicated and to some extent confusing. The author hopes that in a further study the model could be improved, becoming much simpler and easier to understand as essential requirements for a "good" model. In addition, given that it is sometimes difficult to manipulate such models to adjust to the real data under the real contexture, the author intends to probe in a further study and develop the model used in this study to be more accurate and simpler.

Finally, there remains an argumentation on student achievement because it is purported that the score could not represent student learning competency. The evaluation for student competency sbhould be diversified in a further study, not with the performance rating of specific subjects as the exclusive evaluation objective, such as reading and math. It is not only the parental wish but also a requirement to policy-holders. The point of education is cultivating students from diversified aspects

rather than only the scores that students gain. In order to address such issues, more studies on students' perception and motivations alongside their interests in subjects are required to probe into principal effectiveness research. Put simply, as more factors are involved, the school effectiveness research and principal effectiveness research will move forward.

Future prospects

To date, research on the relationship between school leadership and student achievement has not achieved a universal result. The main purpose of this study was to contribute new perspectives into this domain. However, school stakeholders and researchers who are interested in the commons and differences in principal effectiveness between the Western and Eastern contexts should consider the future prospects.

First, the data used was based on principals' self-evaluation, indicating possible bias in the estimation of school leadership. It would be more informative if future studies could re-examine the findings from this study via in-depth interviews and direct observations.

Second, for model fitting reasons, the author did not consider all relevant factors given in the TIMSS database that might hold relevance in the relationship between school leadership and student mathematics achievement. It would be more precise if future studies could consider the mediating and moderating factors via appropriate methodologies.

Third, the author fulfilled the latent class analyses based upon principals' time distribution rather than their leading behaviors. This deficiency might lead to a rough classification of school leadership styles in Germany and Chinese Taipei. The author expects that future studies could depict the leadership styles in the two economies taking into consideration the principals' background characteristics and their school contexts.

References

[1] Agirdag, O., Van Houtte, M., & Van Avermaet, P. (2011). Why does the ethnic and socio-economic composition of schools influence math achievement? The role of sense of futility and futility culture. *European Sociological Review, 28,* 366-378.

[2] Alfeld, C., Hansen, D., Aragon, S., & Stone III, J. (2006). Inside the black box: Exploring the value added by career and technical student organizations to students' high school experience. *Career and Technical Education Research, 31,* 121-156.

[3] Ashkanasy, N. M., & Tse, B. (2000). Transformational leadership as management of emotion: A conceptual review.

[4] Aurin, K. (1989). School effectiveness and improvement in the Federal Republic of Germany. School effectiveness and school improvement. *Proceedings of the First International Congress of School Effectiveness and Improvement* (pp. 83–87). School of Education, University College of Wales: Cardiff.

[5] Avenarius, H., & Heckel, H. (2000). *Schulrechtskunde: Ein Handbuch für Praxis, Rechtsprechung und Wissenschaft.* Luchterhand.

[6] Aydin, Y. (2016). The Germany-Turkey migration corridor: Reffitting policies for a transnational age. *Transatlantic Council on Migration, A Project of Migration Policy Institute,* 1-22.

[7] Bagozzi, R. P., & Edwards, J. R. (1998). A general approach for representing constructs in organizational research. *Organizational Research Methods, 1,* 45-87.

[8] Bamburg, J., & Andrews, R. (1990). School goals, principals and achievement. *School Effectiveness and School Improvement, 2,* 175-191

[9] Bandalos, D.L. (2002). The effects of item parceling on goodness-of-fit and parameter estimate bias in structural equation modeling. *Structural Equation Modeling: A Multidisciplinary Journal, 9,* 78-102.

[10] Banerjee, N., Stearns, E., Moller, S., & Mickelson, R. A. (2017). Teacher job satisfaction and student achievement: The roles of teacher professional community and teacher collaboration in schools. *American Journal of Education, 123,* 1-39.

[11] Barone, C. (2006). Cultural capital, ambition and the explanation of inequalities in learning outcomes: a comparative analysis. *Sociology, 40,* 1039–1058.

[12] Bass, B.M. & Avolio, B.J. (Eds.). (1994). *Improving organizational effectiveness through transformational leadership.* Thousand Oaks, CA: Sage Publications.

[13] Beare, H., Caldwell, B., & Millikan, R. (1992). *Creating an Excellent School.* London: Routledge.

[14] Bell, L., Bolam, R., & Cubillo, L. (2003). *A systematic review of the impact of school head teachers and principals on student outcomes.* London, UK: EPPI-Centre, Social Science Research Unit, Institute of Education.

[15] Bernstein, B. (1970). Education cannot compensate for society. *New Society, 15,* 344-347.

[16] Bigoness, W. J., & Blakely, G. L. (1996). A cross-national study of managerial values. *Journal of International Business Studies, 27,* 739-748.

[17] Black, J., & Porter, L. (1991). "Managerial behavior and job performance: A Successful Manager in Los Angeles May Not Succeed in Hong Kong." *Journal of International Business Studies, 22,* 99-114.

[18] Blanden, J., & Gregg, P. (2004). Family income and educational attainment: A review of approaches and evidence for Britain. *Oxford Review of Economic Policy, 20*, 245-263.

[19] Blase, J. (1999). "Ineffective instructional leadership and its effects on classroom teaching". manuscript in preparation.

[20] Blendinger, J., & Snipes, G. (1996). Managerial Behavior of a First-Year Principal.

[21] Blendinger, J., Ariratana, W., & Jones, L. (2000, November). Field investigation of on-the-job behavior of an elementary school principal. *Paper presented at the annual meeting of the Mid-South Educational Research Association, Bowling Green, KY.* (ERIC Document Reproduction Service No. ED 452 604).

[22] Bliese, P. D. (2000). An introduction to multilevel modeling techniques. *Personnel Psychology, 53,* 1062.

[23] Bliese, P. D., & Ployhart, R. E. (2002). Growth modeling using random coefficient models: Model building, testing, and illustrations. *Organizational Research Methods, 5,* 362-387.

[24] Bobeth-Neumann, W. (2014). *Karriere » Grundschulleitung «: Über den Einfluss des Geschlechts beim beruflichen Aufstieg ins Schulleitungsamt* (Vol. 31). transcript Verlag.

[25] Bogler, R. (2001). The influence of leadership style on teacher job satisfaction. *Educational Administration Quarterly, 37,* 662-683.

[26] Bol, T., Witschge, J., Van de Werfhorst, H. G., & Dronkers, J. (2014). Curricular tracking and central examinations: Counterbalancing the impact of social background on student achievement in 36 countries. *Social Forces, 92,* 1545-1572.

[27] Bollen, K. A. (1990). *Structural Equations with Latent Variables.* Manhattan, Hoboken , NM: Wiley.

[28] Bolman, L. G., & Deal, T. E.(1991). *Reforming organizations: Artistry, choice, and leadership.* San Franciso, CA:Jssey-Bass.

[29] Bonsen, M., Bos, W., & Rolff, H. G. (2008). Zur Fusion von Schuleffektiväts-und Schulentwicklungsforschung. *Jahrbuch der Schulentwicklung, 15,* 11-39.

[30] Borman, G. D., & Rachuba, L. T. (2001). *Academic success among poor and minority students: An analysis of competing models of school effects.* Baltimore, MD: Johns Hopkins University, Center for Research on the Education of Students Placed At Risk. Retrieved from http://eric.ed.gov/?id=ED45128.

[31] Bosker, R. J., & Scheerens, J. (1989). Issues in the interpretation of the results of school effectiveness research. *International Journal of Educational Research, 13,* 741–751.

[32] Branch, G. F., Hanushek, E. A., & Rivkin, S. G. (2013). School leaders matter. *Education Next, 13,* 62-69.

[33] Brauckmann, S., & Schwarz, A. (2015). No time to manage? The trade-off between relevant tasks and actual priorities of school leaders in Germany. *International Journal of Educational Management, 29,* 749-765.

[34] Brookover, W. (1978). Elementary school social climate and school achievement. *American Educational Research Journal, 15,* 301-318.

[35] Brookover, W. B., & Lezotte, L. W. (1979). *Changes in school characteristics coincident with changes in student achievement* (Occasional Paper No 17). East Lansing: Michigan State University, East Lansing Institute for Research in Teaching. (ERIC Document Reproduction Service No ED 181 005).

[36] Brookover, W., Beady, C., Flood, P., Schweitzer, J., & Wisenbaker, J. (1977). *Schools can make a difference.* Washington, DC: National Institute of Education. (ERIC Document Reproduction Service No ED 145 034).

[37] Brown, Timothy. (2015). *Confirmatory factor analysis for applied research.* The Guilford Press.

[38] Buchen, H., & Rolff, H. G. (2013). *Professionswissen Schulleitung.* Bad Langensalza : Beltz.

[39] Burns, J.M. (1978) *Leadership.* New York. Harper & Row.

[40] Bush, T., D. Glover, and A. Harris. 2007. *Review of school leadership development.* Nottingham, UK: National College for School Leadership.

[41] Buttram, J. L., Mead, H., Loftus, D., & Wilson, J. O. (2008). Allocation of school leaders time. In *Annual Meeting of American Educational Research Association. Nueva York .*

[42] Campbell, J. C., Webster D., Koziol-McLain J., Block, C., Campbell, D., Curry, M., Gary, F.,

[43] Campbell, R.F. & Faber, C. (1961), Administrative behavior: Theory and research. *Review of Educational Research, 31,* 353-367.

[44] Caro, D. H., & Lenkeit, J. (2012). An analytical approach to study educational inequalities: 10 hypothesis tests in PIRLS 2006. *International Journal of Research & Method in Education, 35,* 3–30. doi:10.1080/1743727X.2012.666718.

[45] Carroll, J. B. (1963). A model of school learning. T*eachers College Record, 64,* 723-733.

[46] Cattaneo, M. A., Oggenfuss, C., & Wolter, S. C. (2017). The more, the better? The impact of instructional time on student performance. *Education Economics, 25,* 433-445.

[47] Chang, I. H. (2011). A study of the relationships between distributed leadership, teacher academic optimism and student achievement in Taiwanese elementary schools. *School Leadership & Management, 31,* 491-515.

[48] Chen, M. J., & Yang, N. Hs. (2011). The Planning of Principal Training Curriculum in Elementary and Middle Schools. *Education Policy Forum, 14,* 143-180.

[49] Cheng, T. F. (2013). A Meta-Study on the Relationships between Organizational Behavior of Elementary Schools and Students' Learning Performance Nearly a Decade Year in Taiwan Chinese Taipei. *Advances in Education, 3,* 73-79.

[50] Cheng, Y. C. (1994). Principal's Leadership as a Critical Factor for School Performance: Evidence from Multi‐Levels of Primary Schools 1. *School Effectiveness and School Improvement, 5,* 299-317.

[51] Cheng, Y. C. (1996b). *The pursuit of school effectiveness: Research, management and policy.* Hong Kong: Chinese University of Hong Kong, Hong Kong Institute of Educational Research.

[52] Chou, C., & Ching, G. (2012). *Taiwan Chinese Taipei education at the crossroad: When globalization meets localization.* Springer.

[53] Christensen, G., & Stanat, P. (2007). Language policies and practices for helping immigrants and second-generation students succeed. *The Transatlantic Taskforce on Immigration and Integration, Migration Policy Institute (MPI) and Bertelsmann Stiftung .*

[54] Codianni, A. V., & Wilbur, G. (1983). *More effective schooling from research to practice.* New York: Clearing House and Urban Education.

[55] Coleman, J. S. (1973). Inequality: A Reassessment of the Effect of Family and Schooling in America. *American Journal of Sociology, 78,* 1523-1544.

[56] Coleman, J. S., Campbell, E. Q., Hobson, C. J., McPartland, J., Mood, A. M., Weinfeld, F. D., York, R. L. (1966). *Equality of Educational Opportunity.* Washington, D.C.: U.S. Government

Printing Office.

[57] Comer, J. P., & Haynes, N. M. (1991). Parent involvement in schools: An ecological approach. *The Elementary School Journal, 91,* 271-277.

[58] Connell, J. P., & Tanaka, J. S. (1988). Introduction to the special section on structural equation modeling. *Annual Progress in Child Psychiatry and Child Development,* 1988, 197.

[59] Cook, E. R., Meko, D. M., Stahle, D. W., & Cleaveland, M. K. (1999). Drought reconstructions for the continental United States. *Journal of Climate, 12,* 1145-1162.

[60] Creemers, B. P. M. (1991). *Effectieve instructie. Een empirische bijdrage aan de verbetering van het onderwijs in de klas.* Den Haag: SVO.

[61] Creemers, B. P. M. (2002). From School Effectiveness and School Improvement to Effective School Improvement: Background, Theoretical Analysis, and Outline of the Empirical Study. *Educational Research and Evaluation, 8,* 343–362.

[62] Creemers, B. P. M., & Kyriakides, L. (2010). School Factors Explaining Achievement on Cognitive and Affective Outcomes: Establishing a Dynamic Model of Educational Effectiveness. *Scandinavian Journal of Educational Research, 54,* 263–294.

[63] Creemers, B. P. M., & Kyriakides, L. (2010). Using the Dynamic Model to develop an evidence-based and theory-driven approach to school improvement. *Irish Educational Studies, 29,* 5-23.

[64] Creemers, B. P. M., & Schaveling, J. (1985). *Verhoging van onderwijseffectiviteit [Improving educational effectiveness].* The Hagure: WRR.

[65] Creemers, B. P. M., Stoll, L., Reezigt, G., & the ESI Team. (2007). Effective school improvement –ingredients for success: The results of an international comparative study of best practice case studies. In T. Townsend (Ed.), *International handbook of school effectiveness and improvement* (pp. 825-838). Dordrecht: Springer.

[66] Creemers, B.P.M. (1996). The goals of school effectiveness and school improvement. In D. Reynolds, R. Bollen, B. Creemers, D. Hopkins, L. Stoll, & N. Lagerweij, *Making good schools* (pp. 21-35). London/New York: Routledge.

[67] Cuban L 1988. *The Managerial Imperative and the Practice of Leadership in Schools.* Albany, NY: State University of New York Press.

[68] Curran, P. J. (2003). Have multilevel models been structural equation models all along?. *Multivariate Behavioral Research, 38,* 529-569.

[69] Darling-Hammond, L. (2000). Teacher Quality and Student Achievement: A Review of State Policy Evidence. *Education Policy Analysis Archives, 1,* 1-44.

[70] Darling-Hammond, L., LaPointe, M., Meyerson, D., Orr, M. T., & Cohen, C. (2007). Preparing School Leaders for a Changing World: Lessons from Exemplary Leadership Development Programs. School Leadership Study. Final Report. *Stanford Educational Leadership Institute.*

[71] Darling-Hammond, L., Meyerson, D., LaPointe, M., & Orr, M. T. (2009). *Preparing principals for a changing world: Lessons from effective school leadership programs.* John Wiley & Sons. Ross

[72] Day, C. (2007). Sustaining success in challenging contexts: Leadership in English schools. In C. Day & K. Leithwood (Eds)., *Successful Principal Leadership in Times of Change* (pp. 59-70). Dordrecht: Springer.

[73] Day, C., Gu, Q., & Sammons, P. (2016). The impact of leadership on student outcomes: How successful school leaders use transformational and instructional strategies to make a difference.

Educational Administration Quarterly, 52, 221-258.

[74] Day, C., Harris, A., & Hadfield, M. (2001). Grounding knowledge of schools in stakeholder realities: A multi-perspective study of effective school leaders. *School leadership & management, 21*, 19-42.

[75] Diamond, J. B., & Spillane, J. P. (2016). School leadership and management from a distributed perspective: A 2016 retrospective and prospective. *Management in Education, 30,* 147-154.

[76] Ditton, H. (2000). Qualitätskontrolle und Qualitätssicherung in Schule und Unterricht. Ein Überblick zum Stand der empirischen Forschung: 73-92.

[77] Doppler, K., & Lauterburg, C. (2008). *Change management: den Unternehmenswandel gestalten.* Campus Verlag.

[78] Dubinsky, A. J., Yammarino, F. J., Jolson, M. A., & Spangler, W. D. (1995). Transformational leadership: An initial investigation in sales management. *Journal of Personal Selling & Sales Management, 15,* 17-31.

[79] Earley, P., & Weindling, D. (2004). *Understanding school leadership.* New York: SAGE.

[80] Eberts, R. W., & Stone, J. A. (1988). Student achievement in public schools: Do principals make a difference?. *Economics of Education Review, 7,* 291-299.

[81] Eddy-Spicer, D., Bubb, S., Earley, P., Crawford, M., & James, C. (2017). Head teacher performance management in England: Balancing internal and external accountability through performance leadership. *Educational Management Administration & Leadership*, 1-19.

[82] Edmonds, R. (1979). Effective Schools for the Urban Poor. *Education Leadership, 37,* 15-24.

[83] Elliott, J. (1996). School effectiveness research and its critics: Alternative visions of schooling. *Cambridge Journal of Education, 26,* 199-224.

[84] Elliott, S. N., & Clifford, M. (2014). *Principal assessment: Leadership behaviors known to influence schools and the learning of all students.* Retrieved from University of Florida, Collaboration for Effective Educator, Development, Accountability, and Reform Center http://ceedar. education.ufl. edu/tools/literature-syntheses.

