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A Comparison Of The Achievement Test Performance Of Children Who Attended Montessori Schools And Those Who Attended Non-Montessori Schools In Taiwan

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A COMPARISON OF THE ACHIEVEMENT TEST PERFORMANCE OF CHILDREN WHO ATTENDED MONTESSORI SCHOOLS AND THOSE WHO ATTENDED NON-MONTESSORI SCHOOLS IN TAIWAN

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ABSTRACT

There are two purposes of the current study. First was to examine whether or not children in the elementary school in Taiwan who had received Montessori early childhood education obtain significantly higher scores on tests of language arts, math, and social studies than children who attended non-Montessori pre-elementary programs. Second one was to examine whether or not the number years of Montessori education has a positive impact on the students' scores when they are in elementary grades. According to Chattin-McNichols (1992b), children from Montessori education program are doing better in some respects than other programs. Some studies have found that in the United States, Montessori students have strong academic outcomes especially in language arts than non-Montessori students (Daux, 1995; Hobbs, 2008; Lillard & Else-Quest, 2006; Manner, 1999). The present study involved 196 participants from a private Catholic elementary school in Taipei City, Taiwan. Ninety-eight first, second, and third grade students had Montessori early childhood experience and 98 first, second, and third grade students did not have Montessori early childhood experience. Using one-way MANOVA as a statistical tool, there were mixed results in the present study. The results showed students who had Montessori early childhood education experience had higher test scores of language arts than the students who did not have Montessori education experience. In conclusion, the present study partially supports the findings of other studies and shows

that Montessori education has some long-term impact on the students' language arts learning.

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INTRODUCTION

Statement of the Problem

When President George W. Bush signed the No Child Left Behind (NCLB) Act of 2001, the purpose was to let the students in public schools be assured of good quality learning outcomes. All students in the United States, regardless of their ability or ethnicity, are to have equal opportunity to achieve positive learning outcomes (Abernathy, 2007). This is the primary aim of NCLB which makes state educational departments, school districts, schools, and teachers accountable for the students' learning. Consequently, standardized testing has become extremely important for students in the public schools in each state.

In implementing NCLB, each state uses standardized tests of its choice to evaluate its students. For example, in the state of Indiana, students who are in the public school systems are required to take the *Indiana Statewide Testing for Educational Progress-Plus* (ISTEP+) exam beginning in the third grade and continuing every year until the tenth grade. All questions on the ISTEP+ are based on Indiana's Academic Standards as determined by the Indiana Department of Education. Each grade has its own academic standards.

Compared to the United States, the educational system in Taiwan, where data for the present dissertation are collected, is much different. In order to evaluate students' learning outcome and knowledge, Taiwanese students are administered mid-terms and final examinations each semester and are tested on content knowledge at each grade. Because the examination questions for mid-terms and finals are determined individually by each school in Taiwan, most students are not given statewide or nationally standardized tests such as ISTEP+ but they take entrance exams when they enter private junior high school or high school.

Even though the educational system between Taiwan and the United States is different, both countries realize that quality education is essential for everyone in the society. A common saying in Taiwan is that when a child turns three years old, if the child is well-educated, he or she will have a successful future. This popular proverb indicates that not only education is considered important but that early childhood education, child development, and learning environment are very significant and necessary for young children. However, preschool and kindergarten education in Taiwan is not compulsory (Tu, 2007).

When early childhood educators talk about child development, the theory of Lev Semenovich Vygotsky is usually brought up. Vygotsky thought that the welfare of the society is dependent on quality education (Berk & Winsler, 2002) and that social and cognitive development cannot be separated from each other. For this reason, social interaction with peers and teachers contribute to children's learning and knowledge. Following Vygotsky's lead, Bodrova and Leong (2007) highlighted four principles of Vygotskian thoery: "children construct knowledge, cognitive development cannot be

separated from its social context, learning can lead to development, and language plays a central role in mental development" (p. 9). According to Vygotsky's theory, child development and mental growth are related to the culture and society.

Therefore, if educators desire to enhance the academic performance of their students, the experience of preschool and kindergarten will be an important factor. Research shows that high-quality early childhood education and good quality day-care experience promote children's social and academic abilities and help them throughout their school life (Zeller, 2007). Duncan (2007) notes that the earlier the child starts learning, the better will be the achievement and positive behaviors of the child. The Head Start program in the United States is a good example of a good quality preschool education. Recent studies show that the Head Start program is less expensive than other preschool programs and day care centers but it enhances children's early achievement skills. Moreover, when the children develop cognitive and social skills at an early age, their later learning is also enhanced.

Throughout the world, many pedagogical approaches are used in early childhood settings. The Montessori Method of teaching young children is a widely used program. Teaching young children through the Montessori approach is used in many countries (Morrison, 2004). Many educators claim that the Montessori approach results in high-quality educational achievement (Humphryes, 1998; Neubert, 1992). In the United States, the Montessori Method has been used for educating children during the last 30 years (Neubert). According to Chattin-McNichols (1992a), the Montessori pedagogy keeps growing in importance in both private and public schools in the United States. Humphryes notes that the Montessori program provides high-quality education and

conforms to developmentally appropriate practice based on the standards of The National Association for the Education of Young Children (NAEYC) of the United States.

The proposed study examines the possibility that Montessori program as practiced in Taiwan is academically more beneficial to children than other preschool and kindergarten programs. The present study also examines the effectiveness of the Montessori Method in relation to other preschool programs in Taiwan. A brief description of the Montessori Method is presented in the following section.

The Montessori Approach

The Montessori approach is child-centered education. All materials and learning tools used in the Montessori classroom are matched to the child's age and ability. Furthermore, additional efforts are made to create a suitable environment in the Montessori classroom. The role of the teacher is very important because it is the teacher who is ultimately responsible for creating and maintaining proper educational environment. When children are placed in a prepared, structured environment, they are ready to learn, and such an environment encourages children to construct knowledge by themselves.

Morrison (2004) briefly describes five basic principles that underlie the Montessori method of instruction. The first principle is the concept of "sensitive period," or "critical period," defined as "the period of special sensibility" (Standing, 1998, p. 119). In other words, even in prepared environments, children have a specific time to learn special skills. If the sensitive period is missed, it is difficult for the child to learn that special skill later. Therefore, teachers, parents, and educators should be able to

recognize children's sensitive periods. Although children may have the same basic experiences, the sensitive period can be different for each child.

The second principle, an absorbent mind, is also a term coined by Maria Montessori. According to Morrison's (2004) definition, the absorbent mind refers to "the idea that the minds of young children are receptive to and capable of learning. The children learn unconsciously by taking in information from the environment" (p. 142). The child's mind is like a sponge. By being immersed in their environment, children can absorb information readily and, in turn, gain knowledge.

The next principle is the prepared environment. A prepared environment is a very important element in the Montessori classroom. Montessori teachers prepare learning environments that are designed to support children and help them to learn spontaneously. One of the important philosophies of Montessori education is that teachers need to observe children's progress rather than require the children to follow the teachers' teaching directions and pace. This approach is intended to give children more freedom to choose their curricular activities individually.

Respect for children and auto-education are two other important principles of Montessori education. Montessori believed that every child is unique and has his or her own ways of learning which parents and teachers should respect (Morrison, 2004). Auto education means once teachers and parents provide children a prepared environment, children have the ability to educate and correct themselves.

In Montessori preschool and Montessori kindergarten classes, the curriculum is made up of five subjects: practical life, sensorial experience, mathematics, language, and cultural studies. Compared to traditional preschools, child-care and family day care

centers, Montessori education provides children with more sequential learning activities and opportunities to learn key academic subjects such as mathematics, writing and reading at an earlier age than children who are in non-Montessori schools.

Montessori Education in Taiwan

Montessori education in Taiwan is based on almost the same principles as that of the United States. According to the Chinese Montessori Foundation for Early Childhood Educational Research (2008) in Taiwan, even though Montessori education is Western in origin, the curriculum areas covered and the principles of teaching are the same both in Eastern countries and Western countries. The only difference between the curriculum in Taiwan and the United States is that the curriculum content may reflect the differences in the two cultures because the Chinese Montessori Foundation for Early Childhood educational Research encourages teachers to emphasize the local culture with their students.

Some educators believe that Montessori education has a great impact on academic performance when children reach elementary school. This belief leads to the question: once children reach elementary school, do those with Montessori experience have better academic learning outcomes compared to children who did not have the Montessori experience? The following question is addressed in the present enquiry: Does Montessori education received in pre-elementary programs including preschools and kindergartens in Taiwan have an effect on students' academic achievement when they are in elementary grades?

Purpose of the Study

The purpose of the present study was to examine whether or not children in the elementary school in Taiwan who had received Montessori early childhood education obtain significantly higher scores on tests of language arts, math, and social studies than children who attended non-Montessori pre-elementary programs. This question was answered by adopting the following procedure.