[85] Elmore, R. F., Peterson, P. L., & McCarthey, S. J. (1996). *Restructuring in the classroom: Teaching, learning, and school organization.* San Francisco: Jossey-Bass Inc..

[86] Erikson, R., & Jonsson, J. O. (1996). Explaining class inequality in education: The Swedish test case. *Can Education Be Equalized,* 1-63.

[87] Erikson, R., & Jonsson, J. O. (Eds.). (1996). *Can education be equalized?: The Swedish case in comparative perspective.* Westview Press.

[88] Euen, B., Wendt, H., Bos. W. (2012). Germany. In I.V.S. Mullis, M.O. Martin, C.A. Minnich, G.M. Stanco, A. Arora, V.A.S. Centurino & C.E. Castle (Eds.), *TIMSS 2011 Encyclopedia: Education Policy and Curriculum in Mathematics and Science, 1, 2, 313–340.* Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College. Retrieved from http://timssandpirls.bc.edu/timss2011/downloads/TIMSS2011_Enc-v1.pdf

[89] Eurydice Network (2013). Germany. Eurypedia – European Encyclopedia on National Education Systems, 22 November. Retrieved (10/05/2014) from: https:// webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php?title=Germany:Over view&oldid=90931.

[90] Evans, L. (1999). *Managing to Motivate: A Guide for School Leaders.* London: Cassell.

[91] Everard, K. B., Morris, G., & Wilson, I. (2004). *Effective School Management.* New York: SAGE.

[92] Feldhoff, T., Huber, S. G., & Rolff, H. G. (2010). Steering groups as designers of school

development processes/Steuergruppen als Gestalter von Schulentwicklungsprozessen. *Journal for Educational Research Online, 2,* 98-124.

[93] Fend, H. (1986). „Gute Schulen–schlechte Schulen ". Die einzelne Schule als pädagogische Handlungseinheit. *Die Deutsche Schule, 78,* 275-293.

[94] Fend, H. (2006a): *Geschichte des Bildungswesens: Der Sonderweg im europäischen Kulturraum.* Wiesbaden: VS Verlag für Sozialwissenschaften.

[95] Fend, H. (2006b): *Neue Theorie der Schule: Eine Einführung in das Verstehen von Bildungssystemen.* Wiesbaden: VS Verlag für Sozialwissenschaften.

[96] Fend, H. (2008): *Schule gestalten: Systemsteuerung, Schulentwicklung und Unterrichtsqualität.* Wiesbaden: Verlag für Sozialwissenschaften.

[97] Finn, J. D., & Voelkl, K. E. (1993). School characteristics related to student engagement. *The Journal of Negro Education, 62,* 249-268.

[98] Firestone, W. A., & Wilson, B. L. (1985). Using bureaucratic and cultural linkages to improve instruction: The principal's contribution. *Educational Administration Quarterly, 21,* 7-30.

[99] Flores, S. M., & Horn, C. L. (2009). College persistence among undocumented students at a selective public university: A quantitative case study analysis. *Journal of College Student Retention: Research, Theory & Practice, 11,* 57-76.

[100] Frederick, J. M. (1987). *Measuring school effectiveness: Guidelines for educational practioners.* Princeton: ERIC Clearinghouse on Tests, Measurement, and Evaluation. (ERIC Document Reproduction Service No. ED 282 891).

[101] Freiberg, H.J., Driscoll, A., & Knights, S. (1999). *School Climate.* Bloomington, IN. Phi Delta Kappa.

[102] Fuchs, T., & Wößmann, L. (2008). What accounts for international differences in student prformance? A re-examination using PISA data. In *The economics of education and training* (pp. 209-240). Physica-Verlag HD.

[103] Geiser, C. (2012). *Data analysis with Mplus.* Guilford Press.

[104] Glaser, D., & Hastings, R. H. (2011). An introduction to multilevel modeling for anesthesiologists. *Anesthesia & Analgesia, 113,* 877-887.

[105] Glass, N., MacFarlane, J., Sachs, C., Sharps, P., Ulrich, Y., Wilt, S., Marganello, J., Xu, X., Schollenberger, J., Frye, V., and Laughon, K. (2003). "Risk Factors for Femicide in Abusive Relationships: Results From a Multi-Site Case Control Study." *American Journal of Public Health, 93,* 1089–1097.

[106] Glenn, N. D. (1975). Psychological well-being in the postparental stage: Some evidence from national surveys. *Journal of Marriage and the Family, 37,* 105-110.

[107] Glewwe, P., & Jacoby, H. (1994). Student achievement and schooling choice in low-income countries: Evidence from Ghana. *Journal of Human Resources, 29,* 843-864.

[108] Glickman, C. D., Gordon, S. P., & Ross-Gordon, J. M. (1995). *Supervision of instruction* (3rd ed.). Needham Heights, MA: Simon & Schuster.

[109] Goldring, E. B., & Pasternack, R. (1994). Principals' Coordinating Strategies and School Effectiveness 1. *School Effectiveness and School Improvement, 5,* 239–253.

[110] Goldstein, H. (1997). Methods in school effectiveness research. *School Effectiveness and School Improvement, 8,* 369-95.

[111] Gomolla, M. (2005). *Schulentwicklung in der Einwanderungsgesellschaft. Strategien gegen:*

institutionelle Diskriminierung in England, Deutschland und in der Schweiz. Münster et al.: Waxmann-Verlag.

[112]   Gomolla, M., & Radtke, F. O. (2009). *Institutionelle Diskriminierung: Die Herstellung ethnischer Differenz in der Schule.* VS Verlag, Wiesbaden.

[113]   Griffith, J. (1999). The school leadership/school climate relation: Identification of school configurations associated with change in principals. *Educational Administration Quarterly, 35,* 267-291.

[114]   Grissom, J. A., Loeb, S., & Master, B. (2013). Effective instructional time use for school leaders longitudinal evidence from observations of principals. *Educational Researcher, 42,* 433–444.

[115]   Gruenert, S. (2008). School culture, school climate: They are not the same thing. *Principal Arlington, 87,* 56.

[116]   Gröhlich, C., Scharenberg, K., & Bos, W. (2009). Wirkt sich Leistungsheterogenität in Schulklassen auf den individuellen Lernerfolg in der Sekundarstufe aus?. *Journal for Educational Research Online, 1,* 86-105.

[117]   Guba, E. G., & Lincoln, Y.S. (1989). *Fourth generation evaluation.* Newbury Park, CA: Sage.

[118]   Gunter, H. M., & Forrester, G. (2009). School leadership and education policy-making in England. *Policy Studies, 30,* 495-511.

[119]   Gunter, H. M., & Forrester, G. (2009). Institutionalised governance: The case of the National College for school leadership. *International Journal of Public Administration, 32,* 349–369.

[120]   Hailbronner, K. (2010). Country Report: Germany. *Country Reports, 45-58.*

[121]   Halasz, G., Santiago, P., Ekholm, M., Matthews, P., & McKenzie, P. (2004). Attracting, Developing and Retaining Effective Teachers: Country Note: Germany. Retrieved from https://www.oecd.org/germany/33732207.pdf

[122]   Halle, T., Kurtz-Costes, B., & Mahoney, J. (1997). Family influences on school achievement in low-income, African American children. *Journal of Educational Psychology, 89,* 527–537.

[123]   Hallinan, M. T. (Ed.). (2006). *Handbook of the Sociology of Education.* Dordrecht, Netherland: Springer Science & Business Media.

[124]   Hallinger, P. (2005). Instructional leadership and the school principal: A passing fancy that refuses to fade away. *Leadership and Policy in Schools, 4,* 221-239.

[125]   Hallinger, P. (2011). Leadership for learning: Lessons from 40 years of empirical research. *Journal of Educational Administration, 49,* 125-142.

[126]   Hallinger, P. (2014). Reviewing Reviews of Research in Educational Leadership. *Educational Administration Quarterly, 50,* 539–576.

[127]   Hallinger, P. (Ed.). (2005). *Reshaping the landscape of school leadership development: A global perspective.* CRC Press.

[128]   Hallinger, P., & Heck, R. H. (1996). Reassessing the principal's role in school effectiveness: A review empirical research, 1980-1995. *Education Administration Quarterly, 32,* 5-44.

[129]   Hallinger, P., & Heck, R. H. (1998). Exploring the principal's contribution to school effectiveness: 1980‐1995. *School Effectiveness and School Improvement, 9,* 157–191.

[130]   Hallinger, P., & Huber, S. (2012). School leadership that makes a difference: international perspectives. *School Effectiveness and School Improvement, 23,* 359-367.

[131]   Hancock, G. R. (1997). Structural equation modeling methods of hypothesis testing of latent variable means. *Measurement and Evaluation in Counseling and Development, 30,* 91.

[132]   Hancock, G. R., & Mueller, R. O. (Eds.). (2013). *Structural equation modeling: A second course.* Iap.

[133]   Hanson, E. M. (2003). *Educational administration and organizational behavior.* San Francisco: Allyn and Bacon.

[134]   Harris, A. (2003). Teacher leadership as distributed leadership: heresy, fantasy or possibility?. *School Leadership & Management, 23,* 313-324.

[135]   Harris, A., & Chapman, C. (2004). Democratic leadership for school improvement in challenging contexts. *Democratic Learning: The challenge to school effectiveness,* 164-178.

[136]   Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement.* New York: Routledge.

[137]   Hau, K. T., & Marsh, H. W. (2004). The use of item parcels in structural equation modelling: Non‐normal data and small sample sizes. *British Journal of Mathematical and Statistical Psychology, 57,* 327-351.

[138]   Haveman, R., & Wolfe, B. (1995). The determinants of children's attainments: A review of methods and findings. J*ournal of Economic Literature, 33,* 1829–1878.

[139]   Hay, I., Ashman, A., & Kraayenoord, C. E. (1997). Investigating the influence of achievement on self-concept using an intra-class design and a comparison of the PASS and SDQ-1 self-concept tests. *British Journal of Educational Psychology, 67,* 311-321.

[140]   Hayduk, L. A. (1987). *Structural equation modeling with LISREL: Essentials and advances.* Jhu Press.

[141]   Heck, R. (1992). Principals' instructional leadership and school performance: Implications for policy development. *Educational Evaluation and Policy Analysis, 14,* 21-34.

[142]   Heck, R. H., & Thomas, S. L. (2015). *An introduction to multilevel modeling techniques: MLM and SEM approaches using Mplus.* Routledge.

[143]   Heck, R. H., Larsen, T. J., & Marcoulides, G. A. (1990). Instructional leadership and school achievement: Validation of a causal model. *Education Administration Quarterly, 26,* 94-125.

[144]   Hernandez, A. S. (2008). School Effectiveness Research: A Review of Criticisms and Some Proposals to Address Them. *Educate~(Special Issue),* 31-44.

[145]   Hindin, A., Morocco, C. C., Mott, E. A., & Aguilar, C. M. (2007). More than just a group: Teacher collaboration and learning in the workplace. *Teachers and Teaching: Theory and Practice, 13,* 349-376.

[146]   Hirsch, E., & Emerick, S. (2007). *Teacher Working Conditions Are Student Learning Conditions: A Report on the 2006 North Carolina Teacher Working Conditions Survey.* Center for Teaching Quality.

[147]   Hirsch, E., Freitas, C., Church, K., & Villar, A. (2008). Massachusetts Teaching, Learning and Leading Survey: Creating school conditions where teachers stay and students thrive. Retrieved from Mass TeT TSwebsite:

[148]   Hofstede, G. (2003). *Culture's consequences: Comparing values, behaviors, institutions and organizations across nations.* Sage publications.

[149]   Holtappels, H. G. (2007). Schulentwicklungsprozesse und Change Management. Innovationstheoretische Reflexionen und Forschungsbefunde über Steuergruppen (School

development processes and change management. Innovation-theoretical reflections and research findings on steering groups). *Schulische Steuergruppen und Change Management (School Steering Groups and Change Management)*, 5-34.

[150]   Holtappels, H. G. (Ed.). (2004). *Schulprogramme-Instrumente der Schulentwicklung: Konzeptionen, Forschungsergebnisse, Praxisempfehlungen*. Thuringia: Beltz Juventa.

[151]   Hopkins, D., & Reynolds, D. (2001). The past, present and future of school improvement: Towards the third age. *British Educational Research Journal, 27,* 459–475.

[152]   Hoppe, K. (1993). Whose life is it, anyway?: Issues of representation in life narrative texts of African women. *The International Journal of African Historical Studies, 26,* 623-636.

[153]   Horn, J. L., & McArdle, J. J. (1992). A practical and theoretical guide to measurement invariance in aging research. *Experimental Aging Research, 18,* 117-144.

[154]   Horng, E. L., Klasik, D., & Loeb, S. (2010). Principal's time use and school effectiveness. *American Journal of Education, 116,* 491-523.

[155]   Horng, E., & Loeb, S. (2010). New thinking about instructional leadership. *Phi Delta Kappan, 92,* 66-69.

[156]   Horstmann, K. T., & Ziegler, M. (2016). Situational Perception: Its Theoretical Foundation, Assessment, and Links to Personality. *In The Wiley Handbook of Personality Assessment.* (pp. 31-43).

[157]   House, R. J., Hanges, P. J., Javidan, M., Dorfman, P. W., & Gupta, V. (Eds.). (2004). *Culture, leadership, and organizations: The GLOBE study of 62 societies.* Sage publications.

[158]   Houtveen, A. A. M., Booy, N., de Jong, R. . R., & van de Grift, W. J. C. M. (1999). Adaptive instruction and pupil achievement. *School Effectiveness and School Improvement, 10,* 172 - 192.

[159]   Hox, J. J., & Bechger, T. M. (1998). An introduction to structural equation modeling. *Family Science Review, 11,* 354-373.

[160]   Hoy, W. K., & Hannum, J. W. (1997). Middle school climate: An empirical assessment of organizational health and student achievement. E*ducational Administration Quarterly, 33,* 290-311.

[161]   Hoy, W. K., & Sweetland, S. R. (2000). School bureaucracies that work: Enabling, not coercive. J*ournal of School Leadership, 10,* 525-541.

[162]   Hoy, W. K., & Tarter, C. J. (2004). Organizational justice in schools: No justice without trust. *International Journal of Educational Management, 18,* 250-259.

[163]   Hsieh, C. C., & Lee, F. J. (2009). The study of relationships between innovative management and school effectiveness in elementary school in Taoyuan County, Hsinchu County, Hsinchu City and Miaoli County : An application of Structural Equation Modeling. *Taiwan Chinese Taipei Education Research Conference,* 1-19.

[164]   Huber S.G. (2005). Schulbegleitforschung - internationale Erfahrungen [School leadership research - international experiences]. In E. Eckert (Ed.), *Schulbegleitforschung. Erwartungen-Ergebnisse-Wirkungen* [Research on schools. Expectations - results - effects] (pp. 41-74). Münster: Waxmann.

[165]   Huber, S. G. (2003). School leader development: Current trends from a global perspective. *Reshaping the Landscape of School Leadership Development: a global perspective,* 273-288.

[166]   Huber, S. G. (2004). *Preparing school leaders for the 21st century.* CRC Press.

[167]   Huber, S. G. (2004). School leadership and leadership development: Adjusting leadership

theories and development programs to values and the core purpose of school. *Journal of Educational Administration, 42,* 669-684.

[168]   Huber, S. G. (2013). Multiple learning approaches in the professional development of school leaders–Theoretical perspectives and empirical findings on self-assessment and feedback. *Educational Management Administration & Leadership, 41,* 527-540.

[169]   Huber, S. G. (2015). Germany: The School Leadership Research Base in Germany. *A Decade of Research on School Principals: Cases from 24 Countries, 21,* 375.

[170]   Huber, S. G. (2016). Germany: The School Leadership Research Base in Germany. *In A Decade of Research on School Principals* (pp. 375-401).   Springer International Publishing.

[171]   Huber, S. G. (Ed.). (2009). *School leadership-international perspectives* (Vol. 10). Springer Science & Business Media.

[172]   Huber, S. G., & Gördel, B. (2006). Quality assurance in the German school system. *European Educational Research Journal, 5,* 196-209.

[173]   Huber, S., Tulowitzki, P., & Hameyer, U. (2017). School leadership and curriculum: German perspectives. *Leadership and Policy in Schools, 16,* 272-302.

[174]   Isac, M. M., Maslowski, R., & van der Werf, G. (2011). Effective civic education: an educational effectiveness model for explaining students' civic knowledge. *School Effectiveness and School Improvement, 22,* 313-333.

[175]   Jencks, C., & Mayer, S. E. (1990). The social consequences of growing up in a poor neighborhood. *Inner-city poverty in the United States, 111,* 186.

[176]   Jencks, Christopher, Marshall Smith, Henry Ackland, Mary Jo Bane, David Cohen, Herbert Gintis, Barbara Heyns, and Stephan Michelson. (1972). In *equality: A Reassessment of the Effects of Family and Schooling in America.* New York: Basic Books.

[177]   Johansson, O., & Bredeson, P. V. (2000). Research on principals: Future perspectives and what's missing. *REKTOR–EN FORSKNINGSÖVERSIKT 2000-2010,* 295.