Procedure

Test scores were obtained for 196 children in the first, second, and third grade who had received Montessori early childhood education and was compared with the scores obtained by a comparable group of children who had received early childhood education other than the ones based on Montessori philosophy. Achievement test scores obtained in language arts, math, and social studies by these children during 2008 fall semester of the first, second, and third grade were used in the proposed study. Another objective of the present study was to examine if the number of years of Montessori early childhood education experience has an influence on the achievement test scores of the Montessori trained children in language arts, mathematics, and social studies. In other words, do children who have been exposed to Montessori education for two years obtain higher scores in language arts, mathematics, and social studies than children who have been exposed to Montessori education for only one year?

Terms and Definitions

The terms used in the dissertation are presented and defined in the following section.

1. *Montessori Method* is defined for this research as "a system of early childhood education founded on the ideas and practices of Maria Montessori" (Morrison, 2004, p. 140).
2. *Kindergarten* (*pre-elementary education*) or pre first grade is defined for this research as educational programs which educate children who are from two years old to six years old before attending the first grade (Cheng, 2008). In Taiwan, kindergarten is similar to full-day or half-day preschools, day care centers, and kindergartens in the United States.
3. *Montessori kindergarten* is a pre-elementary (pre first grade) program in which the teaching method used adheres to Montessori philosophy and uses Montessori materials.
4. *Non-Montessori kindergarten* is pre-elementary (pre first grade) program in which Montessori principles are not followed.
5. *Montessori classroom* is defined for this research as a classroom which is taught by teachers who have had training and have teacher certification from any of the following organizations: the American Montessori Society (AMS) or the Association Montessori International (AMI). In Taiwan, teachers can get Montessori certification from any of the above. Montessori teachers can also have training and receive teacher certification from the Chinese Montessori Foundation.

6. *Montessori experience* is defined as having been taught through Montessori Approach during early childhood period from infancy to age six before attending the first grade. Taiwanese Montessori instructors in this study can be certified by any of the following organizations: the American Montessori Society, the Association Montessori International or the Chinese Montessori Foundation. In the present study, teachers in Taiwan who have been trained by Montessori qualified teachers or have received on-the-job training are also considered as "Montessori instructors."
7. *Non-Montessori experience* is defined as pre-elementary education that does not strictly follow the Montessori approach and does not rely on activities that are used by the Montessori Approach during children's early childhood period from infancy to six years before attending the first grade.
8. *Standardized test* is defined as a tool that measures the students' academic performance in schools and has acceptable validity and reliability. The language arts achievement test, math achievement test, and social studies achievement test are the three different standardized tests used in schools in Taiwan.
9. *Academic achievement score* is defined for this research as the scores obtained on the following Taiwanese standardized tests: the Elementary School Language Ability Achievement Test (ESLAAT), Elementary School Mathematics Ability Achievement Test (ESMAAT) and Social Studies Ability Achievement Test (SSAAT).

Limitations

The following are the limitations of the present study:

1. The sample of this study was limited to first, second and third grade students attending a school in Taipei City, Taiwan. The researcher had access to only one private school as a target school. The sample size of the study is, therefore, somewhat small. Consequently, this study cannot be considered to be representative of all students in elementary schools in Taiwan.
2. The sample consisted of the first, second and third grade students who attend private elementary school in Taipei City, Taiwan. Even though the students come from the same elementary school, differences in learning environment, the teachers' teaching methods, teacher's personality, and the degree of parental involvement could be factors that can affect this study.
3. The instructional methods used in non-Montessori schools can vary from each other. Although there are many early childhood education teaching pedagogies, this study was concerned only with the comparison of the outcome of the Montessori approach with those of others.
4. In the present study, the researcher focused only on accredited Montessori schools which are recognized by the Chinese Montessori Foundation for Early Childhood Educational Research.

Assumptions

The following assumptions were established for this study:

1. The parents of the participants were assumed to have reliable information

whether their child had Montessori experience or a non-Montessori experience.

2. Every participant was assumed to understand the nature of achievement tests in Chinese language arts, mathematics, and social studies.
3. Participants' families were assumed to have similar socioeconomic background.

Research Questions

The research questions were answered by examining the scores obtained by students in the following tests.

- Peabody Picture Vocabulary Test-Revised (PPVT-R). This is a Chinese version of the Peabody Picture Vocabulary which is designed to assess vocabulary knowledge.
- Social Studies Kindergarten Test (SSK-T). This is designed by the researcher to assess the first grader's cultural studies knowledge.
- Elementary School Language Ability Achievement Test (ESLAAT). This is a standardized test designed to assess Chinese language arts ability.
- Elementary School Math Ability Achievement Test (ESMAAT). This is a standardized test designed to assess mathematics ability.
- Social Studies Ability Achievement Test (SSAAT). This is a test designed to assess social studies knowledge.

For this purpose, in the present study the following questions were identified:

1. Do the first grade students who have attended at least one year of Montessori early childhood education programs (preschool and kindergarten) in Taiwan

obtain higher scores on the Chinese version of the Peabody Picture Vocabulary Test-Revised (PPVT-R) and Social Studies-Kindergarten Test (SSK-T) than the first grade students who attended non-Montessori early childhood education programs?

2. Do elementary students (grade one to three) who have attended at least one year of Montessori early childhood education programs (preschool and kindergarten) in Taiwan obtain higher scores on tests in the subjects of Chinese language arts, math, and social studies than students who attended non-Montessori early childhood education programs?
3. Is there a significant difference between the number of years spent in Montessori preschool program and their languages, math, and social studies test scores when they are in first, second, and third grade?

Hypotheses

The null hypotheses for this quantitative research are as follows:

1. There is no significant difference in Chinese language ability scores on the PPVT-R, SSK-T, Chinese language arts, vocabulary and reading comprehension scores on the ESLAAT, math scores on the ESMAAT, and social studies scores on the SSAAT between the first grade students who have had Montessori early childhood experiences and those who have had non-Montessori early childhood education experiences.
2. There is no significant difference in Chinese language arts, vocabulary and reading comprehension scores on the ESLAAT, math scores on the ESMAAT, and social studies scores on the SSAAT between the second grade

students who have had Montessori early childhood experiences and those who have had non-Montessori early childhood education experiences.

3. There is no significant difference in Chinese language arts, vocabulary and reading comprehension scores on the ESLAAT, math scores on the ESMAAT, and social studies scores on the SSAAT between the third grade students who have had Montessori early childhood experiences and those who have had non-Montessori early childhood education experiences.
4. There is no significant difference between the number of preschool Montessori years the first grade students had and their scores of the PPVT-R, SS-K Test, ESLAAT, ESMAAT, and SSAAT.
5. There is no significant difference between the number of preschool Montessori years the second grade students had and their scores of the ESLAAT, ESMAAT, and SSAAT.
6. There is no significant difference between the number of preschool Montessori years the third grade students had and their scores of the ESLAAT, ESMAAT, and SSAAT.

Organization of the Study

This dissertation was organized into five chapters. Chapter 1 introduced the project. It included a statement of the problem, purpose of the study, procedure, terms and definitions, limitations, assumptions, research questions, hypotheses, and description of the organization of the study. Chapter 2 presents a review of related literature by focusing on the current research literature. Chapter 2 is divided into the following sections: notes an importance of early childhood learning, early childhood program

standards, the Montessori philosophy of pedagogy, research on Montessori education with student's learning outcomes and social skills, and a summary. Chapter 3 describes the research method and design of the study. It is divided into the following sections: research question, research hypotheses, research design, setting, participants, instrumentation, data collection, procedure, data analysis, and summary. In Chapter 4 the data and the results of the study are presented. Chapter 5 details the final analysis of the data, results of the investigation and a discussion of the findings.

Chapter 2

LITERATURE REVIEW

Introduction

The present study examines the question whether Montessori early childhood experiences have a positive impact on elementary school students' achievement on standardized tests. Many educators believe that Montessori education, compared to non-Montessori preschool education, results in higher academic performance when children enter elementary school. In this section, the related literature is presented.

This chapter begins with studies that investigated the importance of early childhood learning. Following is a description of early childhood program standards among kindergarten curricula in Taiwan, the AMS, and the National Association for the Education of Young Children (NAEYC). In addition, the Montessori education set up and background are presented. Next, the research that compared the academic achievement of Montessori and non-Montessori students on standardized tests in public or private Montessori settings in the United States and Taiwan is presented. Finally, a brief summary concludes the chapter.

The Importance of Early Childhood Learning

In order for elementary school students to have successful learning outcomes, early learning experiences are essential. As a result, early childhood education is much emphasized in the United States. Zeller (2007) noted that over one-third of the children under five years old in the United States are cared for by early childhood agencies. Another study reports that three-fourths of preschoolers in the United States attend private preschools, public preschools, or Head Start programs (Barnett & Hustedt, 2003). Barnett and Hustedt also note that more and more free universal pre-K programs are being offered to four-year-old children. The first universal pre-K program was started in Georgia in 1995. In the following years, similar programs were established in New York, Oklahoma, and Florida.