[178]   Jung, T., & Wickrama, K. A. S. (2008). An introduction to latent class growth analysis and growth mixture modeling. *Social and Personality Psychology Compass, 2,* 302-317.

[179]   Jöreskog, K. G. & Sörbom, D.(1979). *Advances in factor analysis and structural equation models.* Cambridge, MA: Abt Books.

[180]   Jöreskog, K. G. (1971b). Statistical analysis of sets of congeneric test. *Psychometrika, 36,* 109-133.

[181]   Jöstingmeier, B., & Boeddrich, H. J. (2007). *Cross-Cultural Innovation.* Oldenbourg Wissenschaftsverlag..

[182]   Kane, T. J., Taylor, E. S., Tyler, J. H., & Wooten, A. L. (2011). Identifying effective classroom practices using student achievement data. J. *Human Resources, 46,* 587-613.

[183]   Klein, H. E. (2007). Neue Wege zum Erfolg. Schulen brauchen Führungshandeln–Schulleiter brauchen Führungsmittel. *Schulmanagement, 2,* 13-15.

[184]   Klein, H. E. (2008). Was Schulleiter als Führungskräfte brauchen: Eine Bestandsaufnahme von Aufgaben, Kompetenzprofilen und Qualifizierungen von Schulleitern in den Ländern der Bundesrepublik Deutschland. Köln: Institut der deutschen Wirtschaft. Online verfügbar unter http://www.schule-wirtschaft-hamburg.de/service/downloads/SW_Schulleiterstudie_Juni_2008_0 1. pdf, zuletzt geprüft am, 2, 2012.

[185]   Klieme, E. (2013). The role of large-scale assessments in research on educational

effectiveness and school development. *In The role of international large-scale assessments: Perspectives from technology, economy, and educational research* (pp. 115-147). Springer, Dordrecht.

[186]   Klieme, E., N. Fischer, H. G. Holtappels, T. Rauschenbach, & L. Stecher. (2010b). *Ganztagsschule-Entwicklung und Wirkungen.* Frankfurt a. M.: DIPF.

[187]   Kober, N. (2001) *It takes more than testing: Closing the achievement gap.* A Report of the Center on Education Policy. Washington D.C. (ERIC Reproduction Service Number ED454358).

[188]   Kristen, C. (2008). Primary school choice and ethnic school segregation in German elementary schools. *European Sociological Review, 24,* 495-510.

[189]   Kyriakides, L., & Creemers, B. P. (2008). Using a multidimensional approach to measure the impact of classroom-level factors upon student achievement: A study testing the validity of the dynamic model. *School Effectiveness and School Improvement, 19,* 183-205.

[190]   Kyriakides, L., Georgiou, M. P., Creemers, B. P., Panayiotou, A., & Reynolds, D. (2017). The impact of national educational policies on student achievement: A European study. *School Effectiveness and School Improvement,* 1-33.

[191]   Ladd, H. (2009). *Teachers' perceptions of their working conditions: How predictive of policy-relevant outcomes.* National Center for Analysis of Longitudinal Data in Education Research Working Paper 33. Washington, DC: CALDER.

[192]   Lee, C. M. (2003). Justice, Caring and discipline- A case study on moral life and moral atmosphere of an elementary school. *Bulletin of Civic and Moral Education, 13,* 21-46.

[193]   Lee, M., & Hallinger, P. (2012). National contexts influencing principals' time use and allocation: Economic development, societal culture, and educational system. *School Effectiveness and School Improvement, 23,* 461–482.

[194]   Lee, S. Y. (2007). *Structural equation modeling: A Bayesian approach* (Vol. 711). Hoboken, NM: John Wiley & Sons.

[195]   Leithwood, K. A., Jantzi, D., & Steinbach, R. (1999). *Changing leadership for changing times.* Buckingham, UK: Open University Press.

[196]   Leithwood, K., & Jantzi, D. (2008). Linking leadership to student learning: The contributions of leader efficacy. *Educational Administration Quarterly, 44,* 496-528.

[197]   Leithwood, K., & Menzies, T. (1998). Forms and effects of school-based management: A review. *Educational Policy, 12,* 325-346.

[198]   Leithwood, K., & Montgomery, D. (1982). The role of the elementary principal in program improvement. *Review of Educational Research, 52,* 309-339

[199]   Leithwood, K., Begley, P., & Cousins, B. (1992). *Developing expert leaders for future schools.* Bristol, PA: Falmer.

[200]   Leithwood, K., Day, C., Sammons, P., Harris, A., & Hopkins, D. (2006). *Seven strong claims about successful school leadership.* Retrieved from Leadership Innovations Team website: www .leadershipinnovationsteam.com/files/seven-strong-claims.pdf

[201]   Leithwood, K., Louis, K.S., Anderson, S., & Wahlstrom, K. (2004). *How leadership influences student learning.* New York: The Wallace Foundation.

[202]   Leitner, D. (1994). Do principals affect student outcomes? An organizational perspective. *School Effectiveness and School Improvement, 5,* 219–239.

[203]   LeTendre, G. K., Hofer, B. K., & Shimizu, H. (2003). What is tracking? Cultural

expectations in the United States, Germany, and Japan. *American Educational Research Journal, 40,* 43-89.

[204]   Levels M., Dronkers J., Kraaykamp G. (2008). Immigrant children's educational achievement in Western countries: origin, destination, and community effects on mathematical performance. Am. Sociol. Rev. 73, 835–853. 10.1177/000312240807300507.

[205]   Levine, D U., & Lezotte, L W. (1990). *Unusually Effective Schools: A Review and Analysis of Research and Practice.* Madison, WI, National Centre for Effective Schools Research and Development.

[206]   Lewin, K. (1936). *Principles of Topological Psychology.* New York ‑ London. New York: McGraw Hill.

[207]   Lezotte, L. (1991). *Correlates of effective schools: The first and second generation.* Okemos, MI: Effective Schools Products, Ltd.

[208]   Li, C. H. (2014). *The performance of MLR, USLMV, and WLSMV estimation in structural regression models with ordinal variables* (Doctoral dissertation, Michigan State University).

[209]   Li, D. (2012). *School accountability and principal mobility: how no child left behind affects the allocation of school leaders.* Unpublished manuscript.

[210]   Li, L. J., Hallinger, P., & Walker, A. (2016). Exploring the mediating effects of trust on principal leadership and teacher professional learning in Hong Kong primary schools. *Educational Management Administration & Leadership, 44,* 20–42.

[211]   Littrell, P., Billingsley, B., & Cross, L. (1994). The effects of principal support on special and general educators' stress, job satisfaction, school commitment, health, and intent to stay in teaching. *Remedial and Special Education, 15,* 297-310.

[212]   Liu, S., Wang, M., Bamberger, P., Shi, J., & Bacharach, S. B. (2015). The dark side of socialization: A longitudinal investigation of newcomer alcohol use. *Academy of Management Journal, 58,* 334-355.

[213]   Liu, Y., Wang, M., Chang, C. H., Shi, J., Zhou, L., & Shao, R. (2015). Work–family conflict, emotional exhaustion, and displaced aggression toward others: The moderating roles of workplace interpersonal conflict and perceived managerial family support. *Journal of Applied Psychology, 100,* 793.

[214]   Lo, Y., Mendell, N. R., & Rubin, D. B. (2001). Testing the number of components in a normal mixture. *Biometrika, 88,* 767-778.

[215]   Lohmar, B., & Eckhardt, T. (2014). The Education System in the Federal Republic of Germany 2012/2013: A Description of the Responsibilities, Structures and Developments in Education Policy for the Exchange of Information in Europe. In Bonn: Secretariat of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany.

[216]   Louis, K. S., Leithwood, K., Wahlstrom, K. L., Anderson, S. E., Michlin, M., & Mascall, B. (2010). Learning from leadership: Investigating the links to improved student learning. *Center for Applied Research and Educational Improvement/University of Minnesota and Ontario Institute for Studies in Education/University of Toronto, 42,* 50.

[217]   Louis, S. K., Dretzke, B., & Wahlstrom, K. (2010). How does leadership affect student achievement? Results from a national US survey. *School Effectiveness and School Improvement, 21,* 315-336.

[218]   Loukas, A., & Robinson, S. (2004). Examining the moderating role of perceived school climate in early adolescent adjustment. *Journal of Research on Adolescence, 14,* 209-233.

[219]   Lumby, J., Crow, G. M., & Pashiardis, P. (Eds.). (2009). *International handbook on the preparation and development of school leaders.* Abingdon, UK: Routledge.

[220]   Lunenburg, F. C. (2011). Leadership versus management: A key distinction—at least in theory. *International Journal of Management, Business, and Administration, 14,* 1-4.

[221]   Maciel, R.G. (2005). *Do principals make a difference? An analysis of leadership behaviors of elementary principals in effective schools.* University of Texas-Pan American.

[222]   MacNeil, A. J., Prater, D. L., & Busch, S. (2009). The effects of school culture and climate on student achievement. *International Journal of Leadership in Education, 12,* 73-84.

[223]   Madaus, G. F., Scriven, M., & Stufflebeam, D. L. (1983). *Evaluation models.* Boston: Kluwer-Nijhoff.

[224]   Magnuson, K. (2007). Maternal education and children's academic achievement during middle childhood. *Developmental Psychology, 43,* 1497–1512.

[225]   March, J. G. (1978). American public school administration: A short analysis. *The School Review, 86,* 217-250.

[226]   Marks, G. N., Cresswell, J., & Ainley, J. (2006). Explaining socioeconomic inequalities in student achievement: The role of home and school factors. *Educational research and Evaluation, 12,* 105-128.

[227]   Marks, H. M., & Printy, S. M. (2003). Principal leadership and school performance: An integration of transformational and instructional leadership. *Educational administration quarterly, 39,* 370-397.

[228]   Marsh, H. W., Köller, O., & Baumert, J. (2001). Reunification of East and West German school systems: Longitudinal multilevel modeling study of the big-fish-little-pond effect on academic self-concept. *American Educational Research Journal, 38,* 321-350.

[229]   Marzano, R. J., Waters, T., & McNulty, B. A. (2005). *School Leadership that Works: From Research to Results.* Association for Supervision and Curriculum Development.

[230]   May, H., & Supovitz, J. A. (2011). The scope of principal efforts to improve instruction. *Educational Administration Quarterly, 47,* 332-352.

[231]   Mayeske, G. W., Cohen, W. M., Wisler, C. E., Okada, T., Beaton, A. E., Jr., Proshek, J. M., Weinfell, F. F., & Tabler, K. A. (1973). *A Study of Our Nation's Schools.* Washington, D. C.: U. S. Government Printing Office.

[232]   McColumn, B. R. (2010). Principals' leadership styles and their impact on school climate: Assistant principals' perceptions. *Electronic Theses & Dissertations.* 393.

[233]   Merkens, H. (Ed.). (2007). Erziehungswissenschaft und Bildungsforschung. Springer-Verlag.

[234]   Miller, R. T., Murnane, R. J., & Willett, J. B. (2008). Do teacher absences impact student achievement? Longitudinal evidence from one urban school district. *Educational Evaluation and Policy Analysis, 30,* 181-200.

[235]   Mohammadpour, E., & Abdul Ghafar, M. N. (2014). Mathematics achievement as a function of within-and between-school differences. *Scandinavian Journal of Educational Research, 58,* 189-221.

[236]   Montt, G. (2011). Cross-national differences in educational achievement inequality. *Sociology of Education, 84,* 49-68.

[237]   Mortimore, P., & Whitty, G. (2000). 10 Can School Improvement Overcome the Effects of Disadvantage?. In *Combating Educational Disadvantage: Meeting the needs of vulnerable children* (p. 156). Routledge.

[238]   Mortimore. P., Sammons. P., Stall, L.. Lewis, D., & Ecoh. R. (1988). *School matters: the junior years.* Somerset: Open Books.

[239]   Mulford, B., Silins, H., & Leithwood, K. (2004). *Leadership for organisational learning and student outcomes: A problem-based learning approach.* Dordrecht: Kluwer.

[240]   Mullins, L., & Christy, G. (2010). *Management & Organisational Behaviour.* Pearson Education.

[241]   Muthén, B. (2001). Latent variable mixture modeling. *New developments and techniques in Structural Equation Modeling, 1,* 33.

[242]   Muthén, B. (2010). *Bayesian analysis in Mplus: A brief introduction.* Unpublished manuscript. www. statmodel. com/download/IntroBayesVersion, 203.

[243]   Muthén, L. K., & Muthén, B. O. (1998). *Mplus* [computer software]. Los Angeles, CA: Muthén & Muthén.

[244]   Müller, S., Dedering, K., & Bos, W. (2008). *Schulische Qualitätsanalyse in Nordrhein-Westfalen.* Köln: Luchterhand.

[245]   Nguni, S., Sleegers, P., & Denessen, E. (2006). Transformational and transactional leadership effects on teachers' job satisfaction, organizational commitment, and organizational citizenship behavior in primary schools: The Tanzanian case. *School Effectiveness and School Improvement, 17,* 145-177.

[246]   Norton, M.S. (2008). *Human Resources Administration for Educational Leaders.* New York: Sage.

[247]   Nylund, K. L., Asparouhov, T., & Muthén, B. O. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Structural equation modeling, 14,* 535-569.

[248]   O'Day, J., & Quick, H. E. (2009). Assessing instructional reform in San Diego: A theory-based approach. *Journal of Education for Students Placed at Risk, 14,* 1-16.

[249]   Ogawa, R. T., & Bossert, S. T. (1995). Leadership as an organizational quality. *Educational Administration Quarterly,* 31, 224-243..

[250]   Ouston, J., Maughan, B., & Rutter, M. (1991). Can schools change? II. Practice at six London secondary schools. *School Effectiveness and School Improvement, 2,* 3 – 13.

[251]   Pan, H. L., & Yang, Ch, H. (2013). An Empirical Investigation into organizational learning propelled by principal empowering leadership. *Education Policy Forum, 16,* 67-97.

[252]   Peel, D., & McLachlan, G. J. (2000). Robust mixture modelling using the t distribution. *Statistics and Computing, 10,* 339-348.

[253]   Pepper, K. & Thomas, L. (2001). Making a change: The effects of the leadership role on school climate. *Learning Environments Research, 5,* 155-166.

[254]   Peterson, P. L. (1977). Interactive effects of student anxiety, achievement orientation, and teacher behavior on student achievement and attitude. *Journal of Educational Psychology, 69,* 779-792.

[255]   Peterson, P. L. (1979a). Direct instruction: Effective for what and for whom? *Educational Leadership, 37,* 4648.

[256]   Peterson, P. L. (1979b). Direct instruction reconsidered. In P.L. Peterson & H. J. Walberg (Eds.), *Research on teaching: Concepts, findings and implications*. Berkeley, CA: McCutchan.

[257]   Pietsch, M., & Tulowitzki, P. (2017). Disentangling school leadership and its ties to instructional practices–an empirical comparison of various leadership styles. *School Effectiveness and School Improvement, 28,* 629-649.

[258]   Pont, B., Nusche, D., & Moorman, H. (Eds.) (2008). *Improving School Leadership Volume 1: Policy and Practice*. Paris, France: OECD publishing.

[259]   Popp, U. (2012). Zur biografischen Bedeutung der Schule im Jugendalter– Jugendsoziologische Thesen und Befunde einer qualitativen Studie. *Diskurs Kindheits-und Jugendforschung, 7*(1).

[260]   Portes, A., & Zhou, M. (1993). The new second generation: Segmented assimilation and its variants. *The Annals of the American Academy of Political and Social science, 530,* 74-96.

[261]   Pounder, D. G., Ogawa, R. T., & Adams, E. A. (1995). Leadership as an organization-wide phenomena: Its impact on school performance. *Educational Administration Quarterly, 31,* 564-588.

[262]   Purkey, S., & Smith, M. (1983). Effective schools: a review. *The Elementary School Journal, 83,* 427-452.

[263]   Rajek, B. (1997). *Designing and Implementing Value Focused Effectiveness Indicators*. ERIC ED 409957.

[264]   Ralston, D. A., Holt, D. H., Terpstra, R. H., & Kai-Cheng, Y. (2008). The impact of national culture and economic ideology on managerial work values: A study of the United States, Russia, Japan, and China. *Journal of International Business Studies, 39,* 8-26.

[265]   Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (Vol. 1). New York: Sage.

[266]   Reid, K., Hopkins, D., & Holly, P. (1987). *Towards the effective school: the problems and some solutions*. Basil Blackwell.

[267]   Reynolds, D. (1997). School effectiveness: retrospect and prospect. *Scottish Educational Review, 29,* 97-113.

[268]   Reynolds, D., Sammons, P., De Fraine, B., Townsend, T., & Van Damme, J. (2014). Educational effectiveness research (EER): A state of the art review. *School Effectiveness and School Improvement, 25,* 197-230.

[269]   Reynolds, D., Teddlie, C., Creemers, B. P. M., Scheerens, J., & Townsend, T. (2000). An introduction to school effectiveness research. In D. Reynolds, & C. Teddlie (Eds.), *The International Handbook of School Effectiveness Research* (pp. 3 - 25). London: Falmer.