Researchers have shown that attending a high-quality preschool and kindergarten program has positive effects on school performance and social skills in later life (Cohen, 2004; Jacobson, 2005; Westchester Institute For Human Services Research, 2007; Wilgoren, 1999; Zeller, 2007). A well-known longitudinal study is the High/Scope Perry Preschool Study which has investigated the effect of preschool education for almost 40 years (Wilson, 2000). This study was conducted in 1962 and examined 123 African American children who were three to four years old. These children came from low socioeconomic status families but they had high quality preschool learning experiences. The researchers continued to follow up and collect data from these children. The results showed that these children had several significantly positive long-term outcomes (Schweinhart, 2008; Wilson, 2000). After 40 years, when they were adults, these African American adults were more likely hold a job, had lower crimes and teenage pregnancy,

and more than 71% had graduated from high school. They were better than the adults who did not have preschool experiences.

Duncan (2007) notes the importance of a good quality preschool program for children this way: "a strong foundation in a child's early years helps promote lifelong achievement and positive behavior, while a weak foundation increases the chances of later problems" (p. 20). Barnett (2004) expresses a similar view that high-quality preschool programs managed by professional teachers can have long-term educational, social, and economic benefits.

Barnett and Lamy (2006) conducted a study to determine whether or not attending preschools in the United States has an impact on the vocabulary, literacy, and math skills of low-income students at kindergarten entry. The participants were 1372 kindergarteners from 21 kindergarten classes who were administered the Peabody Picture Vocabulary Test, the Woodcock-Johnson Tests of Achievement, and the Blending subtest of the Preschool Comprehensive Test of Phonological & Print Processing. The researchers found that kindergarten students who had had two years of preschool experience had higher scores on receptive vocabulary, phonological awareness, and math skills when compared to students who had only one year of preschool experience or no preschool experience. This means that preschool experiences had a positive impact on vocabulary and phonological development, especially for the children from disadvantaged backgrounds.

Wilgoren (1999) noted that a good early childhood education had a positive impact on poor children which lasted into adulthood. He found that 35% of underprivileged students who attended day care programs later on attended a four-year

college before they turned 21. Moreover, 40% of 21-year-olds who had had day care experiences were still in school, and the other 60% had a good job or went to a college. Only a few participants who had child care experience had children of their own before age 21. The results of this study indicate that the earlier children attend good early childhood education programs, the more positive is the outcome when they reach adulthood. This is particularly true of under privileged children.

Morrison (2004) reviewed studies relating to early childhood education and concluded that high-quality care education bestows three benefits:

> The high-quality child care children had higher cognitive test scores than the control group from toddler- years to age twenty-one. Their academic achievement in both reading and math was higher from the primary grades through young adulthood. They completed more years of education and were more likely to attend a four-year college. (p. 190)

Based on the studies, it is obvious that children benefit from good quality early childhood education. Robin, Frede, and Barnett (2006) compared the academic achievement of all-day preschool versus half-day preschool and found that the children who attended all day preschool showed greater progress in verbal and mathematics skills than the children who attended only half-day preschool. The evidence showed that "extended-day preschool of good quality had dramatic and lasting effects on children's learning across a broad range of knowledge and skill" (p. 2). Furthermore, Robin et al. found that some children, especially those who were from low-income families, and were in good quality half-day preschool program may not get the same amount of positive effects compared with full-day good quality preschool. One of Robin et al.'s

conclusions is that high-quality preschool programs include age-appropriated curriculum, qualified teachers, and a low teacher-to-students ratio. They also showed that even though the children from low-income families fall behind compared to their peers when they first enter all-day preschool, they still can develop language and math skills which move them toward the national norms. Additionally, Robin et al. observed that if children participated in full-day quality preschool program, their teachers may have more time to work with each individual child and better understand each student. Therefore, children in the full-day preschool high quality program not only increase their academic achievement but also gain other positive benefits in social skills, cognitive skills, and emotional health.

In addition to experience in a preschool or day care center, kindergarten attendance also has positive influences. Clark and Kirk (2000) observed that attending full-day kindergarten has a positive influence on the educational achievement and social skills of children who are from low-income families and disadvantaged backgrounds. They also concluded that children in all-day kindergarten have more opportunities to interact with their peers and teachers who, in turn, understand more about their students. Clark and Kirk observed that good quality kindergarten can provide children a developmentally appropriate curriculum and instruction. This results in improved academic knowledge and other academic skills. In summary, a good quality early childhood program can lead to good academic achievement and social behaviors. Considering the advantages of early childhood education, the Montessori approach can also be expected to have a positive impact on children's education and achievement.

The Montessori Method

Dr. Montessori founded the first full-day Montessori school in Rome, Italy, in 1907 for four- to seven-year-old children who were from low-income families (Chattin-McNichols, 1992a). Kahn (1995) summarized the essence of the Montessori preschool education as follows:

> Children under six have extraordinary powers of mind. They have a universal, once-in-a-lifetime ability to absorb knowledge from their surroundings just by living. They take in their environment-the physical space, the language and movement of adults and children-with what Montessori called 'the absorbent mind.' The absorbent mind is at its peak of receptivity during the preschool years. (p. 4)

Montessori education gives the children opportunities to explore language and mathematics at an early age. For example, in Montessori preschool, the children explore spoken language and use Montessori language materials to enhance the development of spoken language. Based on the child's level of development, written language materials are also used. At the same time, children are encouraged to discover reading and writing (Kahn, 1995). According to the Montessori philosophy, preschool-age children have mathematical minds. Children can learn to progress from concrete to abstract thought through sensory experiences. It is also believed that children can discover math principles by themselves. Therefore, compared to other early childhood pedagogies, Montessori education provides young children with opportunities to explore academic learning in language and math, the foundations of curriculum in Montessori education.

Chattin-McNichols (1992b) stated that students in a Montessori education environment achieve as well as those in non-Montessori programs, such as traditional nursery school. However, Davis (2006) reported that the students who attended Montessori schools made better progress on academic and social skills compared to the students in other programs. Earlier, Epstein (1990) noted that when educators think about educational reforms, the Montessori Method is one of the programs that should be considered. Montessori education not only offers academic curriculum to develop the students' cognition and intelligence, but also benefits the students' social, emotional, and physical development.

Some studies also show that Montessori students secure better achievement scores on their school subjects. Duax (1995) studied students who went to Montessori school when they were three or four years old and continued in the Montessori program until they were in the eighth grade. All the participants were given the Stanford Achievement Test (SAT). The students showed a high level of academic performance in math and reading, giving support to the theory that Montessori education could help students achieve higher academic levels than students in non-Montessori programs. In a study conducted in Houston Texas, Epstein (1990) observed that Montessori students had above-average scores compared to non-Montessori students on the Iowa Test of Basic Skills and the Metropolitan Achievement Test. Moreover, on a national scale, students who were in public Montessori program scored 10 to 20 points higher on the California Achievement Test compared to non-Montessori children.

Vygotsky's Theories and Early Education

One of the major learning theories applied in early childhood education classrooms is that of Lev Semenovich Vygotsky, who stressed the sociocultural approach in children's cognitive, language, and social development (Berk & Winsler, 2002; Mooney, 2000; Morrison, 2004). Vygotsky focused on how social development and cultural differences influence the child's development and indicated that learning and social development cannot be separated. According to Vygotsky (1978), learning and development cannot be separated and they are interrelated from the time the child was born.

Two important terms coined by Vygotsky are still used in education: *the zone of proximal development* (ZPD) and *scaffolding*. ZPD refers to "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86).

Scaffolding occurs when teachers or adults help the child, causing him or her to do better than if left alone. If helpers or adults then slowly decrease their level of assistance, the learners perform better at the task (Bodrova & Leong, 2007). Bodrova and Leong offered three ideas for scaffolding within the ZPD for children. First of all, if the work is not very easy to do, assistance and facilitation are necessary to help the children. Second, let children have responsibility for their performance. Third, when the children know how to do the work, adults should let them do it by themselves. The support and scaffolding is only temporary. Collaborative learning such as ZPD and scaffolding, is necessary for the learners, and the learners not only can learn from others

but also can learn independently. Loeffler (1992) also explained both the ZPD and scaffolding as follows:

> Children are more intellectually competent (the zone of proximal development) than they can demonstrate when asked to solve a problem or perform a task alone. If, however, they are supported by an adult or a slightly more advanced peer (scaffolding), they will be able to perform at a higher level and move forward in their development more quickly. (p. 109)

Vygotsky and Montessori were constructivists. They believed that all children can actively construct their own knowledge through connection and interactions with their environment (Bodrova, 2003; Loeffler, 1992), and both of them focused on child development learning, and early childhood education. Montessori called constructivism auto-education, in which the teachers let the children learn from their own discovery. Montessori teachers also encourage the students to develop cooperation, not competition (Chattin-McNichols, 1992b) and support students who ask peers for help. In the Montessori classrooms, teachers reduce the amount of testing of their students; instead they let the students figure out problems by themselves or through interaction with peers and teachers. In Vygotsky's view, "learning occurs through co-construction. The child is helped by the mind of another person in learning" (Bodrova & Leong, 2007, p. 34). Even though Montessori and Vygotsky are constructivists who believed that children learn from their environment, they also differed in some of their views.