[270]   Rice, J. K. (2010). Principal Effectiveness and Leadership in an Era of Accountability: What Research Says. Brief 8. *National center for analysis of longitudinal data in education research*.

[271]   Richter, M. M., Lewis, T. J., & Hagar, J. (2012). The relationship between principal leadership skills and school-wide positive behavior support: An exploratory study. *Journal of Positive Behavior Interventions, 14*, 69-77.

[272]   Riedel, A., Schneider, K., Schuchart, C., & Weishaupt, H. (2010). School Choice in German Primary Schools: How Binding are School Districts? 1/Schulwahl in deutschen Grundschulen: Wie verbindlich sind Schulbezirke?. *Journal for Educational Research Online, 2,* 94.

[273]   Rolff, H. G. (2014). Professionelle Lerngemeinschaften als Königsweg von

Unterrichtsentwicklung. Schulentwicklung und Schulwirksamkeit als Forschungsfeld. *Theorieansätze und Forschungserkenntnisse zum schulischen Wandel,* 195-217.

[274]   Rolff, H. G. (Ed.). (2015). *Handbuch Unterrichtsentwicklung.* beltz Verlag.

[275]   Rosenbusch, H. S. (2005). *Organisationspädagogik der Schule.* Grundlagen pädagogischen Führungshandelns. München, Neuwied: Luchterhand.

[276]   Ross, J. A., & Gray, P. (2006). School leadership and student achievement: The mediating effects of teacher beliefs. *Canadian Journal of Education,* 798-822.

[277]   Roth, P. L., Switzer III, F. S., & Switzer, D. M. (1999). Missing data in multiple item scales: A Monte Carlo analysis of missing data techniques. *Organizational Research Methods, 2,* 211-232.

[278]   Rowan, B. (1990). Commitment and control: Alternative strategies for the organizational design of schools. *Review of Research in Education, 16,* 353-389

[279]   Rutter, M. (1982). *Fifteen thousand hours: Secondary schools and their effects on children.* Cambridge: Harvard University Press.

[280]   Rutter, M., & Maughan, B. (2002). School effectiveness findings 1979–2002. *Journal of School Psychology, 40,* 451–475.

[281]   Sagor, R. D. (1992). Three principals who make a difference. *Educational leadership, 49,* 13-18.

[282]   Sammons, P., Hillman, J., & Mortimore, P. (1995). *Key characteristics of effective schools: A review of school effectiveness research.* London: OFSTED.

[283]   Sammons, P., Gu, Q., Day, C., & Ko, J. (2011). Exploring the impact of school leadership on pupil outcomes: Results from a study of academically improved and effective schools in England. *International Journal of Educational Management, 25,* 83-101.

[284]   Scheerens, J. & Bosker, R. (1997). *The Foundations of Educational Effectiveness ,* Oxford: Pergamon.

[285]   Scheerens, J. (1990). School effectiveness research and the development of process indicators of school functioning. *School Effectiveness and School Improvement, 1*(1), 61-80.

[286]   Scheerens, J. (1992). *Effective Schooling: Research, Theory and Practice.* London: Cassell.

[287]   Scheerens, J. (2013). The use of theory in school effectiveness research revisited. *School Effectiveness and School Improvement, 24,* 1–38.

[288]   Scheerens, J., & Creemers, B. P. M. (1996). School effectiveness in the Netherlands: The modest influence of a research programme. *School Effectiveness and School Improvement, 7,* 181–195.

[289]   Scheerens, J., & Creemers. B. P. M. (1989). Conceptualizing school effectiveness. *International Journal of Educational Research, 13,* 691-706.

[290]   Scheerens, J., & Creemers. B. P. M. (1994). Developments in the educational effectiveness research programme. *International Journal of Educational Research, 21,* 125-140.

[291]   Scheerens, J., & Demeuse, M. (2005). The theoretical basis of the effective school improvement model (ESI). *School Effectiveness and School Improvement, 16,* 373–385.

[292]   Schmitt, N., Pulakos, E. D., & Lieblein, A. (1984). Comparison of three techniques to assess group-level beta and gamma change. *Applied Psychological Measurement, 8,* 249-260.

[293]   Schnellenbach, J. (2007). Public entrepreneurship and the economics of reform. *Journal of Institutional Economics, 3*, 183-202.

[294]   Schratz, M. (2003). From administering to leading a school: Challenges in German-speaking countries. *Cambridge Journal of Education, 33,* 395-416.

[295]   Schunck, R., & Windzio, M. (2009). Ökonomische Selbstständigkeit von Migranten in Deutschland: Effekte der sozialen Einbettung in Nachbarschaft und Haushalt/Self-Employment of Immigrants in Germany: Effects of Social Embeddedness within Neighborhood and Household. *Zeitschrift für Soziologie, 38,* 113-130.

[296]   Seidel, T. (2008). Stichwort: Schuleffektivitätskriterien in der internationalen empirischen Forschung. *Zeitschrift für Erziehungswissenschaft, 11,* 348-367.

[297]   Sergiovanni, T. J. (2001). *Leadership: What's in it for Schools?.* Psychology Press.

[298]   Shindler, J., Jones, A., Williams, A. D., Taylor, C., & Cardenas, H. (2016). The school climate-student achievement connection: If we want achievement gains, we need to begin by improving the climate. *Journal of School Administration Research and Development, 1,* 9-16.

[299]   Shouse, R. C., & Lin, K. P. (2010). *Principal leadership in Taiwan schools.* Maryland: Rowman & Littlefield Publishers.

[300]   Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research, 75,* 417–453.

[301]   Slater, R.O., & Teddlie, C. (1992). Toward a theory of school effectiveness and leadership. *School Effectiveness and School Improvement, 3,* 247–257.

[302]   Sliwka, A. (2010). From homogeneity to diversity in German education. *Educational Research and Innovation,* 205-217.

[303]   Smith, S. C., & Piele, P. K. (Eds.). (2006). *School leadership: Handbook for excellence in student learning.* Corwin Press.

[304]   Smith, W. F., & Andrews, R. L. (1989). *Instructional leadership: How principals make a difference.* Alexandria, VA: Association for Supervision and Curriculum Development.

[305]   Southworth, G. (2008). Primary school leadership today and tomorrow. *School Leadership and Management, 28,* 413-434.

[306]   Stanat, P., & Christensen, G. (2006). *Where immigrant students succeed: A comparative review of performance and engagement in PISA 2003.* Paris, France: OECD publishing.

[307]   Steenbergen, M. R., & Jones, B. S. (2002). Modeling multilevel data structures. A*merican Journal of Political Science, 46,* 218-237.

[308]   Steiger, J. H. (1990). Structural model evaluation and modification: An interval estimation approach. *Multivariate Behavioral Research, 25,* 173-180.

[309]   Stringfield, S.C. and Slavin, R.E. (1992). A hierarchical longitudinal model for elementary school effects. In B.P.M. Creemers and G.J. Reezigt (eds.). *Evaluation of Educational Effectiveness.* Groningen: ICO.

[310]   Supovitz, J., Sirinides, P., & May, H. (2010). How principals and peers influence teaching and learning. *Educational Administration Quarterly, 46,* 31-56.

[311]   Sörbom, D. (1974). A general method for studying differences in factor means and factor structure between groups. *British Journal of Mathematical and Statistical Psychology, 27,* 229-239.

[312]   Tabachnick, B. G., Fidell, L. S., & Osterlind, S. J. (2001). *Using multivariate statistics.* Needham Heights, MA: Allyn & Bacon, Inc.

[313]   Teddlie, C., & Reynolds, D. (2001). Countering the critics: Responses to recent critics of

school effectiveness research. *School Effectiveness and School Improvement. 12,* 41-82.

[314]   Teltemann, J., & Schunck, R. (2016). Education systems, school segregation, and second-generation immigrants' educational success: Evidence from a country-fixed effects approach using three waves of PISA. *International Journal of Comparative Sociology, 57,* 401-424.

[315]   Tett, R. P., Jackson, D. N., & Rothstein, M. (1991). Personality measures as predictors of job performance: a meta‐analytic review. *Personnel Psychology, 44,* 703-742.

[316]   Thompson, B., & Melancon, J. G. (1996). Using Item "Testlets"/ "Parcels" in Confirmatory Factor Analysis: An Example Using the PPSDQ-78.

[317]   Thoonen, E. E., Sleegers, P. J., Oort, F. J., Peetsma, T. T., & Geijsel, F. P. (2011). How to improve teaching practices: The role of teacher motivation, organizational factors, and leadership practices. *Educational Administration Quarterly, 47,* 496-536.

[318]   Townsend, T. (Ed.). (2007). *International handbook of school effectiveness and improvement: Review, reflection and reframing* (Vol. 17). Springer Science & Business Media.

[319]   Townsend, T., & MacBeath, J. (2011). International handbook of leadership for learning. *Spring International Handbooks of Education, 25,* 1-1344.

[320]   Tsai, C. H. (2006). A study of ideal follower's behavior from the principals' viewpoint. *Journal of Educational Research and Development,* 2, 151-170.

[321]   Van de Grift, W. (1990). Educational leadership and academic achievement in elementary education. *School Effectiveness and School Improvement, 1,* 26-40.

[322]   Van de Vijver, F. J., & Leung, K. (1997). *Methods and data analysis for cross-cultural research* (Vol. 1). Sage.

[323]   Van de Werfhorst, H. G., & Mijs, J. J. (2010). Achievement inequality and the institutional structure of educational systems: A comparative perspective. *Annual Review of Sociology, 36,* 407-428.

[324]   Van Houtte, M., & van Maele, D. (2011). The black box revelation: In search of conceptual clarity regarding climate and culture in school effectiveness research. *Oxford Review of Education, 37,* 505–524.

[325]   Wang, J. C., & Wang, X. Q. (2012). *Structural Equation Modelling.* Beijing: High Education Press.

[326]   Wang, M., Burlacu, G., Truxillo, D., James, K., & Yao, X. (2015). Age differences in feedback reactions: The roles of employee feedback orientation on social awareness and utility. *Journal of Applied Psychology, 100,* 1296.

[327]   Wasserberg, M. (1999), Creating the vision and making it happen, in Tomlinson, H., Gunter, H. and Smith, P. (Eds.). *Living Headship: Voices, Values and Vision.* London, Paul Chapman.

[328]   Wertsch, J. V., & Tulviste, P. (1992). LS Vygotsky and contemporary developmental psychology. *Developmental psychology, 28,* 548.

[329]   Westerbeek, K. (1999). *The Colour of My Classmates. A Study into the Effect of the Ethnic Composition of Classrooms on the Achievement of Pupils from Different Ethnic Background.* (Rotterdam, CED).

[330]   Whitaker, C. D. C. H. P., Day, C. W., Hall, C., & Whitaker, M. P. (1998). *Developing Leadership in Primary Schools.* New York: Sage.

[331]   Wilkins, A., 2012. Public battles and private takeovers: academies and the politics of

educational governance. *Journal of Pedagogy, 3,* 11–29.

[332]   Wilmore, E. L. (2002). *Principal leadership: Applying the new educational leadership constituent council (ELCC) standards.* New York: Corwin Press.

[333]   Wimpelberg, R. K., Teddlie, C., & Stringfield, S. (1989). Sensitivity to context: The past and future of effective schools research. *Educational Administration Quarterly, 25,* 82-107.

[334]   Witziers, B., Bosker, R. J., & Krüger, M. (2003). Educational leadership and student achievement: The elusive search for an association. *Educational Administration Quarterly, 39,* 398–425.

[335]   Wohlstetter, P., Datnow, A., & Park, V. (2008). Creating a system for data driven decision making: Applying the principal-agent framework. *School Effectiveness and School Improvement, 19,* 239-259.

[336]   Wolff, H. G., & Preising, K. (2005). Exploring item and higher order factor structure with the Schmid-Leiman solution: Syntax codes for SPSS and SAS. *Behavior Research Methods, 37,* 48-58.

[337]   Wu, Y. T. & C.C. Tsai. (2005). Effects of constructivist oriented instruction on elementary school students' cognitive structures. *Journal of Biological Education, 39,* 113-119.
www. masstells. org/sites/default/files/attachments/finalreport. pdf.

[338]   Young, D. Y. (1998). Rural and urban in student achievement in science and mathematics: A multilevel analysis. *School Effectiveness and School Improvement, 9,* 386-418.

[339]   Yu le, G. (2005). *Leadership in organizations,* 5th edn, Upper Saddle River, NJ: Pretice-Hall International.

[340]   陳慧芬. (2015). 國民小學校長文化領導與學校效能關係之研究. *教育理論與實踐學刊,* 31: 63-94.

[341]   陳木金, & 李冠嫻. (2009). 台灣中小學校長專業發展與校長培訓改革芻議 (Prospects for Principal Profession Development and Preparation Training Reform for Elementary and Secondary School in Chinese Taipei)，刊載於國立台北教育大學舉辦「2009 年兩岸三地校長學學術研討會：校長專業之建構」論文集, 127-143.

[342]   陳木金. (2009). 我國國民小學校長儲訓模式的回顧與展望 (Reviews and Prospects for Principal Preparation Training Model for Elementary School in Chinese Taipei). *學校行政雙月刊,* 60, 98-120.

[343]   陳順利, 何憲昌, 陳金祝, 曾淑玉, 吳宗成, & 黃照恩. (2006). 以分析階層程序法 (AHP) 建構國小校長甄選辦法成績指標的權重體系之初探-以第 102 期國小校長儲訓班的實作為例. *學校行政,* 45, 185-204.

[344]   陳幸仁, & 許惠茹. (2011). 教師情緒政治之探究：台灣一所國民中學之個案研究. *教育學報,* 39, 157–182.

[345]   陳雅新. (2003). 國民小學校長領導能力現況之研究 (The leadership competences of elementary school principals). 國立暨南國際大學教育政策與行政研究所碩士學位論文. 1-180.

[346]   陳瑜沂. (2006). 台北縣市國民小學校長專業知能與學校創新經營關係之研究 (The Study of Relationship between the Principals' Professional Competence and School Innovative Management of Elementary Schools in Taipei City and County). 國立臺北教育大學國民教育學系碩士班學位論文, 1-199.

[347]   陳宗民. (2009). 國民中小學校長遴選制度之探討—以苗栗縣為例. 玄奘大學公共事務

管理學系 98 學年度碩士在職專班論文計畫書, 1-72.

[348]   戴振浩. (2001). 國民小學男女校長領導特質與學校效能影響之研究 (A study of the Elementary School Man and Woman Principals' Leadership Traits and School Effectiveness). 國立臺北教育大學國民教育研究所學位論文, 1-211.

[349]   董素芬. (2002). 社會變遷中的教師角色--台灣國小教師角色期望變化之研究 (The Teacher's Role in the Changing Society : A Study on the Change of the Teacher's Role-Expectation of Elementary School Teachers in Chinese Taipei). 臺灣師範大學教育學系學位論文, 1-242.

[350]   范熾文. (2001). 國小校長領導行為, 教師組織承諾與學校組織績效之研究 (A Study of the Relationships Among Principals' Leadership Behavior, Teacher's Organizational Commitment, and School's Organizational Performance in Elementary Schools). 臺灣師範大學教育學系學位論文, 1-438.

[351]   范熾文. (2004). 國小校長轉型、互易領導與學校組織績效之研究 (A Study of the Relationship Between Principal's transformational、transactional Leadership and School Organizational Performance in Elementary Schools). 花蓮師范学报, 19, 21-40.

[352]   郭明德. (2002). 現階段教育改革中, 校長角色的定位與因應策略. 研習資訊, 19, 62-75.

[353]   郭小蘋, & 吳勁甫. (2011). 台灣地區近年來校長教學領導與教師教學效能學位論文研究走向之分析. 嘉大教育研究學刊, 27, 1-27.

[354]   侯杰泰, 溫忠麟, & 成子娟. (2004). 结构方程模型及其应用 (Structural Equation Model and Its Application). 北京：教育科学出版社.

[355]   侯世昌. (2001). 國民小學家長教育期望, 參與學校教育與學校效能之研究 (The study of school effectiveness, parental expectancy and involvement in elementary schooling). 臺灣師範大學教育學系學位論文, 1-390.

[356]   黃淑馨. (1997). 學校成為學習型組織之發展策略與具體作為. 教育研究月刊, 57, 55-60.

[357]   簡惠敏, & 高家斌. (2007). 提升學校效能之具體策略-學習型學校的觀點. 教育資料與研究雙月刊, 79, 155-168.

[358]   江文雄. (2004). 教育行政與管理評鑑的回顧與前瞻———一位教育行政老兵的見證與省思. 教育資料集刊, 29, 272-291.

[359]   江志正. (2000). 國民小學團體動力、組織學習、學校發展策略與學校效能關係之研究 (A study on the relationships among the group dynamic, organizational leraning, development strategy and effectivendess of elementary schools). 國立高雄師範大學教育研究所博士論文, 未出版, 高雄市.

[360]   柯仲甫. (2010). 澎湖縣國民小學校長時間運用與管理之研究 (Research on Penghu Elementary School Principals' Time utilization and management) .國立臺中教育大學教育學系教育行政與管理碩士在職專班碩士論文.

[361]   李耿嘉. (2015). 中小學校長的職責與角色. 臺灣教育評論月刊, 4, 99-105.

[362]   李新鄉. (2010). 學校經營-中小學文化整合觀點. 載於楊國賜主編, 新世紀的教育學概論: 科際整合導向.

[363]   李永吟, 張新仁, 潘慧玲, & 許殷宏. (1999). 國民小學學校效能縱貫研究. 教育研究資訊, 1, 1-25.

[364]   李咏吟. (1998). 認知教學: 理論與策略. 臺北: 心理出版社.

[365]   廖裕月. (1997). 國小校長轉化領導型式與領導效能之研究:以北部四縣市為例 (The study of principals" transformational leadership styles and leadership effectiveness in the

elementary schools:take four countries of North Chinese Taipei as examples). 國立臺北教育大學國民教育研究所學位論文.

[366]　　林錦杏. (2000). 國民小學校長專業成長需求之研究 (A Study on the Essential Competencies and Needs for Professional Development of Primary School Principals). 國立臺北教育大學國民教育研究所學位論文, 1-180.

[367]　　林進材. (2001). 教學效能研究的取向、典範及趨勢之探析 (Approch、Paradigm and New Trend in Teacher Effectiveness Research). *國立台南師範學院初等教育學報*, 14, 105-135.

[368]　　林明地. (2001). 校長領導的影響：近三十年來研究結果的分析 (The Impact of Principal Leadership: An Analysis of the Research Findings, 1970-1990). 國家科學委員會研究彙刊：人文及社會科學, 10, 232-254.

[369]　　林淑貞. (2004). 組織變革中國民小學校長變革領導行為之研究-以中部四縣市為例 (A Study of Principals'Change Leadership Behavior in the Organization Change of Elementary Schools Selected from four Counties in Central Chinese Taipei). 臺中師範學院國民教育研究所碩士學位論文, 1-240.

[370]　　林天佑.(2000).　教育行政革新. 臺北市：心理出版社.

[371]　　林宇. (2011). 台湾公立中小学候用校长遴选考试制度探析 (Select Examination System about Mothball Public Primary and Middle School Principals in Chinese Taipei). *河北师范大学学报: 教育科学版*, 13, 37-40.

[372]　　林政逸. (2006). 國民小學校長職前培育制度之建構 (The Construction of the Pre-service Preparation System of Elementary School Principal). *國民教育研究集刊*, 15, 65-89.

[373]　　劉春榮. (1994). 國民小學組織結構、組織承諾與學校效能關係之研究 (A study on the relationships between organizational structure 、 organizational commitment and school effectiveness in elementary school). 國立政治大學教育研究所博士論文，未出版 (unpublished), 臺北市.

[374]　　劉妙真. (2005).　我國師資培育之現況與檢討. *學校行政*, 39, 201-212.

[375]　　劉世閔. (2006). 批判台灣師資培育市場化所面臨的議題及其競爭力. *教育研究月刊*,141, 99-113.

[376]　　潘慧玲. (1999). 學校效能研究領域的發展 (The Development of School Effectiveness Research Area). *教育研究集刊*, 43, 77-102.

[377]　　秦慧嫻. (2001). 國民小學校長專業發展需求及其因應策略以台北市為例. 國立臺北教育大學國民教育研究所學位論文, 1-197.

[378]　　秦夢群. (2006). 教育行政: 實務部分. 五南圖書出版股份有限公司.

[379]　　秦夢群. (2007). 校長培育制度之趨勢分析：以英, 美及新加坡為例 (Administrative Preparation of Principals: Issues and Perspectives in USA, Great Britain, and Singapore). *學校行政*, 51, 1-18.

[380]　　茹金崑, & 許美雲. (2007).　我國國民小學校長培育制度之探討. *研習資訊*, 24, 121-132.

[381]　　孙河川, 马笑颜, & 何万里. (2006). 中德教育督导比较研究及其启示. *教育前沿*, 5, 040.

[382]　　孫敏芝, 吳宗立, & 林官蓓. (2012). 中小學校長培訓與評鑑制度之跨國研究：以臺灣, 新加坡, 韓國為例 (A Cross-National Study of Preparation and Evaluation of Principals in Elementary and Middle Schools— Cases in Chinese Taipei, Singapore and South Korea). 屏东：國立屏東教育大學出版.

[383]　　谈松华. (2004). 试行效能评价. *中国远程教育*, 04X, 68-68.

[384] 譚以敬. (2003). 兩岸教育視導制度之比較分析. *教育資料與研究, 55*, 86-92.

[385] 王琳. (2010). 中德教育督导制度对比研究. 投资与合作: 学术版, 9, 77-77.

[386] 王升. (2006). 计量经济学导论. 北京：清华大学出版社有限公司.

[387] 王宗平. (2003). 國小校長教學領導對初任教師專業成長影響之個案研究 (Elementary School Principal Instruction Leadership to Beginning Teacher's Professional Development Case Study). 國立臺北教育大學國民教育研究所學位論文, 1-237.

[388] 温恒福.(2007). 学校效能的基本理论问题探讨.*教育研究, 2*, 56-60.

[389] 吳財順. (2004). 國民中小學校長遴選制度之研究― 以臺北縣與新竹市為例 (A Study on the Principal Selection of Public Junior High and Elementary School at Taipei County and Hsin Chun City). 國立臺北教育大學教育政策與管理研究所學位論文, 1-329.

[390] 吳明雄. (2001). 國民小學校長轉型領導行為與學校效能之研究 (A Study Between Elementary School Principals' Transformational Leadership and School Effectiveness in Hsinchu County). 臺中師範學院/國民教育研究所碩士論文, 未出版 (unpublished).

[391] 吳清山. (1998). 學校效能研究. 台北:五南圖書出版股份有限公司.

[392] 吳武典. (2004). 台灣教育改革的經驗與分析. 論文發表於香港教育學院舉辦之 [第一屆香港校長研討會(The 1st Hong Kong School Principals' Conference 2004)], 香港.

[393] 蕭佳純, 董旭英, & 黃宗顯. (2009). 少子化現象對國小教育發展之影響及其因應對策 (The Proper Strategies for Influences of Few-Generating on the Development of Elementary School Education). *臺中教育大學學報: 教育類, 23*, 25-47.

[394] 謝文全. (1997). 教育行政―理論與實務 (十二版). 台北: 文景書局.

[395] 葉川榮, & 謝佳蓁. (2013). 淺談學校組織文化中校長與教師權責角色之關係-代理理論的觀點. *臺灣教育評論月刊, 2*, 80-87.

[396] 葉春櫻. (2001). 國民中小學校長專業發展之研究-以桃竹苗四縣市為例 (The Study of Professional Developments for Principals of Elementary and Secondary School in Tao Yuan, Shin Chu and Miaoli Counties). *國立臺北教育大學學報, 18*, 101-130.

[397] 葉連祺. (2008). 不同類別評量者對國小校長領導能力知覺評量之比較 (A Comparison of the Assessments of Elementary School Principals' Leadership Competence by Different Types of Evaluators). *師大學報: 教育類*.

[398] 尹纳宇. (2014). 台湾地区教育督导的机构设置及职能. *教育导刊, 6*, 49-52.

[399] 張德銳. (2010). 喚醒沈睡的巨人-論教師領導在我國中小學的發展. *臺北市立教育大學學報. 教育類, 41*, 81-110.

[400] 張芳全, & 林惠玲. (2009). 我國近十年來學校效能學位論文後設分析 (A Meta-analysis of the Theses on School Effectiveness in Chinese Taipei during the Past Decade). 台灣教育學術研討會. 國立新竹教育大學.

[401] 張紀遠. (2009). 台灣與大陸地區教育視導制度之比較研究 (A Comparative Study on Educational Supervision System between Chinese Taipei and Mainland China). 國立暨南國際大學碩士學位論文, 1-158.

[402] 張慶勳. (2004). 國小校長領導風格與行為之研究 (Leadership Style and Behavior in Elementary School Principals). *屏東師院學報第二十, 1-38*.

[403] 張昭仁. (2000). 國小校長轉型領導, 互易領導與學校組織學習能力關係之研究 (A Study of the Relationships among Principals' Transformational Leadership, Transactional Leadership and the Capacity for Organizational Learning in Elementary Schools). 臺灣師範大學教育學系學位論文, 1-370.

[404]　郑彩凤. (2010). 学校组织行为与学生学习表现关系之探讨：以台湾近十年"国民小学学校效能"研究主题之硕博士论文资料为基础 (A Study on the Relationships between Organizational Behavior of Elementary Schools and Students' Learning Performance: Based on the Research of "School Effectiveness" in the Electronic Theses and Dissertations system in Chinese Taipei Nearly a Decade Year). 上海教育科學研究院「2010年海峽兩岸中小學教育學術研討會—基於學生發展的學校教育與變革論文集」，57-75.

[405]　鄭嘉麟. (2007). 領導風格與領導效能之研究 (Relationships of Leadership Styles and Effectiveness). 國立中山大學人力資源管理研究所碩士學位論文. 1-80.

[406]　鄭文實. (2007). 國小組織氣氛, 教師自我效能感與專業評鑑意願之相關研究. 未出版碩士論文 (unpublished), 國立臺東大學, 臺東市.

[407]　仲秀蓮. (2004). 臺北縣市國民小學校長正向思考, 領導型式與學校效能關係之研究 (The relationship among the Elementary School Principal''s positive thinking, leadership style and school effectiveness in Taipei County and City). 國立臺北教育大學教育政策與管理研究所學位論文, 1-312.

[408]　周崇儒. (1997). 國民小學教師專業成長、組織承諾與學校效能關係之研究 （文）: The Relationship of Teachers Professional Growth, Teachers Organizational Commitment and School Effectiveness in Elementary Schools). 台北市立師範學院國民教育研究所碩士論文, 未出版 (unpublished).

[409]　周幸吟. (2002). 中英中小學校長培訓與任用制度之比較研究 (A Comparative Research of the Training and Appointment of Elementary School and Junior High School Principals in Chinese Taipei and Britain). 國立臺北教育大學國民教育研究所學位論文, 1-140.

[410]　周祝瑛. (2012). 台湾地区基础教育阶段的公民教育. *思想前沿 (Study frontier),* 30-33.

Additional websites：

[1]　http://conservancy.umn.edu/bitstream/handle/11299/2102/1/CAREI%20ExecutiveSummary%20How%20Leadership%20Influences.pdf

[2]　http://digitalcommons.liberty.edu/cgi/viewcontent.cgi?article=1750&context=doctoral.

[3]　http://www.eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED 404726.

[4]　http://www.oecd.org/education/school/30100518.pdf

[5]　http://www.reformzeit.de/fileadmin/reformzeit/dokumente/pdf/heterogenitaet_tillmann.pdf[18.10.2011].

[6]　http://www.sici-inspectorates.eu/getattachment/48fbee76-621d-4ec8-a987-110c73d5a392.

[7]　https://www.criticalthinking.org/files/5th_Annual_CTConf-opt.pdf

[8]　http://assets00.grou.ps/0F2E3C/wysiwyg_files/FilesModule/criticalthinkingandwriting/20090921185639-uxlhmlnvedpammxrz/CritThink1.pdf

[9]　http://www.sici-inspectorates.eu/getattachment/48fbee76-621d-4ec8-a987-110c73d5a392.

[10]　https://www.oecd.org/germany/33732207.pdf

[11]　https://lehrkraefteakademie.hessen.de/

[12]　https://www.csee-etuce.org/images/attachments/SchoolLeadershipsurveyEN.pdf

[13]　www.caldercenter.org/upload/CALDER -Research-and-Policy-Brief-8.pdf

[14]　http://files.eric.ed.gov/fulltext/ED389826.pdf

Appendix

Table 1 Main dimensions of SER in Western countries and Chinese Taipei

Researchers	School principals	Executive communications	The goals of teaching	The arrangement of teaching resources and curriculums	School environment and school capitals	the support of communities and parents	Professional development of teachers	The job satisfaction of teachers	Student performance
Codianni & Wilbur (1983)	√	√			√		√		
Levine & Lezotte (1990)	√			√			√		√
Elliot (1996)				√	√		√		√
Rajek (1997)					√			√	√
Chuen-rong Liu (1993)	√	√			√	√	√		√
Xiudong Zhuo (1995)	√	√		√	√	√	√	√	√
Tsay-feng Cheng (2001)	√	√			√	√			√
Shih-chang Hou (2002)	√	√		√	√	√	√	√	√

Hsiu-Lien Chung (2004)	√				√	√		√	√
Hsien-Cheng Lin (2006)	√	√		√		√	√		

Note. The resource is from literature review by the author. (More details, see Chuan-Chung Hsieh & Fang-Ju Lee, 2009)

Table 2 Samples in Germany and Chinese Taipei

	Germany	Chinese Taipei
The number of schools	197	150
The number of students	3960	4138

Table 3 The indicators of school leadership used in the study

Dimensions	*During the past year, approximately how much time have you spent on the following school activities in your role as a school principal?*
Vision/Goal(S1)	Promoting the school's educational vision or goals (015A)
	Developing the school's curricular and educational goals (015B)
	Visiting other schools or attending educational conferences for new ideas (15K)
	Initiating educational projects or improvements (015L)
Management(S2)	Monitoring teachers' implementation of the school's educational goals in their teaching (015C)
	Monitoring students' learning progress to ensure that the school's educational goals are reached (015D)
	Initiating a discussion to help teachers who have problems in the classroom (015I)
	Advising teachers who have questions or problems with their teaching (015J)
Maintain the school climate(S3)	Keeping an orderly atmosphere in the school (015E)
	Ensuring that there are clear rules for student behavior (015F)
	Addressing disruptive student behavior (015G)

Table 4 Means, standard deviations, and frequencies of outcomes, control, and question variables

		Germany (Estimated/S.E)		Chinese Taipei (Estimated/S.E)	
Full sample(students)		3960		4138	
Full sample(schools)		197		150	
outcome variables					
MATH achievement		528.29(61.3)		593.93(72.26)	
student individual level control variables					
AGE		10.37(0.51)		10.24(0.31)	
HB(home background)		4.74(1.92)		4.60(1.44)	
Gender		--		--	
School level variables					
x1					
Category 1	91	46.2%		42	28.0%
Category 2	94	47.7%		107	71.3%
x2					
Category 1	92	46.7%		47	31.3%
Category 2	93	47.2%		101	67.3%
x3					
Category 1	43	21.8%		78	52.0%
Category 2	116	58.9%		71	47.3%
Category 3	27	13.7%		--	--
x4					
Category 1	12	6.1%		70	46.7%
Category 2	129	65.5%		79	52.7%
Category 3	45	22.8%		--	--
x5					
Category 1	32	11.7 %		61	40.7%
Category 2	132	67.0%		88	58.7%
Category 3	29	14.7%		--	--
x6					
Category1	25	12.7%		68	45.3%
Category 2	126	64.0%		81	54.0%
Category 3	33	16.8%			
x7					
Category 1	15	7.6%		92	61.3%
Category 2	122	61.9%		56	37.3%
Category 3	48	24.4%		--	--
x8					

Category 1	10	5.1%	84	56.0%
Category 2	123	62.4%	63	42.0%
Category 3	53	26.9%		
x9				
Category 1	80	40.6%	74	49.3%
Category 2	105	53.3%	75	50.0%
x10				
Category 1	101	51.3%	74	49.4.7%
Category 2	83	42.1%	74	49.3%
x11				
Category 1	95	48.2%	10	10.7%
Category 2	90	45.7%	110	73.3%
Category 3	--	--	22	14.7%

Table 5 Reliability Statistics in Germany and Chinese Taipei

	Case processing summary		
	N	Percent(%)	Cronbach's Alpha
Germany	3665	92.3	0.761
Chinese Taipei	4041	94.9	0.840

Table 6 KMO & Bartlett's Test in Germany and Chinese Taipei

	Kaiser-Meyer-Olkin Measure of Sampling Adequacy	Bartlett's Test of Sphericity Approx. Chi-Square
Germany	0.741	9302.812, sig. 0.000*
Chinese Taipei	0.801	17094.536, sig. 0.000*

Table 7 Percentages of each item in Germany

	No time (Estimated/S.E)	Some time (Estimated/S.E)	A lot of time (Estimated/S.E)
Promoting the school's educational vision or goals	1.03(0.73)	52.79(3.56)	46.17(3.66)
Developing the school's curricular and educational goals	1.94(0.95)	50.49(3.88)	47.57(3.87)
Visiting other schools or attending educational conferences for new ideas	25.5(3.33)	59.28(4.22)	15.21(3.90)
Initiating educational projects or improvements	6.25(2.16)	66.73(4.72)	27.02(4.70)
Monitoring teachers' implementation of the school's educational goals in their teaching	11.94(2.97)	71.61(3.71)	16.44(2.33)
Monitoring students' learning progress to ensure that the school's educational goals are reached	12.90(3.15)	61.75(3.87)	25.35(3.35)
Initiating a discussion to help teachers who have problems in the classroom	8.39(1.55)	64.60(3.44)	27.01(3.39)
Advising teachers who have questions or problems with their teaching	7.27(2.81)	65.02(4.29)	27.71(3.38)
Keeping an orderly atmosphere in the school	2.85(0.81)	36.72(4.07)	60.42(3.13)
Ensuring that there are clear rules for student behavior	3.09(1.18)	45.39(4.28)	51.52(4.29)
Addressing disruptive student behavior	1.29(0.82)	45.57(4.16)	53.14(4.23)