According to Bodrova and Leong (2007), Montessori and Vygotsky differed in their opinions about development. Montessori thought that development is a natural process, but Vygotsky believed that culture is an important influence. There are

additional differences between these two theorists in their understanding of language development and the role of play. Regarding language development, Montessori had the same idea as Piaget, that learning language is a product of cognition. However, Vygotsky (1978) thought that "language was the engine of development, that it helped children to acquire concepts" (p. 34). They also had different views of written language. Montessori believed that writing can help children to practice their motor skills and is a preliminary step to learn to read, thus assisting them in meeting the demands of academic work in the primary grades. Vygotsky believed that when the children write, they put the cultural elements of their lives into their writing. He believed "writing was a cultural tool whose acquisition influenced the child's mental processes" (p. 35). As for the role of play, Montessori thought that play is not necessary for children, while Vygotsky thought that through play, children develop their creative and social skills.

In spite of these differences, it should be noted that Vygotsky's concepts of ZPD and scaffolding are related to the Montessori learning approach. According to Loeffler (1992), Montessori education advocates Vygtsky's ZPD and scaffolding theories by using Montessori materials in mathematics and language to help children to construct higher levels of understanding and skills. The system has been effective in creating a conducive learning environment for early childhood education. According to Kahn (1992), the Montessori learning environment is comparable to Vygotsky's concept of scaffolding. In other words, Montessori materials and social interaction provide the experiences that enable children to learn within their own ZPD. From this perspective, the instructor is able to determine the children's progress and if a particular environment is effective for the learner.

Early Childhood Program Standards

In the current education systems, standards for curriculum and education are a necessity. If schools do not have any standards to follow, teachers will not have guidelines for instruction and no goals to meet. In addition, establishing standards will create good quality curriculum and can improve the quality of education. For the purposes of this study, early childhood program standards for AMS as well as the NAEYC, and the Standards of Kindergarten Curriculum in Taiwan will be discussed. Established in 1960, AMS is the largest Montessori organization in the world (American Montessori Society, 2008a). It is a non-profit organization for supporting both private and public schools which use Montessori pedagogy to educate their students. AMS provides Montessori teacher education and also ensures that all children from birth to eighteen years old can receive quality Montessori education. The mission of this organization is to "[provide] leadership and inspiration to make Montessori a significant voice in education. The Society advocates quality Montessori education, strengthens members through its services, and champions Montessori principles to the greater community" (American Montessori Society, 2008b, para.1).

The AMS has principles that ensure good quality Montessori education: (1) its goal is to foster the development of competent, responsible, adaptive citizens who are lifelong learners and problem solvers; (2) it believes that learning occurs in an inquiring, cooperative, nurturing atmosphere. Students increase their own knowledge through self- and teacher-initiated experiences; (3) it believes that learning takes place through the senses, and students learn by manipulating materials and interacting with others; these meaningful experiences are precursors to the understanding of ideas; (4) the Montessori

system also requires that the individual should be taught as a whole; the physical, emotional, social, aesthetic, spiritual, and cognitive needs and interests are inseparable and equally important; and (5) Montessori system also advocates respectful and caring attitudes for oneself, others, the environment, and all life (American Montessori Society, 2008c).

The NAEYC is the largest organization devoted to early childhood education in the United States. In the 1920s, NAEYC began prescribing nursery school instruction for young children. In this period, this organization provided assistance related to early childhood education in order to promote high quality care. Currently, NAEYC serves all school children from birth through eight years old. Its mission is "to serve and act on behalf of the needs, rights, and well-being of all young children with primary focus on the provision of educational and developmental services and resources" (NAEYC, 2008, para.1). NAEYC has three goals: (1) to improve professional practice and working conditions of early childhood education; (2) to support early childhood programs by working to achieve a high-quality system of early childhood education; and (3) to build a high-performing, inclusive organization of groups and individuals who are committed to promoting excellence in early childhood education for all young children (NAEYC).

Besides NAEYC and AMS standards, early childhood curriculum in Taiwan has its own standards. In Taiwan today, the age at which enrolling children in early childhood programs is a controversial issue. According to the Tu (2007), there is no compulsory education for children aged two to seven. However, because more and more families have two working parents and only one or two children, early childhood education is becoming important and desirable. The Ministry of Education encourages

parents of children who are five years old to enroll them in kindergarten. Currently, more than 90% of five-year-old children are enrolled in either public kindergartens or private kindergartens in Taiwan.

Standards of Kindergarten Curriculum in Taiwan

Originally, kindergarten education in Taiwan served children who were four to six years old. Until recently, accredited kindergartens followed the Standards of Kindergarten Curriculum published by the Ministry of Education in 1987. However, these standards are over twenty years old, and are not as good a fit for today's early childhood education. The Taiwanese government is revising standards to accommodate the new era. According to the standard of Kindergarten Curriculum (Ministry of Education, 1987), kindergarten education should focus on health education, social education, moral education, and family education. Based on these four categories of education, there are five goals to be reached: (1) to foster the children's physical and psychological development; (2) to foster good habits; (3) to give the children life experiences; (4) to enhance the children's moral concepts; and (5) to foster social skills and habits. In Taiwan, the Standards of Kindergarten Curriculum includes the six curriculum areas: health, play, music, work, language, and general knowledge (such as social studies and science).

NAEYC of America has ten standards that relate to early childhood programs. They include "relationships, curriculum, teaching, assessment, health, teachers, families, community partnership, physical environment, and leadership and management" (NAEYC, 2005, p. 9-12). The standards of early childhood program of the AMS are physical environment, structure and curriculum, classroom leadership, assessment, and

professionalism (American Montessori Society, 2008e). The standards of the AMS and NAEYC are similar; the only differences are that Montessori classes feature mixed-age groups; teachers have to use Montessori pedagogy and follow Montessori principles, and that teachers need certification to teach different age level of children (American Montessori Society, 2008d). The standards of NAEYC and Kindergarten curriculum in Taiwan are similar. Even though the Standards of Kindergarten Curriculum has only six curriculum areas, most of its content is similar to that of the NAEYC. The only difference is that the Standards of Kindergarten Curriculum in Taiwan focus on Thematic Unit pedagogy, which is teaching curriculum based on the units that the teachers choose. However, many kindergarten classes and preschools in Taiwan use other pedagogies as well. Therefore, this standard is still being revised by early childhood educators and officials from the Ministry of Education in Taiwan.

The Education System in Taiwan

Parents in Taiwan hope and believe that their children will have a bright future. Therefore, education in Taiwan is very important. Cheng (2008) points out that in order to enhance the quality of education, Minister of Education adopts the flexible entrance exams to allow the junior high students to be able to enter the most appropriate institution based on their abilities. In addition, the Minister of Education encourages teachers to use the most appropriate teaching techniques to teach their students. Moreover, the Ministry of Education also advocates that every child should have an equal education opportunity, especially the children from disadvantaged families and low income families. Generally speaking, Taiwan's education system is divided into three categories: basic education, intermediate education, advanced education (Cheng,

2008). Basic education includes preschool, kindergarten, elementary schools, and junior high schools. Intermediate education includes senior high schools, vocational schools, and junior colleges. Advanced education includes universities that offer bachelor's degrees, master degree level, and doctoral degree level.

According to Cheng (2008), a student who has formal education from preschool to doctoral degree from the university spends at least 22 years of schooling. It includes two years of preschool, six years of elementary school, three years of junior high school, three years of senior high school, four to seven of college of university, one to four years of master program, and two to seven years or doctoral program.

In Taiwan, preschool and kindergarten education is not required of children who are between the ages of two and seven years. Parents may decide to let their children go or not to go to preschool or kindergarten. However, everyone is required to have six years of elementary school and three years of junior high school because elementary education and junior high school education are compulsory. According to Cheng (2008), "Taiwan's nine-year compulsory education was first defined by the Compulsory Education Regulations in 1982" (p. 16). Every six-year-old child must enter elementary school without taking any entrance exam. After six years in elementary school, each sixth grader graduates in June and receives a primary school diploma and is not required to take any test to enter public junior high schools. After another three years in junior high school, they will receive the junior high school diploma. "The basic coverage of the present nine-year compulsory education, has a strong emphasis on mathematics, physics, chemistry, and other sciences." (p. 16).

Once they graduate from junior high school, every student has to take the entrance exam in order to enter senior high school. High schools follow two tracks. One is an academic track and the other is a vocational track. If the students choose to follow the academic track in senior high school, they will take college entrance exam after these years to enter college. On the other hand, the students can also choose to take three-year vocational high school or five-year junior college. After three or five years, they can still take an entrance exam to enter the University of Technology. Students who want to enter master's programs and doctoral programs in Taiwan also need to take an exam.

Preschool and Kindergarten Education in Taiwan.

According to Cheng (2008), the compulsory education in Taiwan does not include kindergarten education which serves children who are between two to seven year old. According to Wei (2007), in the 1980's, because family structure changed from large families to core families, and living quality is getting better, more and more women went to work after they were married. The number of children who are going to preschools or kindergartens is therefore, increasing. Moreover, Yeh (2007) found in 2005 that in Taiwan, 45.8% of children up to the age of three were taken care of by their mothers. When the children turn three years old, 40.14% attend kindergarten. In general, parents emphasize the quality of education, especially early childhood education. Currently, the preschool and kindergarten classes in Taiwan are managed by different departments of the government. The preschools and day care centers belong to the Department of Social Welfare, Ministry of Interior and serve children from birth to six years. Kindergarten in Taiwan is under the Ministry of Education and it serves four to six year old children (Cheng, Wei). Because preschool and kindergarten are managed by

different departments, preschool and day care center teachers and kindergarten teachers have to meet different requirements. Wei notes that kindergarten teachers need to graduate from early childhood education programs and receive kindergarten teacher license. Day care center and preschool teachers need to graduate from early childhood care, child development, or other programs related to early childhood care and development.

Wei (2007) notes that in Taiwan, private kindergarten makes up 75% of the schools while public kindergarten makes up only 25% of the school. The kindergarten program needs to follow what is called the Kindergarten Curriculum Standards. The Kindergarten Curriculum Standard includes health, play, music, work, language, and social skill development. In each kindergarten or preschool, the manager can use different early childhood pedagogy to teach children, such as Montessori pedagogy, Unit Thematic pedagogy, or Project approach.

According to Chou (2007), current kindergarten managers and teachers are more creative in the way they teach. However, Chou evaluated current kindergartens and notes there are four characteristics which most kindergartens should think about. First, children in kindergartens have to learn many subjects. The children should learn subjects such as language arts, science, and mathematics as well as extra-curricula such as computer skills and English. Second, even though there is the Kindergarten Curriculum Standards, most teachers like to use textbooks and give children worksheets. Third, most kindergartens use teacher-centered method. It means students have the same curriculum and most teachers like to work with large number of children rather than utilize small group activities. Because teachers control the student's learning most of time, the

children may not be encouraged to be creative and may not develop critical thinking. Lastly, most kindergartens emphasize English. Recently, more and more parents want their children to learn English; therefore, most kindergartens use English to teach the children during classes time when "No Chinese" is allowed. Chou thinks that most foreign teachers who teach in these kindergartens do not have teaching and early childhood education degrees and they may not know how to teach language to the young children.

History of Montessori Education in Taiwan

Montessori education is prevalent not only in western countries but also in Asian countries such as Taiwan, South Korea, and India (Wei, 2007). According to Wei, Taiwan has its own early childhood education approach which is Unit Thematic pedagogy and it becoming more and more professional; however, in recent years, other early childhood education approaches have been coming into Taiwan. The most typical western type early childhood education approaches in Taiwan are based on theories of Jean Piaget and Maria Montessori. Currently, there are about 1,330 accredited Montessori preschools and kindergartens in Taiwan (Chinese Montessori Foundation for Early Childhood Educational Research, 2008).

Montessori education was introduced in Taiwan in 1985 (Chien, 2007). According to Y. H. Yu (personal communication, September 22, 2008), in a 1915 conference, one educator introduced Montessori education to Mainland China. This was the first time people in China came to know about Montessori education; however, after this conference, no one talked about it until about 1970. In 1970, Hsin-Jen Hsu started to study Montessori education, translate Montessori principles into Chinese and tried to

make Montessori material available in Taiwan. He also opened a kindergarten in which he used Montessori approach; but it was very hard to practice Montessori method because at that time, the early childhood curriculum and approach in Taiwan were very different from the Montessori approach (Chien).

Sister Yu (Y. H. Yu, personal communication, September 22, 2008) who had a Catholic background went to Italy to learn Montessori early childhood education from 1978 to 1979. Other Sisters and educators followed Sister Yu and received training in Italy (Chien, 2007). According to Yu, after coming back from Italy, she worked with children with special needs and she herself tried to develop Montessori materials. She found that these children's learning ability was enhanced through working on Montessori materials. Therefore, in 1981, the Catholic Church asked her to be a principal of a kindergarten program. During her time as kindergarten principal, she went to Japan to visit Montessori kindergarten classes there. In 1985, she started to use Montessori approach in her kindergarten. At that time, there were 30 children in one class and she and her assistant who received Montessori training, used the Montessori way to teach these children. During this time, journalists interviewed Sister Yu and the Montessori Method was thus introduced through radio and conferences. In 1988, Sister Yu went to Italy again to learn the Montessori teaching methods at the elementary level. Later, her assistant also went to Italy to learn about Montessori education in 1994.

In 1984, Lan Hu opened a Montessori kindergarten school in Taipei (Chien, 2007). After that, the first Montessori kindergarten program was affiliated with the elementary school in Taipei (M. T. Liu, personal communication, September 5, 2008). Liu worked very hard to introduce Montessori education and Montessori materials to

parents, educators, and government officers. In 1985, the Chinese Montessori Foundation was founded. At present, this foundation provides training to Montessori teachers.

Montessori Teacher Training in Taiwan

According to Wei (2007), in western countries, Montessori teachers focus on Montessori method of teaching; however, in eastern countries such as India, China, and Japan, Montessori teachers emphasize Montessori classroom environment and the Montessori teaching materials.

The trainees receive at least 360 hours of training in Montessori theory and they practice working with Montessori materials. After 360 hours of training, the trainees undergo internship in accredited Montessori kindergarten or preschool schools. Some Montessori trainees go abroad to receive a Montessori certificate and some of them do not undergo internship. They just come back to Taiwan and become Montessori trainers. According to Chien (2007), Montessori trainers not only teach trainees to use Montessori materials, but they should also understand early childhood education and child development. In Taiwan, there are many different Montessori teacher training programs. According to Cardinal Tien College of Health Care of Management, (2008) so far, only the Chinese Montessori Foundation gives certificates of approval and is authorized by Ministry of Education in Taiwan.

The Chinese Montessori Foundation for Early Childhood Educational Research (2008) has teacher programs which train people to become professional Montessori teachers. At the end of the program, if the Montessori teacher candidates pass the training, they will become licensed Chinese Montessori Teachers. So far, there has been

over ten thousand teachers who have received Montessori education training in Taiwan. According to Liu (personal communication, September 5, 2008), to be licensed as a Montessori teacher, each trainee needs to have a college degree and take courses on Montessori education such as Montessori Method of teaching, practical life, sensorial education, language arts, and math. In addition, the training requires a nine-month internship (540 hours) in an accredited Montessori kindergarten school. All requirements are based on AMS, but the certificate is approved by the Chinese Montessori Foundation for Early Childhood Educational Research.

On other hand, Chien (2007) thinks that there are a lot of Montessori teacher training centers in Taiwan where after training; every training center will give Montessori candidates its own training certification. This however, does not mean they have passed the American Montessori Society or Association Montessori International teacher training requirements. According to Chien, in the United States, to become a qualified Montessori teacher, one needs to receive Montessori education training and get the certificate or diploma from the Montessori Accreditation Council for Teacher Education (MACTE). However, in Taiwan, there is no such requirement. Therefore, if Montessori teachers in Taiwan want to receive AMS Montessori teacher certificate or AMI Montessori teacher certificate, they have to go to a the accredited Montessori teacher training program in the United States or to an European country (M. T. Liu, personal communication, September 5, 2008).

Montessori Education Set Up and Background

The Montessori Method is a widespread pedagogy intended to educate children from birth to middle school in the United States of America (USA) (Bodrova, 2003;

North American Montessori Teachers' Association, 2008a). The Montessori education system was founded by Maria Montessori who was born in the town of Chiaravalle, Italy. In 1907, Dr. Montessori opened the first Casa dei Bambini (Children's House). This school served the children who came from slum areas in Rome. Her method of teaching eventually came to be called Montessori Method. Montessori Method has been in existence for over one hundred years and Montessori education is still very well-known and popular throughout the world (Kahn, 1995), and is used schools in more than eighty countries (Turner, 2004).

The Montessori approach and materials are used in the same way in different countries. In the present study, the researcher will discuss Montessori early childhood education only in Taiwan and the USA. More than 4,700 private schools, about 300 public elementary schools, and some middle schools use Montessori pedagogy in the USA. Epstein (1990) noted that five to ten public schools which use the Montessori Method are opened every year in the United States.

Montessori schools in Taiwan use the same pedagogy, principles, and materials but in a different language and impart different cultural information. Montessori education has been available in Taiwan for about 25 years. According to Hsu (1987), the first kindergarten which used the Montessori Method was founded in 1984. The next year, the Chinese Montessori Foundation for Research in Early Childhood Education was founded. Even though Montessori education has become a very popular early childhood teaching pedagogy in Taiwan, the first and only accredited Montessori private elementary and middle school in Taiwan was founded by an American educator, Robert Major, in 1999. Ho (2006) points out that even though most of early childhood

pedagogies are from Western countries, only Montessori education is widely used in most kindergartens and preschools in Taiwan.