Table 8 Percentages of each item in Chinese Taipei

	No time (Estimated/S.E)	Some time (Estimated/S.E)	A lot of time (Estimated/S.E)
Promoting the school's educational vision or goals	0.26(0.26)	28.76(6.50)	70.98(6.50)
Developing the school's curricular and educational goals	0.00(0.00)	25.89(5.65)	74.11(5.65)
Visiting other schools or attending educational conferences for new ideas	1.09(1.09)	52.64(8.94)	46.27(8.96)
Initiating educational projects or improvements	2.32(1.36)	48.10(6.46)	49.58(6.44)
Monitoring teachers' implementation of the school's educational goals in their teaching	0.13(0.13)	38.17(6.87)	61.70(6.87)
Monitoring students' learning progress to ensure that the school's educational goals are reached	0.85(0.70)	41.50(6.77)	57.65(6.67)
Initiating a discussion to help teachers who have problems in the classroom	1.09(1.09)	52.64(8.94)	46.27(8.96)
Advising teachers who have questions or problems with their teaching	2.32(1.36)	48.10(6.46)	49.58(6.44)
Keeping an orderly atmosphere in the school	2.73(1.71)	61.98(6.30)	35.29(6.30)
Ensuring that there are clear rules for student behavior	7.65(5.16)	58.92(7.05)	33.53(5.61)
Addressing disruptive student behavior	15.48(6.43)	72.56(6.24)	11.96(3.34)

Table 9 Model fit information of CFA in Germany and Chinese Taipei*

Groups	CFI	TLI	RMSEA	90 percent C.I.
Germany	0.867	0.822	0.115	0.110 0.119
Chinese Taipei	0.905	0.876	0.145	0.141 0.149

*Note. * represents the original model that is not modified yet*

Table 10 Model fit information of CFA in Germany and Chinese Taipei

Groups	CFI	TLI	RMSEA	90 percent C.I.
Germany	0.939	0.910	0.08	0.077 0.086
Chinese Taipei	0.951	0.931	0.10	0.106 0.114

Table 11 Factor loadings of the latent variables in Germany

The factor loadings of the latent variables in Germany					
		factor loadings (Estimated/S.E)	P value	factor loadings (Estimated/S.E.)	P value	
Vision/goal (S1)	x1	0.750(0.023)	0.00	0.821(0.025)	0.00	School leadership (SL)
	x2	0.634(0.022)	0.00			
	x3	0.507(0.021)	0.00			
	x4	0.688(0.019)	0.00			
Management (S2)	x5	0.663(0.020)	0.00	0.989(0.001)	0.00	
	x6	0.534(0.020)	0.00			
	x7	0.506 (0.022)	0.00			
	x8	0.571 (0.021)	0.00			
Maintaining school climate (S3)	x9	0.804(0.014)	0.00	0.529(0.020)	0.00	
	x10	0.975(0.013)	0.00			
	x11	0.712(0.016)	0.00			

Note. the variances of the latent variables S1, S2, S3 and SL are 0.595, 0.344, 0.639 and 0.351, while P

=0.00

Table 12 Factor loadings of the latent variables in Chinese Taipei

The factor loadings of the latent variables in Chinese Taipei						
		factor loadings (Estimated/S.E)	P value	factor loadings (Estimated/S.E)	P value	
Vision/goal (S1)	x1	0.512(0.020)	0.00	0.962(0.013)	0.00	School leadership (SL)
	x2	0.634(0.016)	0.00			
	x3	0.785(0.012)	0.00			
	x4	0.741(0.013)	0.00			
Management (S2)	x5	0.735(0.010)	0.00	0.991(0.001)	0.00	
	x6	0.642(0.011)	0.00			
	x7	0.988(0.007)	0.00			
	x8	0.850(0.008)	0.00			
Maintaining school climate (S3)	x9	0.750(0.010)	0.00	0.665(0.014)	0.00	
	x10	0.702(0.009)	0.00			
	x11	0.888(0.015)	0.00			

Note. the variances of the latent variables S1, S2, S3 and SL are 0.269, 0.515, 0.555, and 0.240, while

$p < 0.05$.

Table 13 Proportions of variance that explained by the latent variables in Germany/Chinese Taipei (Percentage)

Germany			Chinese Taipei		
	R-SQUARE (Estimated/S.E)	P value		R-SQUARE (Estimated/S.E)	P value
x1	56.3(3.4)	0.00	x1	26.2(2.0)	0.00
x2	40.2(2.8)	0.00	x2	40.2(2.0)	0.00
x3	44.0(2.7)	0.00	x3	54(1.5)	0.00
x4	28.5(2.2)	0.00	x4	41.3(1.4)	0.00
x5	64.6(2.2)	0.00	x5	56.4(2.5)	0.00
x6	95.1(2.5)	0.00	x6	49.3(2.1)	0.00
x7	50.7(2.2)	0.00	x7	78.9(3.3)	0.00
x8	25.6(2.2)	0.00	x8	97.7(1.4)	0.00
x9	32.6(2.4)	0.00	x9	72.3(1.3)	0.00
x10	25.7(2.1)	0.00	x10	61.6(1.9)	0.00
x11	47.4(2.6)	0.00	x11	54.9(1.9)	0.00
S1	67.4(4.0)	0.00	S1	92.5(2.4)	0.00
S2	97.7(0.1)	0.00	S2	98.1(0.1)	0.00
S3	28.0(2.2)	0.00	S3	44.3(2.1)	0.00

Table 14 Model fit information of configural and metric invariance measurement for the

first-order latent variables

	CFI	TLI	RMSEA	90 percent C.I.
Configurable invariance measurement	0.947	0.911	0.07	0.067 0.073
Metric invariance measurement	0.936	0.902	0.073	0.074 0.080

Table 15 Result of the relationship between overall SL and SMA in Germany

Within Level		
MAT01 ON	Estimated (S.E.)	P value
Gender	0.116(0.023)	0.000
Age	-0.153(0.022)	0.000
Home Background	0.272(0.027)	0.000
Between Level		
S1 BY		
x1	0.931(0.034)	0.000
x2	0.870(0.055)	0.000
x3	0.775(0.072)	0.000
x4	0.878(0.054)	0.000
S2 BY		
x5	0.904(0.047)	0.000
x6	0.812(0.069)	0.000
x7	0.781(0.082)	0.000
x8	0.824(0.068)	0.000
S3 BY		
x9	0.935(0.036)	0.000
x10	0.974(0.026)	0.000
x11	0.897(0.044)	0.000
SL BY		
S1	0.804(0.105)	0.000
S2	0.858(0.114)	0.000
S3	0.589(0.101)	0.000
MAT01 ON		
SL	-0.258(0.121)	0.032

Note. In gender analysis, "1" represented girls, "2" represented boys.

Table 16 Result of the relationship between sub-dimensional SL and SMA in Germany

Within Level		
MAT01 ON	Estimated (S.E.)	P value
Gender	0.116(0.023)	0.000
Age	-0.151(0.022)	0.000
Home Background	0.272(0.027)	0.000
Between Level		
S1 BY		
x1	0.922(0.035)	0.000
x2	0.867(0.056)	0.000
x3	0.779(0.072)	0.000
x4	0.880(0.053)	0.000
S2 BY		
x5	0.887(0.045)	0.000
x6	0.790(0.077)	0.000
x7	0.808(0.072)	0.000
x8	0.845(0.062)	0.000
S3 BY		
x9	0.921(0.041)	0.000
x10	0.975(0.026)	0.000
x11	0.896(0.045)	0.000
SL BY		
S1	0.777(0.102)	0.000
S2	0.868(0.111)	0.000
S3	0.623(0.102)	0.000
MAT01 ON		
S1	-0.495(0.184)	0.007
S2	0.435(0.218)	0.046
S3	-0.291 (0.142)	0.041

Note. In gender analysis,"1" represented girls, "2" represented boys.

Table 17 Result of the relationship between overall SL and SMA in Chinese Taipei

Within Level		
MAT01 ON	Estimated (S.E.)	P value
Gender	-0.005(0.014)	0.734
Age	0.094(0.019)	0.000
Home Background	0.252(0.017)	0.000
Between Level		
S1 BY		
x1	0.870(0.115)	0.000
x2	0.909(0.095)	0.000
x3	0.868(0.084)	0.000
x4	0.892(0.066)	0.000
S2 BY		
x5	0.951(0.046)	0.000
x6	0.892(0.063)	0.000
x7	0.980(0.027)	0.000
x8	0.935(0.047)	0.000
S3 BY		
x9	0.975(0.014)	0.000
x10	0.962(0.021)	0.000
x11	0.917(0.038)	0.000
SL BY		
S1	0.851(0.097)	0.000
S2	0.999(0.001)	0.000
S3	0.573(0.099)	0.000
MAT01 ON		
SL	-0.154(0.120)	0.199

Note. In gender analysis, "1" represented girls, "2" represented boys.

Table 18 Result of the relationship between sub-dimensional SL and SMA in Chinese Taipei

Within Level		
MAT01 ON	Estimated (S.E.)	P value
Gender	-0.005(0.014)	0.734
Age	0.096(0.019)	0.000
Home Background	0.252(0.017)	0.000
Between Level		
S1 BY		
x1	0.880(0.111)	0.000
x2	0.913(0.093)	0.000
x3	0.862(0.088)	0.000
x4	0.892(0.067)	0.000
S2 BY		
x5	0.949(0.044)	0.000
x6	0.892(0.061)	0.000
x7	0.981(0.026)	0.000
x8	0.933(0.047)	0.000
S3 BY		
x9	0.978(0.014)	0.000
x10	0.962(0.021)	0.000
x11	0.911(0.040)	0.000
SL BY		
S1	0.862 (0.136)	0.000
S2	0.985(0.090)	0.000
S3	0.582(0.096)	0.000
MAT01 ON		
S1	0.488 (0.373)	0.192
S2	-0.846 (0.402)	0.035
S3	0.369(0.181)	0.042

Table 19 Latent class analysis of school leadership in Germany

Latent classes	AIC	BIC	a-BIC*	Entropy	LMR	BLRT	Latent classes probability
1	3151.496	3232.140	3152.956	1	--	--	1.00
2	2926.566	3020.112	2928.259	0.787	0.00	0.00	0.36 0.64
3	2871.692	2978.141	2873.619	0.801	0.00	0.00	0.42 0.28 0.30
4	**2836.836**	**2956.189**	**2838.996**	**0.819**	**0.04**	**0.00**	**0.26 0.27 0.07 0.40**
5	2825.445	2957.700	2827.839	0.818	0.05	0.00	0.39 0.21 0.07 0.07 0.25
6	2815.626	2960.784	2818.253	0.766	0.61	0.04	0.23 0.18 0.07 0.08 0.21 0.23

Note. a-BIC refers to the value of adjusted BIC

Table 20 Latent class analysis of school leadership in Chinese Taipei

Latent classes	AIC	BIC	a-BIC*	Entropy	LMR	BLRT	Latent classes probability
1	2283.823	2346.905	2280.446	1	--	--	1.00
2	**1960.100**	**2035.199**	**1965.081**	**0.91**	**0.00**	**0.00**	**0.36 0.64**
3	1925.350	2012.464	1920.687	0.872	0.16	0.00	0.25 0.17 0.59
4	1873.595	1972.725	1868.290	0.847	0.08	0.00	0.29 0.21 0.18 0.31
5	1851.637	1962.783	1845.689	0.850	0.14	0.00	0.20 0.15 0.14 0.20 0.32
6	1846.480	1969.642	1839.889	0.883	0.25	0.03	0.13 0.12 0.13 0.09 0.18 0.36

Note. a-BIC refers to the value of adjusted BIC

Table 21 The probability scales of four latent classes in Germany

	Class 1	Class 2	Class 3	Class 4
x1				
Category 1	0.370 (0.083)	0.178 (0.109)	0.022 (0.029)	0.899 (0.068)
Category 2	0.630 (0.083)	0.822 (0.109)	0.978 (0.029)	0.101 (0.068)
x2				
Category 1	0.447 (0.067)	0.299 (0.096)	0.090 (0.069)	0.822 (0.067)
Category 2	0.553 (0.067)	0.701 (0.096)	0.910 (0.069)	0.178 (0.067)
x3				
Category 1	0.055 (0.021)	0.109 (0.043)	0.003 (0.003)	0.204 (0.048)
Category 2	0.754 (0.040)	0.789 (0.035)	0.174 (0.111)	0.745 (0.041)
Category 3	0.191 (0.045)	0.101 (0.037)	0.823 (0.113)	0.051 (0.021)
x4				
Category 1	0.073 (0.022)	0.126 (0.040)	0.007 (0.005)	0.209 (0.048)
Category 2	0.711 (0.039)	0.743 (0.035)	0.233 (0.118)	0.715 (0.039)
Category 3	0.216 (0.044)	0.131 (0.041)	0.760 (0.122)	0.076 (0.026)
x5				
Category 1	0.019 (0.025)	0.673 (0.082)	0.012 (0.025)	0.625 (0.081)
Category 2	0.981 (0.025)	0.327 (0.082)	0.988 (0.025)	0.375 (0.081)
x6				
Category 1		0.905 (0.062)		0.783 (0.076)
Category 2	1 (0.000)	0.095 (0.062)	1 (0.000)	0.217 (0.076)
x7				
Category 1	0.161 (0.066)	0.711 (0.055)	0.131 (0.106)	0.687 (0.056)
Category 2	0.839 (0.066)	0.289 (0.055)	0.869 (0.106)	0.313 (0.056)
x8				
Category 1	0.034 (0.017)	0.069 (0.026)	0.002 (0.002)	0.134 (0.036)
Category 2	0.612 (0.070)	0.723 (0.048)	0.085 (0.088)	0.754 (0.037)
Category 3	0.354 (0.081)	0.208 (0.059)	0.913 (0.090)	0.112 (0.034)
x9				
Category 1	0.017 (0.009)	0.042 (0.020)		0.097 (0.034)
Category 2	0.560 (0.072)	0.729 (0.064)	0.034 (0.035)	0.796 (0.037)
Category 3	0.423 (0.077)	0.229 (0.075)	0.965 (0.035)	0.107 (0.037)
x10				
Category 1	0.133 (0.046)	0.078 (0.039)	0.021 (0.015)	0.443 (0.094)
Category 2	0.732 (0.052)	0.701 (0.053)	0.450 (0.103)	0.528 (0.08)
Category 3	0.135 (0.036)	0.221 (0.064)	0.529 (0.115)	0.029 (0.019)
x11				
Category 1	0.014 (0.015)	0.006 (0.006)	0.001 (0.001)	0.149 (0.053)
Category 2	0.763 (0.055)	0.574 (0.103)	0.142 (0.103)	0.829 (0.042)

| Category 3 | 0.224 (0.056) | 0.421 (0.104) | 0.857 (0.104) | 0.022 (0.028) |

Table 22 The probability scales of two latent classes in Chinese Taipei

	Class 1	Class 2
x1		
Category 1	0.095 (0.045)	0.385 (0.054)
Category 2	0.905 (0.045)	0.615 (0.054)
x2		
Category 1	0.057 (0.038)	0.464 (0.057)
Category 2	0.943 (0.038)	0.536 (0.057)
x3		
Category 1		0.637 (0.060)
Category 2	1.000 (0.000)	0.363 (0.060)
x4		
Category 1	0.093 (0.042)	0.658 (0.060)
Category 2	0.907 (0.042)	0.342 (0.060)
x5		
Category 1	0.266 (0.074)	0.625 (0.052)
Category 2	0.734 (0.074)	0.375 (0.052)
x6		
Category 1	0.008 (0.005)	0.038 (0.019)
Category 2	0.250 (0.070)	0.596 (0.053)
Category 3	0.743 (0.073)	0.366 (0.054)
x7		
Category 1	0.011 (0.008)	0.160 (0.037)
Category 2	0.625 (0.075)	0.807 (0.039)
Category 3	0.364 (0.078)	0.033 (0.019)
x8		
Category 1	0.095 (0.063)	0.909 (0.037)
Category 2	0.905 (0.063)	0.091 (0.037)
x9		
Category 1	0.135 (0.074)	0.806 (0.043)
Category 2	0.865 (0.074)	0.194 (0.043)
x10		
Category 1	0.142 (0.073)	0.735 (0.046)
Category 2	0.858 (0.073)	0.265 (0.046)
x11		
Category 1	0.143 (0.060)	0.652 (0.051)
Category 2	0.857 (0.060)	0.348 (0.051)