Montessori Teacher Requirements

Most Montessori Teacher Training programs in USA and Taiwan are either under AMS or AMI. The training programs under AMS are similar to that of AMI. Mostly, individuals intending to become a Montessori head teacher should undergo training and take courses (American Montessori Society, 2008f). Training programs may differ from one another; some programs provide three-year academic courses whereas others provide one year academic course including summer courses (Association Montessori International, 2008). Even though training programs may require different courses, all Montessori candidates in training program for early childhood (age 3 to age 6) should take courses in psychology, child development, philosophy of Montessori education, materials making and observation, course of practical life, sensorial and perceptual development, concept of early mathematics, language development, and cultural studies (American Montessori Society, Association Montessori International). After completing the course work, all candidates should have one year internship and take two seminars. For example, the Department of Education at Oklahoma City University (2008) provides Montessori teacher certification program for early childhood education and elementary school education. The requirement of this program is that the undergraduate student complete 60 hours of course work with a GPA of at least 3.0. The candidates should take courses directly related to AMS certification such as psychology, sensory motor learning, perceptual development, mathematics, language, materials design in addition to two seminars. After completing course work, the candidates should

undergo internship in an approved Montessori school with an approved Montessori supervising teacher for an academic year. During the period of internship, each Montessori candidate should do a project, take a written exam, an oral exam, and make a project presentation. If the candidate passes coursework and internship, she or he can receive the Montessori diploma awarded by the AMS.

Characteristics of Montessori Education

The Montessori approach is based on the teachers' observation of the child's needs and interests with respect to the different cultural backgrounds of the world (North American Montessori Teachers' Association, 2008a). To comprehend Montessori education, it is very essential to understand its four fundamental characteristics. These characteristics are (a) prepared environment, (b) the role of Montessori teachers, (c) parental involvement, and (d) Montessori curriculum and materials.

Prepared Environment

Prepared environment is an important component of the Montessori approach. In the traditional educational programs, the two factors that are important are the teacher and the student (Standing, 1998). In traditional programs, the teachers often stand in front of the room to teach the students, and the students sit in their seats and listen to their teachers. In contrast, in Montessori education, the teacher's and students' interaction is very important which makes environment a new factor that makes it unique. The teachers not only relate to the students but also pay careful attention to the learning environment. Teachers, students, and the environment make a triangle which are interconnected. Referring to the importance of the learning environment, Humphryes (1998) notes that "the environment be well planned and organized with appropriate

materials and experiences for their ages and abilities" (p. 6). The environment has to be safe and should provide for the development of physical health, cognition, emotion, and social interaction.

Standing (1998) states that another purpose of the prepared environment in the Montessori classroom is to let children's learning be independent of adult dominance. As a result, in the Montessori learning environment, children are active learners. In this environment, teachers use student-centered rather than teacher-centered methods to direct student activities. Teachers in this environment are observers, guiding rather than directing their students. Moreover, Standing describes the prepared environment in Montessori classroom consisting of:

- The materials of practical life and extended teaching materials
- Materials of a sensory nature
- Materials and learning content related to the local culture and other cultures
- All materials and learning components that develop the children's religious lives.

In Dr. Montessori's view, the prepared environment should facilitate physical and psychological development. For example, child-sized furniture is used in the classroom (Roopnarine & Johnson, 2005). Teachers must understand their students' interests and needs and prepare activities accordingly. In addition to the materials, freedom, order, beauty, reality and nature, and development of children's community life also are included in the components that relate to the Montessori's prepared environment (Humphryes, 1998; Lillard, 1972; Standing, 1998).

Roopnarine and Johnson (2005) note that "freedom is necessary so that the child can choose from among the materials and experiences offered those that are of most use and interest at any point" (p. 371). Lillard (1972) explained two reasons for the importance of freedom. First, when children have freedom in the environment, they can readily express themselves, which helps educators and parents understand children's psychological development. Second, in an environment of freedom, children have to learn how to do their work independently. Because of this independence, the children have an inner guide for growth. This means that children in the Montessori classroom are developing self-discipline. As a result, children in the free learning environment gain the most benefit from having the opportunity to build up knowledge by themselves. Roopnarine & Johnson agree that the quality of freedom in the Montessori classroom can nurture children's internal development and self-discipline. These two elements complement each other. Standing (1998) explained that when teachers prepare the learning environment, the goal of motivating children should be taken into account. Therefore, children in the prepared environment have freedom to choose their work.

Dr. Montessori stressed that the learning environment for the children must be orderly (Humphryes, 1998). Research shows that order is very essential for learning and development (Lillard, 2005). What is order in a Montessori classroom? According to Lillard (1972), "order means that the child is assured the possibility of a completed cycle of activity in using the materials" (p. 57). Hymphryes states that when the teachers prepare the materials for children, the materials should be put on the shelf from the left side to the right side, from top to bottom, and tools should be arranged from simple to complex. Under this arrangement, the materials in the right bottom are the most difficult

for children. The purpose of order is not only to prepare the children's writing and reading in the future but also to assist the children in setting the goals needed to accomplish their work.

Beauty is required in the Montessori prepared environment because its presence not only encourages children to have positive reaction to their life but also helps them to grow. Lillard (1972) mentions that "true beauty is based upon simplicity" (p. 59). All of the design of the classroom should be of good quality and should be colorful, clean and attractive to the children. The walls do not need to have special decoration; however, they should have paintings by famous artists on the wall and placed at the children's eye level. In the Montessori classroom, adults have to offer real materials for children to manipulate and take care of. Moreover, in the Montessori classroom, there is only one set of materials of one kind. Thus, the children have to learn to share and be patient while their peers are working with a given material. This is because in the real world, it is impossible for two people to have the same thing at the same time (Lillard).

Nature is also part of the Montessori classroom. According to Montessori (1964), children learn by observing nature. They observe how the teachers respect the students, and at the same time, they learn respect for all living things including plants and animals. Through nature, the children have opportunities to self-educate themselves and become confident.

In Montessori classrooms, cooperation and respect for others are two key points that should be used not only by adults but also by children. Students learn social skills from and through their environment. Creating a good learning environment will help children develop a feeling of community life. Dr. Montessori thought that the children

should interact in mixed-age classrooms that span three years. Older children can help and be role models for the younger children in these classrooms. Lillard (1972) believed that "the older child is more sensitive to the nature and degree of help the young child needs." (p. 75)

The Role of Teachers

In Dr. Montessori's view, teachers are part of the prepared environment, so the first thing Montessori teachers do is to prepare themselves well (Montessori, 1964; 1995). In *The Absorbent Mind,* Montessori (1995) states that a teacher first needs to be the guardian of the learning environment. Creating an attractive environment and watching over it are necessary and the "teachers' appearance is the first step in gaining the child's confidence and respects" (p. 277). Dr. Montessori did not call teachers "teacher," but "directress." The main purpose of the directress is to facilitate the development of the students' capacities (Lillard, 1972). Dr. Montessori suggested that the Montessori classroom should include both female and male teachers (Lillard).

What then is the role of Montessori teacher? According to Lillard (1972), the successful Montessori teacher should have the basic knowledge to deal with children's behavior and ability. Therefore, self-education and self-study are necessary for Montessori teachers. Teachers should have an understanding of their responsibility and the purpose of each learning material (Montessori, 1967). This is a very important requirement of a Montessori teacher. Another important role of the teacher is to observe the children carefully. According to Humphryes, (1998) when teachers are undergoing their Montessori teacher training, an important goal is to expand on their observation ability. There are three key areas when observing the children: the child's work, the

child's conduct, and the child's will and discipline (Lillard, 1972). In addition, teachers should have knowledge of child development and an understanding that each child is unique and an individual. In addition to observing children and recording their behavior, teachers in the Montessori classroom should also demonstrate an understanding of the didactic materials and be able to explain the way to use the materials (Montessori).

In the Montessori classroom, the children follow their own motivation to do their work. The teachers' role is to enhance the children's own development and let the children be independent. Maria Montessori (1967) gave teachers four main points to keep in mind: "knowledge of the materials, maintenance of order, perfecting, and giving lessons" (p. 151-152).

In summary, Montessori teachers need to be engaged in self-study and furthering their own growth and development, including classroom management skills. They also need to be good observers of children's development, be able to create additional learning materials and design a well-prepared learning environment to meet students' needs based on their interests and culture. In addition, teachers should utilize positive thinking and be knowledgeable about child development and use different teaching strategies to help each child (Loeffler, 1992).

Parental Involvement

Parental involvement is significant in Montessori education because Maria Montessori strongly considered that parents are the first teachers of the children and parents should therefore play an important role in the children's life and education (Kahn, 1995; Lillard, 1972). Britton (1992) brought up three rules which parents of Montessori children should follow. First, every child has free choice under discipline, so

parents also need to allow free choice to their children within limits. Second, respecting the child is important. Last, parents should understand the child and not impose their own will on the child.

Wentworth (1999) notes that if a school wants to be successful, gaining the cooperation of parents is vital. He also states that parents need to keep in touch with teachers and the school and be familiar with the Montessori approach which the child's teacher uses in the classroom. Montessori believed that the first three years are more important in the child's life than any other period of the child's development and parental influence during this time is important. Therefore, parents need to take responsibility for the child's life and be in charge of the activities of the children when they are at home (Lillard, 1972). In Montessori's view, "The Montessori school is a natural extension of your home" (Kahn, 1995, p. 20). As a result, Montessori schools encourage family and parents to be involved in school activities. An important goal of Montessori schools is to provide parents with an understanding of the child's development at each stage (Lillard, 1996). In addition, parents are welcome to observe the classroom activities and share their child's development and education (Humphryes, 1998).

According to Montessori's theory, each child has an absorbent mind and absorbs information very rapidly. Their learning environment, learning experiences, and interaction with peers and teachers are crucial and meaningful to them. Meanwhile, parental involvement is necessary because parents have a responsibility to understand the child's school life. Parents should be actively involved in the child's educational process. Therefore, it is very significant that homes have close contact with the school.

Curriculum and Materials

Montessori materials are an integral part of the Montessori curriculum. Dr. Montessori explained that the learning materials in the Montessori environment should always be beautiful and attractive as well as in good condition. Once the material is damaged in any way, the teachers should replace it. Children should feel that the materials are new and ready to use. As Kahn (1995) puts it, all materials for the children need to be put on low and open shelves so that children can easily approach the materials they are interested in. In addition, materials of the same level of difficulty should be placed together on the shelf. "Isolation of difficulty" is another key principle in the Montessori class. Roopnarine and Johnson (2005) noted "the isolation of a single difficulty is intended to induce clarity in the child's learning experience and to focus attention on a key concept" (p. 373). For example, when the children learn to build the "Pink Tower," the material focuses only on the concept of size. "Psychological studies have shown that it is necessary to isolate the senses as far as possible if some single quality is to be brought out" (Montessori, 1967, p.102).

The ability to self-correct (auto-education) in the Montessori classroom is another concept that the children learn from materials and environment. Montessori (1967) called this "the control of error" (p. 103). According to Montessori (1967), "the control of error through the material makes a child use his reason, critical faculty, and his ever increasing capacity for drawing distinctions" (p. 103). Through self-correcting, children can develop the ability to solve problems independently and learn to analyze their own thinking to accomplish their goals (Kahn, 1995). Moreover, Montessori materials are designed for both direct and indirect learning (Roopnarine & Johnson,

2005). For example, when a child works with a Montessori material which is called "knobbed cylinder," he not only learns about depth, length, width, and height of different cylinders (direct learning) but also develops fine motor skills when he learns to hold a pencil properly (indirect learning) because he needs to use one thumb and the first two fingers to hold it.

There are four main curricula in Montessori education: practical life (focusing on everyday living), sensorial (focusing on manipulating sensorial materials to develop the five senses), mathematics, and language. The practical life curriculum is about the skills of everyday living (Kahn, 1995). Even though it is called practical life, it is meant to help the child understand his daily life and assist the child's development and independence (Standing, 1998). According to Lillard (1996), practical life includes the activities which imitate cultural norms including taking care of self and environment, orderly manners, and social behaviors, and interactions. Standing also stated that the activities of practical life may be different in different cultures; so curriculum activities should depend on the local and national situation. It is important to present two different materials and curriculum for practical life. One is to let the child learn to take care of himself or herself and the other is let the child understand how to take care of the environment. Kahn identifies four concepts of practical life exercises: "Care of self (buttoning, tying, etc.), care of environment (cleaning, sweeping, etc.), development of social relations (greeting, serving, etc.), and movement (balancing, walking on the line, playing the silent game, etc.)" (p. 12).

The second curriculum of Montessori education is called sensorial, in which children use their five senses to explore the world: "The sensorial materials comprise a

series of objects which are grouped together according to some physical quality such as color, shape, size, sound, texture, weight, temperature, and so forth" (Montessori, 1967, p. 100). Therefore, when children work with sensorial materials, they should classify and express the concepts and develop the skills of music, language, and mathematics. Lillard (1996) notes that children must manipulate Montessori sensorial materials with their hands so that "the hand and the brain act in unison making a mental connection between an abstract idea and its concrete representation" (p. 36). Morrison (2004) notes that sensorial materials have three purposes. First, they are to train the child's senses. Second, they develop visual discrimination for observing the detail of materials which prepares children to read and write. The third purpose is to enhance the children's thinking processes and skills in solving problems.

The two Montessori curricula related to elementary school academics are language and mathematics. Many of the materials used in the practical life and sensorial curricula train children to develop mathematical minds. Pape (1994) states that working with Montessori sensorial materials develops children's mathematical minds and their understanding of spatial concepts, one-to-one correspondence, pattern, logical classification, and ordering – the basic concepts of pre-primary mathematics. After children master the concepts of pre-primary mathematics, they are ready to learn basic mathematics. According to Montessori (1967), the first material to introduce mathematics in the Montessori classroom is a set of ten rods. These give the children the idea of counting. Later, teachers start to introduce the concepts of decimal system, the role of zero, and the four mathematical operations: addition, subtraction, multiplication, and division (Lillard, 1996).

The curriculum of language includes writing and reading. Language is a tool of communication and people understand that everyone needs to use it. Dr. Montessori thought that language development is very essential for the young children during the sensitive period, which is from birth to age of six. All children in the world follow the same sequence of language development; the sensitive period for language acquisition occurs in the child's first six years (Lawrence, 1998; Standing, 1998). In addition to oral and verbal skills, writing and reading must also be learned. Lawrence also believes that the better children's oral skills are, the easier will be writing and reading skills for them. Therefore, in the Montessori learning environment, language constitutes one of the most important aspects of curricula (Soundy, 2003). Montessori strongly believed that writing should come before reading because reading is a consequence of writing (Morrison, 2004). Therefore, when children are using practical life materials, they not only develop the control of movement of hands and eye-hand coordination but also learn to write (Lillard, 1996).

Montessori versus non-Montessori Early Childhood Education

The Montessori curriculum emphasizes the role of teachers, prepared environment, student assessment, and parent involvement. According to the North American Montessori Teachers' Association (2008b), there are several differences between the traditional classroom and the Montessori classroom. First, in the traditional classroom, the teachers use textbooks, pencils, paper, and worksheets as instructional materials, while in the Montessori environment, the teachers prepare their own materials that incorporate the control of error (auto-education) to let the children find the

mistakes by themselves. This task makes Montessori unique because it facilitates the children to develop their problem-solving skills at an early age.

In terms of the students' schedules, the traditional classroom organizes the students' schedules into time blocks and lesson periods. Lillard (2005) pointed out that in a traditional class, all students in the same class have the same curriculum on the same schedule. However, in the Montessori environment, the teachers use an uninterrupted work cycle and allow each child to choose what he/she wants to do. Furthermore, when the children are busy working on materials, the teacher does not interrupt these activities until their work is completely done.

Compared to Montessori education, the curriculum design of traditional education is narrower and more unit-oriented. Traditional education divides subject matter into units. On the other hand, the Montessori curriculum is more global, focused not only on academic learning but also on cultural studies; therefore, the curriculum of Montessori education is integrated with culture. Moreover, the curriculum design is based on each student's physical and psychological development and ability. Because the curriculum needs to meet the students' needs and interest, each student makes progresses to different degrees.

In the traditional education system, students are divided into grades based on their birth dates which does not provide opportunities to learn from other peers who are older or younger than themselves. The Montessori view is contrary to that of traditional education in that Montessori classrooms are multi-age group. Students are grouped with others within three years of age as themselves. For example, children who are three to six years old are in one classroom, whereas children who are six to nine years old are in

another group. The main purpose for multi-age classrooms is for younger children to learn from older children and for older children to assist younger children and be role models to them. Children in the Montessori classroom develop their social skills and understanding of how to interact with others when they work and learn together. In addition, because teachers stay with the same group of children for three years, they understand more about their students including social, emotional, and cognitive development. For the learning process in the classroom, traditional education is more likely to use teacher-centered methods. Under this situation, the students are relatively passive and listen to the instruction of their teachers. Conversely, Montessori education emphasizes child-centered learning in which the students are more active and have more freedom to choose their learning tasks. Teachers in traditional education may give the students report cards to evaluate their learning. However, in Montessori classroom, the teachers observe students daily and use more process-based evaluations. In summary, Montessori education is a child-centered system rather than teacher-centered system. In addition, the key elements such as (a) exceptional Montessori materials, (b) an uninterrupted work cycle, (c) curriculum integrated with cultures, (d) mixed-age classroom, and (e) child-centered curriculum prove Montessori education more flexible and suitable for children's development.

Research on Montessori Education

Studies which Show Positive Learning Outcomes of Montessori Education

Many public schools in the United States are shifting towards Montessori philosophy to teach their students. However, standardized testing is not a part of Montessori education. Studies have been trying to test the validity of the idea that

children who undertake Montessori education cannot score equally well or better than the students who are used to taking standardized tests. Duax (1989) compared the academic achievement of two groups of students from three middle schools: one group who had Montessori experience and another one without Montessori experience in elementary school. Both students in this study were required to take a standardized test known as Iowa Test and Basic Skills. Duax found that the Montessori school graduates showed higher academic performance compared to graduates from non-Montessori schools. Consequently, the researcher believed that Montessori system of education may be applicable for all grade levels and all schools nationwide and may be viewed as a potential method that can enhance critical thinking of the very young children.