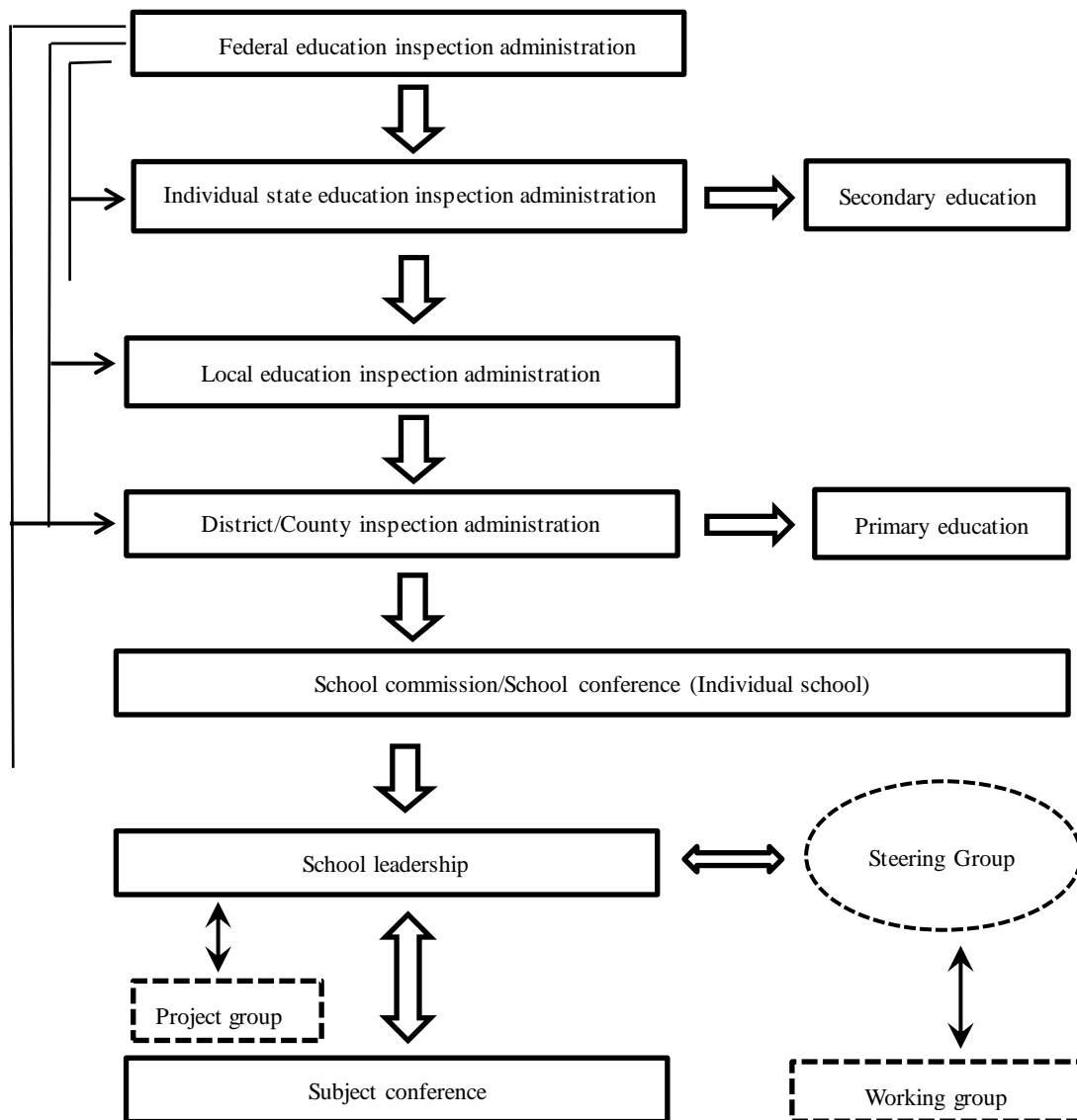**Figure 1 Education inspection administration in Germany**

```
┌──────────────────────────────────────────────────────┐
│     Federal education inspection administration        │
└──────────────────────────────────────────────────────┘
                          ⇩
┌──────────────────────────────────────────────────────┐      ⇨  ┌─────────────────────┐
│  Individual state education inspection administration  │          │ Secondary education │
└──────────────────────────────────────────────────────┘          └─────────────────────┘
                          ⇩
┌──────────────────────────────────────────────────────┐
│        Local education inspection administration        │
└──────────────────────────────────────────────────────┘
                          ⇩
┌──────────────────────────────────────────────────────┐      ⇨  ┌─────────────────────┐
│       District/County inspection administration         │          │  Primary education  │
└──────────────────────────────────────────────────────┘          └─────────────────────┘
                          ⇩
┌──────────────────────────────────────────────────────┐
│  School commission/School conference (Individual school) │
└──────────────────────────────────────────────────────┘
                          ⇩
┌──────────────────────────────────────────────────────┐      ⇔  (  Steering Group  )
│                   School leadership                     │
└──────────────────────────────────────────────────────┘
          ⇕              ⇕                                              ⇕
    ┌ ─ ─ ─ ─ ─ ┐                                            ┌ ─ ─ ─ ─ ─ ─ ─ ┐
    │ Project group │                                        │  Working group  │
    └ ─ ─ ─ ─ ─ ┘                                            └ ─ ─ ─ ─ ─ ─ ─ ┘
┌──────────────────────────────────────────────────────┐
│                  Subject conference                     │
└──────────────────────────────────────────────────────┘
```

Figure 2 Education inspection administration in Chinese Taipei

```
┌─────────────────────────────────┐        ┌──────────────────────────────────┐
│       Education ministry        │  ⇒     │  All kinds of schools except high school │
└─────────────────────────────────┘        └──────────────────────────────────┘
              ⇓
┌─────────────────────────────────────┐   ┌──────────────────┐   ┌───────────────────┐
│ Province/municipal inspection administration │  ⇒  │ Inspection office │  ⇒  │  Coaching group   │
└─────────────────────────────────────┘   └──────────────────┘   └───────────────────┘
              ⇓
┌─────────────────────────────────┐        ┌───────────────────┐
│  County inspection administration │  ⇒     │   Coaching group  │
└─────────────────────────────────┘        └───────────────────┘
```
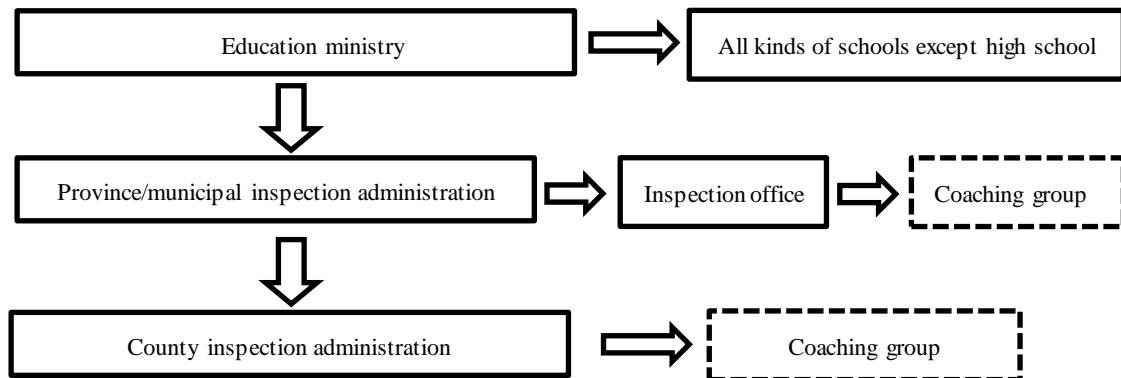
Figure 3 School leadership in German primary school
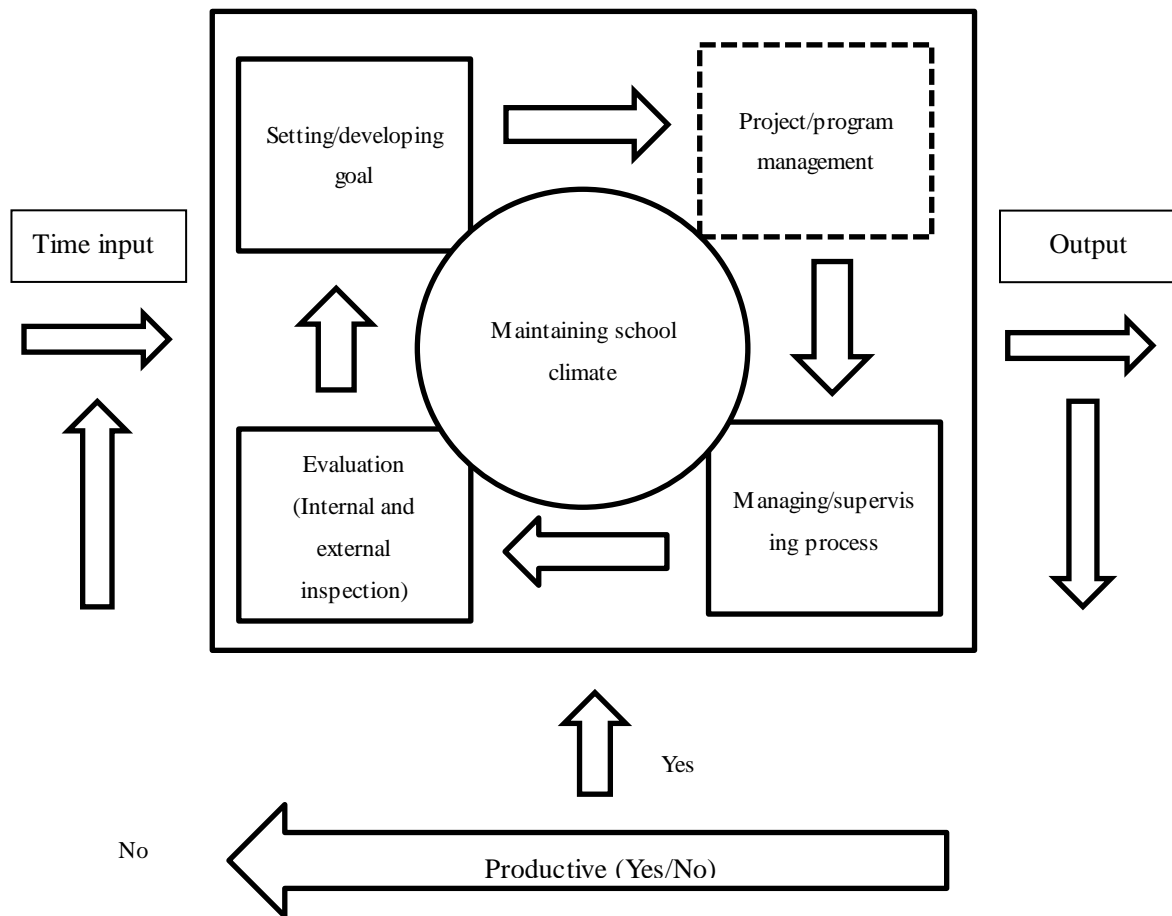
Figure 4 School leadership in Chinese Taipei primary school
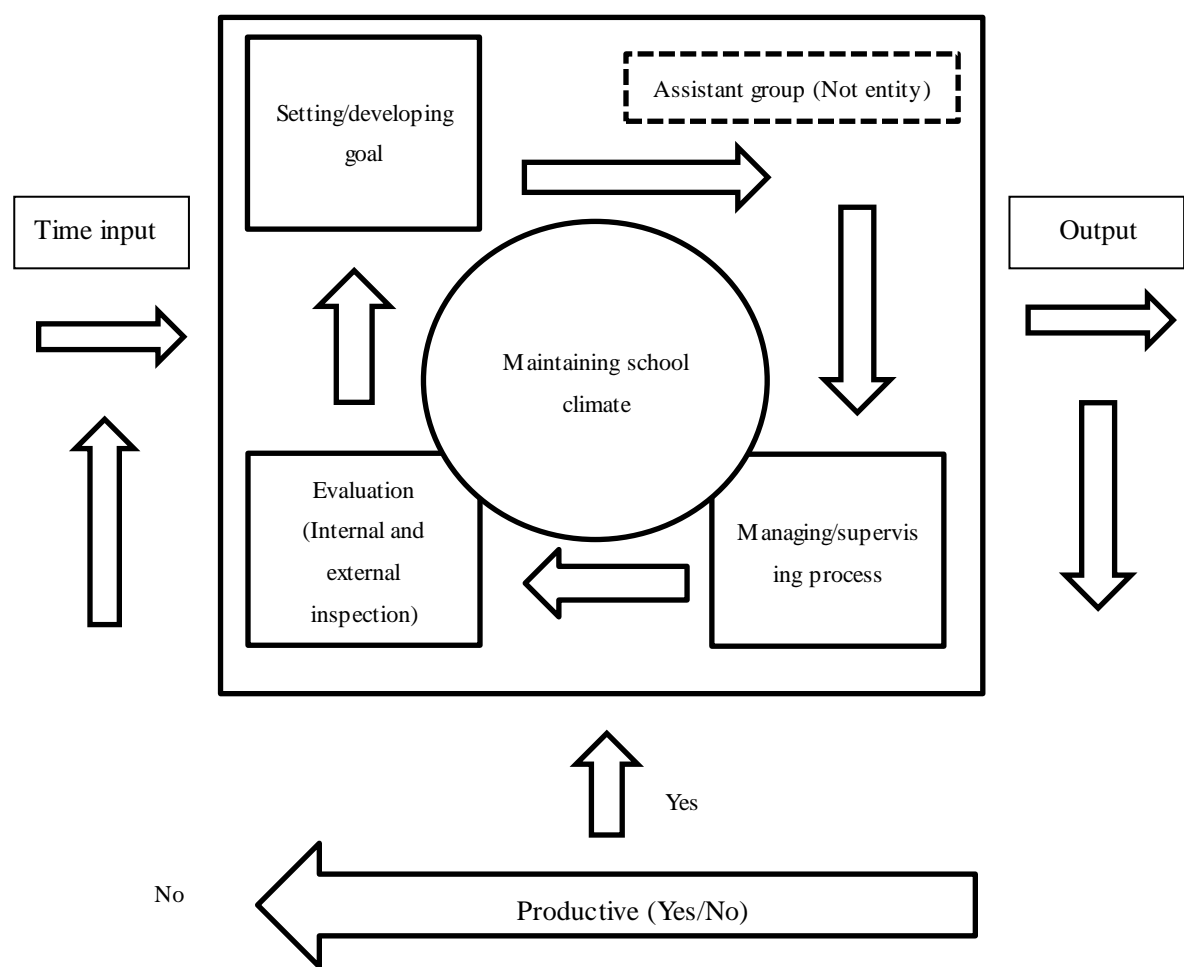
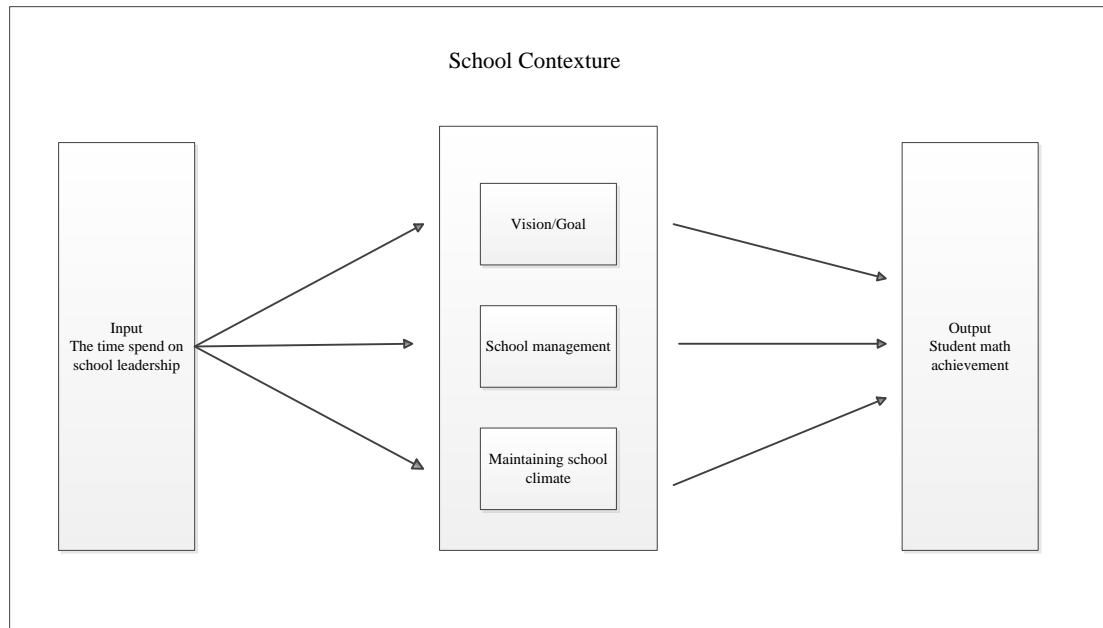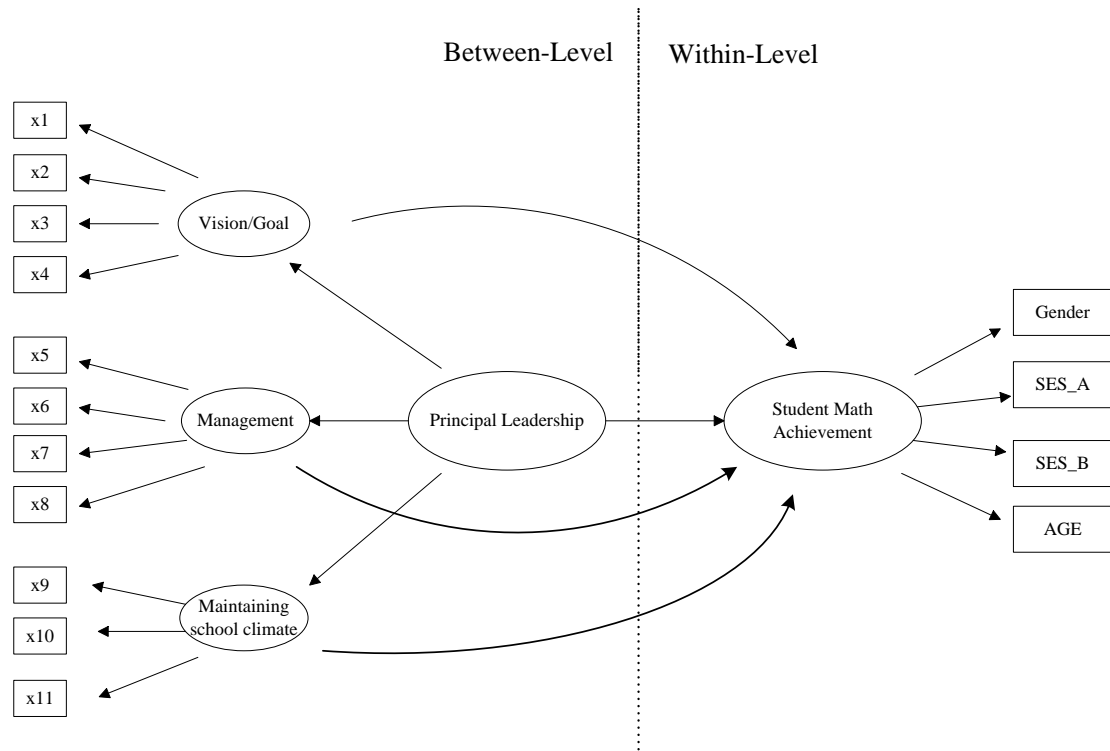**Figure 5 General framework to describe the relationship between SL and SMA**

School Contexture

Input
The time spend on
school leadership

Vision/Goal

School management

Maintaining school
climate

Output
Student math
achievement

Figure 6 Two-level empirical model

Between-Level | Within-Level

Figure 7 Path diagram of the factor mixture model
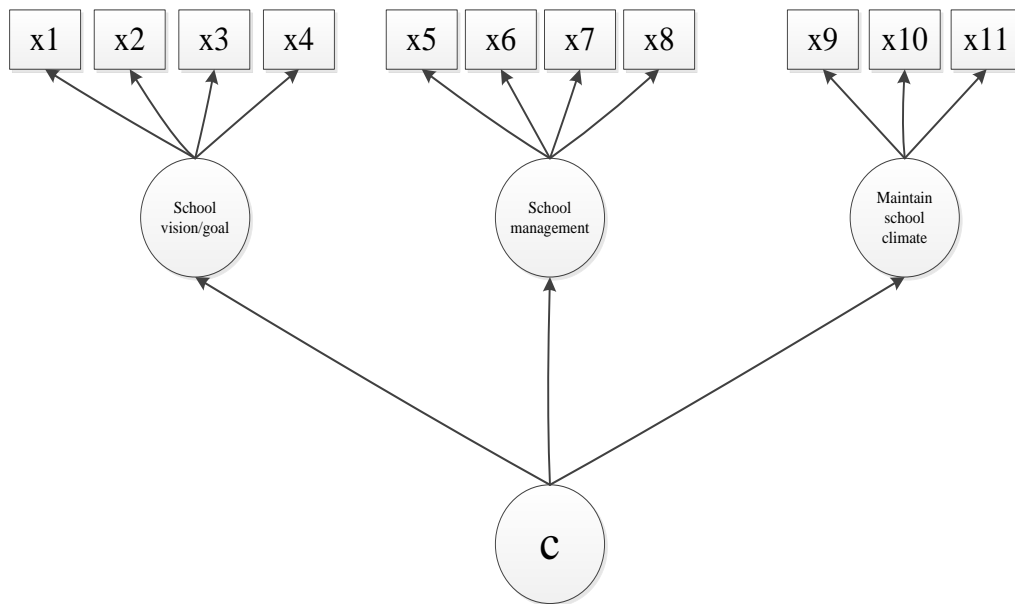
Figure 8 Path diagram of school leadership
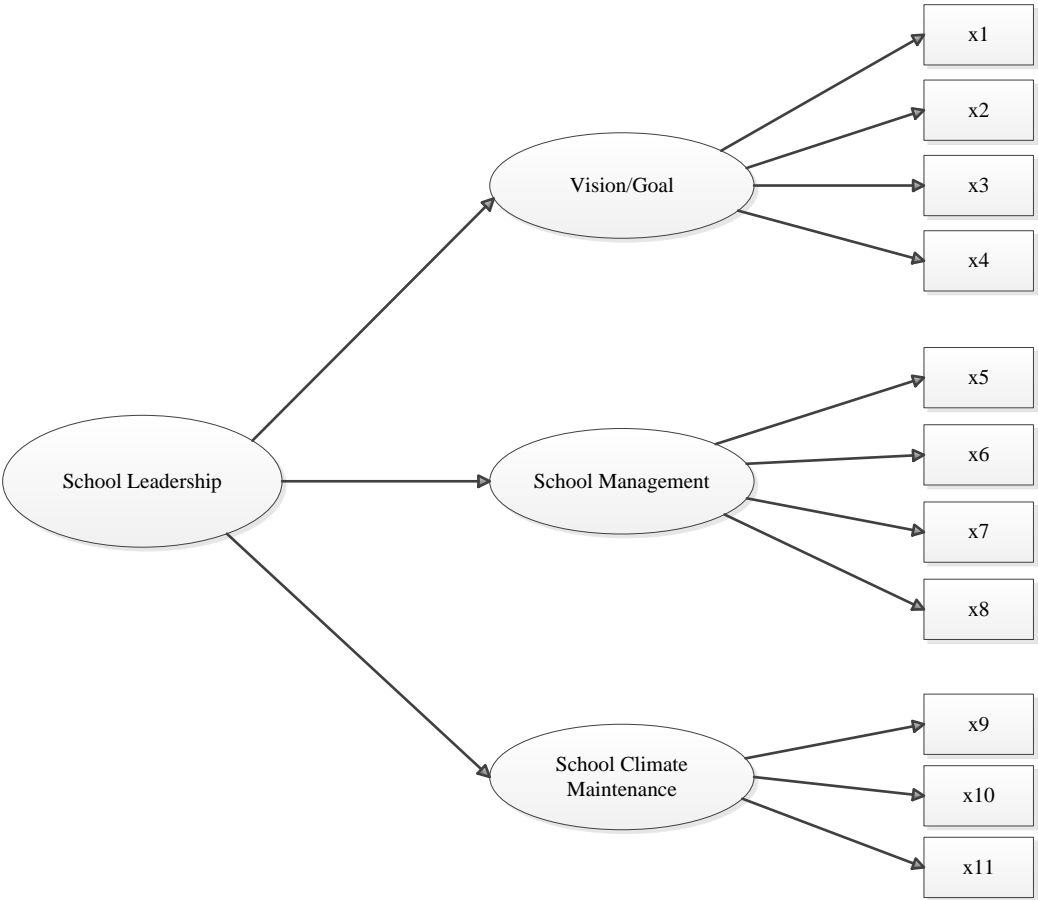
Figure 9 The relationship between SL and SMA in Germany
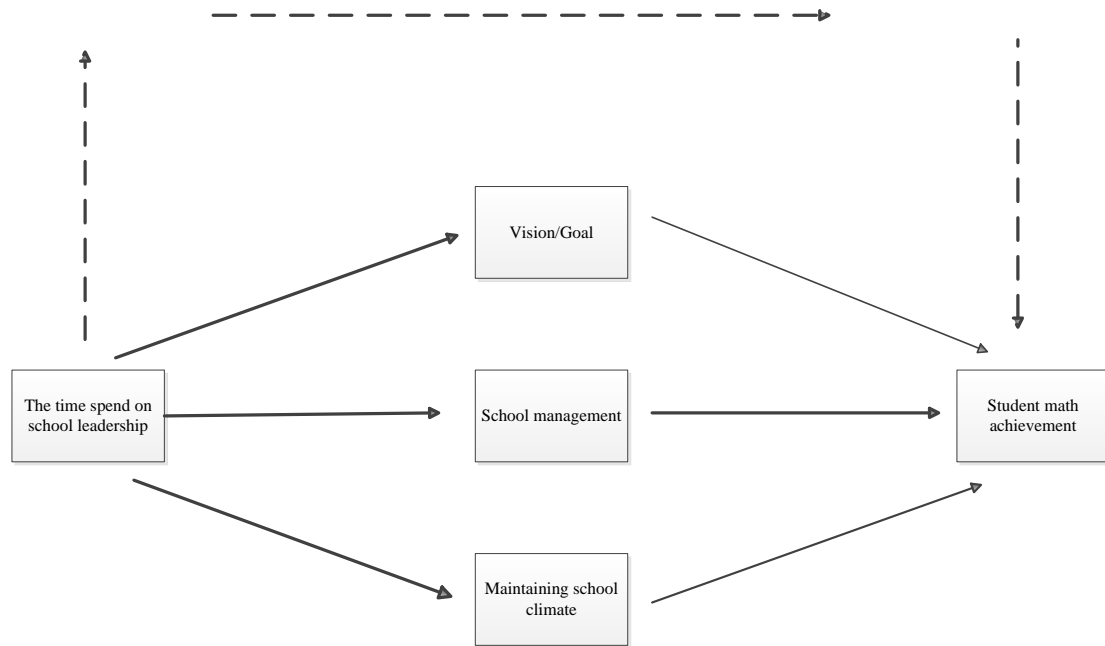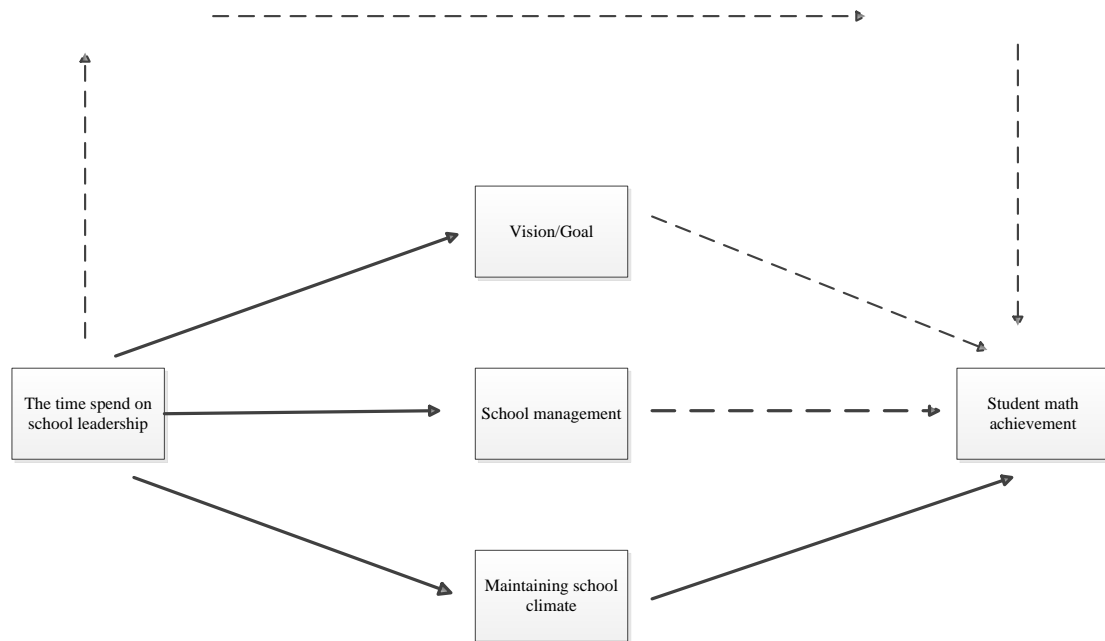

Note. Bold line = significant positive relationship

      Solid line = positive relationship

      Dotted line = negative relationship

Figure 10 The relationship between SL and SMA in Chinese Taipei

Note. Bold line = significant positive relationship

Bold dotted line = significant negative relationship

Light dotted line = insignificant relationship

Figure 11 The proportion of principals in each type who responded that they allocated time to leading activities in Germany
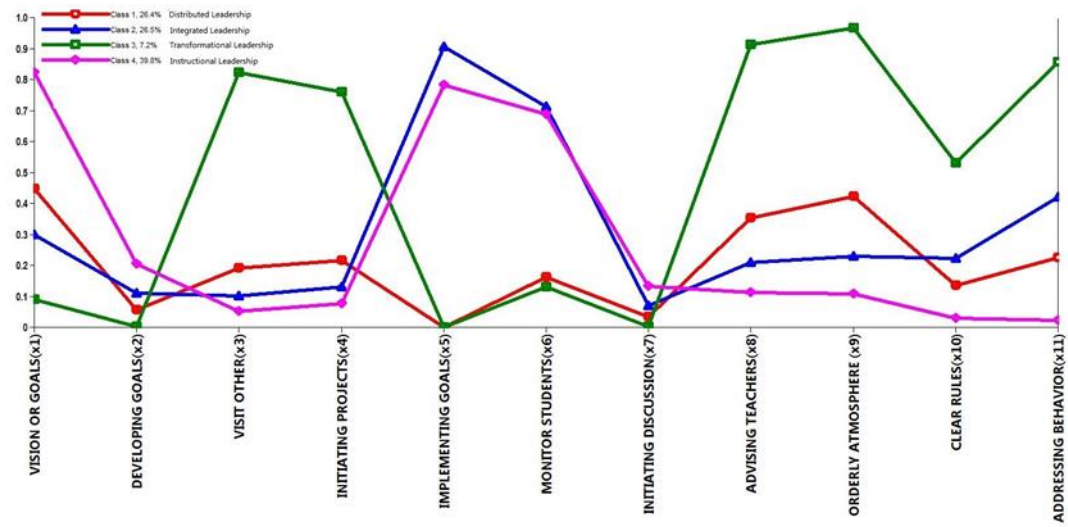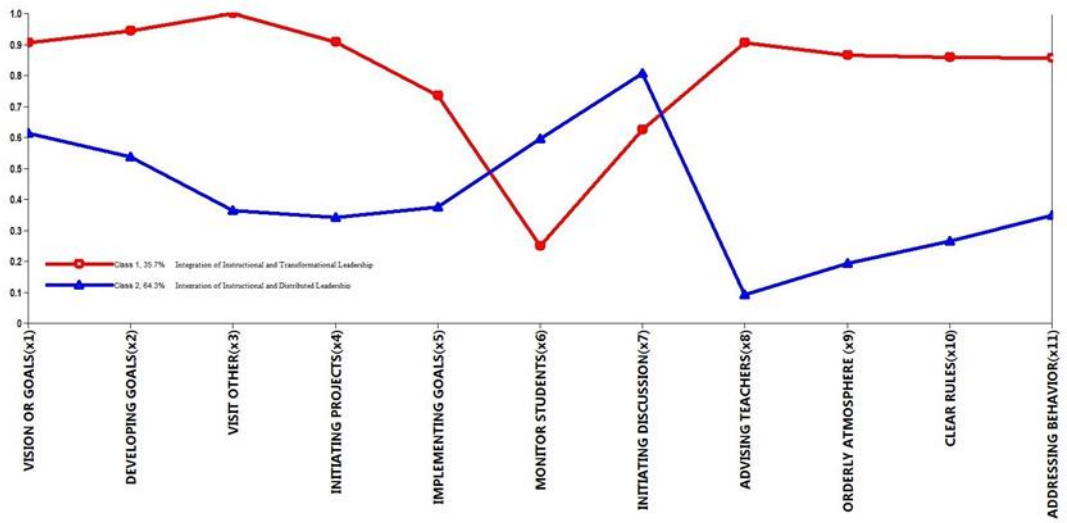
Figure 12 The proportion of principals in each type who responded that they allocated time to leading activities in Chinese Taipei

Erklärungen

Hier mit versichere ich **schriftlich** und **eidesstattlich** gemäß § 11 Abs. 2 PromO v. 08.02.2011/08.05.2013:

1. Die von mir vorgelegte Dissertation ist selbstständig verfasst und alle in Anspruch genommenen Quellen und Hilfen sind in der Dissertation vermerkt worden.
2. Die von mir eingereichte Dissertation ist weder in der gegenwärtigen noch in einer anderen Fassung an der Technischen Universität Dortmund oder an einer anderen Hochschule im Zusammenhang mit einer staatlichen oder akademischen Prüfung vorgelegt worden.

_____   _____
Ort, Datum   Unterschrift

3. Weiterhin erkläre ich **schriftlich** und **eidesstattlich**, dass mir der „Ratgeber zur Verhinderung von Plagiaten" und die „Regeln guter wissenschaftlicher Praxis der Technischen Universität Dortmund" bekannt und von mir in der vorgelegten Dissertation befolgt worden sind (die entsprechenden Texte sind am Ende dieser Datei nachzulesen).

_____   _____
Ort, Datum   Unterschrift