In a similar investigation, Lillard and Else-Quest (2006) evaluated the effects of Montessori education on the social skills and academic performance of urban minority children in Milwaukee, Wisconsin, and compared these with that of non-Montessori students. They collected data from two groups of Montessori students. The groups were primary level (3 to 6 years old) and elementary level (6-12 years old). The primary-level students received the Woodcock-Johnson (WJ III) achievement test at the end of kindergarten. The results were, the primary level, the Montessori students had better test scores on standardized mathematics and reading tests. At the elementary level, the twelve-year-old students had to write a short essay. Both Montessori students and non-Montessori students showed similar performance in grammar and spelling, but the Montessori students wrote more inventive sentences with more complex structure.

Research also has shown that students who spent a number of years in Montessori education have greater chance to perform better in their later academic

achievement and performance. Glenn (1989) conducted a study in Portland, Oregon, to investigate the relationship between the number of years the students spent in Montessori school and academic achievement, and found that there was a strong relationship between academic performance and the length of time spent in Montessori classes. Glenn pointed out that the number of years of Montessori education is strongly and positively correlated with the students' English language abilities including reading, writing, grammar, and spelling.

In the same context, Dohrmann (2003) carried out a longitudinal study (the number of years spent in Montessori school) in Milwaukee public schools with and without Montessori programs. The students in this study took two kinds of standardized tests: the ACT and Wisconsin Knowledge and Concepts Examination (WKCE). After comparing scores from the two groups, the Montessori students were found to score higher than the non-Montessori ones on Math and Science tests. In contrast, both Montessori students and non-Montessori students performed equally well on English and social studies. At the end of this study, the researcher suggested that there may be several reasons for the English and social studies results. For instance, the family may facilitate better development of children's language and social studies. However, the overall findings showed that the Montessori program had a positive long-term influence.

Dohrmann, Nishida, Gartner, Lipsky, and Grimm (2007) had similar results of learning outcomes in a public Montessori program. They found that students who had Montessori experience from preschool to fifth grade had higher math and science scores than non-Montessori students, but there were no differences between these two groups in English and social studies test scores.

Manner (1999) conducted a study to compare the academic achievement of Montessori and non-Montessori third grade children in a public school setting in Broward County, Florida. The two groups were required to take the Stanford Achievement Test (SAT) which measured their reading and math skills. In this study, 74 students were tested on vocabulary and reading, and 60 were tested on mathematical concepts of number, computation, and math problem solving. The two groups (Montessori vs. non-Montessori) did not differ in their math scores. Even though the Montessori students were not very familiar with paper and pencil tests, they were able to self-correct errors and solve math problems. However, the Montessori students did perform better than non-Montessori students in reading.

Studies which Show Mixed Results of Montessori Education

The above studies have shown that in general, Montessori pedagogy is perceived as a high-quality education compared to non-Montessori. This conclusion, however, is not always confirmed. Several researchers report that Montessori students show academic performance similar to that of non-Montessori students. Claxton (1982) compared academic achievement of 182 Montessori and non-Montessori kindergarten, first, second, and third grade students in a public school district, in north Texas. The Bilingual Syntax Measure and Metropolitan Readiness Tests were used to measure academic achievement of kindergarten students; the California Achievement Tests were used for first graders and second graders, and the Iowa Test of Basic Skills was used for third graders. Test results showed that there was no difference between Montessori students and traditional students in their academic performance; however, the first

graders in the traditional public school showed better performance than the Montessori students in the California Achievement Test.

Cisneros (1994) conducted a similar study to compare Montessori students' and non-Montessori students' achievement in a public school setting. The outcome of this study was similar to that of Claxton (1982) in that there were more similarities than differences between the two groups of students. Lopata, Wallace and Finn (2005) also conducted a study which compared Montessori and traditional programs in western New York. Academic performance of fourth and eighth graders on a standardized test was used as the dependent measure. The investigators found that there was no difference on academic achievement in language arts and mathematics between students in the Montessori program and the traditional program.

Sometimes, mixed results are obtained. For instance, Fero (1997) gave second, third, fourth and fifth grade students the Comprehensive Tests of Basic Skills, fourth edition (CTBS/4) and used the scores to compare the students' academic performance. The Test of Cognitive Skills (TCS/2) was used for measuring verbal, nonverbal, and memory skills. The results showed that the Montessori students had higher aptitude and achievement test scores than traditional students. On the other hand, the students from traditional teaching method had higher scores in mathematics concepts than Montessori students.

Although the literature of Montessori and non-Montessori methods shows mixed result, Montessori education is often claimed to have positive effects on children's development and overall learning process. One Montessori advocate, Lillard (2005), summarized that Montessori education can lead the children to (a) good collaborative

learning, (b) interactive skills with peers and teachers, and (c) enhancement of their thinking and learning.

Montessori Education and Learning Outcomes in Taiwan

In Taiwan, there has not been much research about the learning outcomes related to Montessori education. Hsu (1995) compared the mathematics ability of five-year-old children who were taught by Montessori education with that of children who were taught through the traditional teaching method. There were 40 children from a non-Montessori kindergarten and 40 children from a Montessori kindergarten in the study. Each child was administered a one-to-one test of The Test of Early Mathematics Ability (TEMA). The results showed that children who have had Montessori experience were better than non-Montessori children on formal mathematics abilities. According to Hsu, the formal mathematics includes reading and writing numerals and subtraction facts. In Hsu's study, Montessori children could read and write four digit numerals and demonstrate knowledge of subtraction application. However, non-Montessori children were much better than Montessori children on counting backward from 20 and counting by 10s. In addition, the children who had Montessori experience from the time they were five years old were not better than non-Montessori children in mathematics. But when the Montessori children had received just one additional year of Montessori education, their math abilities gradually improved. Hsu concluded that even though the children who were from Montessori and non-Montessori kindergartens did not differ in math abilities, Montessori children still had higher mean scores than non-Montessori children.

However, a study by Shen (2005) showed different results from that of Hsu (1995). Shen compared 52 first graders, (26 students from Montessori kindergartens and

26 from non-Montessori kindergartens) on mathematics abilities. The students were administered a mathematics test. In the test, there were 44 mathematics questions including the concept of numerals, calculation, and application. Shen found that the students who did not have Montessori kindergarten experience had better scores on the concept of numerals, calculation, and application than the children who were from Montessori kindergarten. Shen thinks when the Montessori children do not have particular Montessori math materials to facilitate them to solve the math problems, they may not know how to answer the test questions.

Chen (1991) compared Montessori Method and Unit Thematic Method on children's learning outcomes. The researcher selected 53 kindergarten children of which 27 were from Montessori kindergarten and the other 26 were from Unit Thematic Method kindergarten. She found that Montessori children were better in social interaction and had better body movement than the children who were from non-Montessori kindergarten. The Montessori children were also able to interact well with teachers and their peers. In addition, Montessori children had more positive effect on the abilities of daily life, such as taking care of themselves, removing clothes, eating meal by themselves, and going to the restroom. Montessori children also had better developed fine motor skills. In cognitive development, Montessori children had better memory ability and concept abilities. The differences could be because in the Montessori setting, most of the children do their materials by themselves and teachers only demonstrate materials, observe, and make documentation. Also, Montessori children follow their own learning pace. However, in the Unit Thematic Method, the teachers teach the same contents to all children. If the children do not follow the learning contents, they may feel

stressed and this may affect their learning. The researcher also notes that Montessori education focuses more on each child's learning process whereas the Unit Thematic Method emphasizes the child's learning outcome. Therefore, when children are taught through different pedagogies, their learning outcome, social development, physical development, and cognitive development are different.

Studies of Montessori Education and Social Interaction

Elkind (1992) notes that there are four different learning frames in Montessori education: "classroom frames, activity frames, teacher-child frames, and child-child frames" (p. 123-124). In classroom frames, all children work in the classroom at the same time and learn about responsibility, independence, and cooperation among themselves, their teachers, and their peers. Moreover, the children in the classroom manipulate educational materials. Montessori thought that young children need freedom, unlimited time, and freedom from restraints for learning. Therefore, freedom is very important for Montessori children. Elkind stressed that "freedom is a social and emotional as well as a cognitive experience and orientation. Activity frames have an emotional rhythm that further contributes to their social-emotional value" (p. 127).

In Montessori classrooms, teacher-child frames are as important as child-child frames. In the mixed-age Montessori classroom, teachers are required to interact with children and understand the individual child's abilities and needs. Cooperation and modeling are two essentials in Montessori classrooms. Therefore, Montessori education not only enhances the child's academic skills but also develops self-esteem and social skills. Elkind's (1992) idea of child-child frames is the same as that of Lillard's (2005). Lillard stressed that peer learning is very important in Montessori classrooms. The

children in Montessori classrooms are encouraged to work together freely which is expected to facilitate social development.

Most Montessori principles support the importance of the environment and social learning in early childhood classroom. Kahn (1992) notes that even though children in Montessori classrooms usually learn and work with materials individually, a well-prepared environment gives them opportunities to interact with their peers and learn independence and the ability to pay attention. Three studies have assessed the social interaction skills of Montessori students. Yussen, Mathews, and Knight (1980) compared social cognitive skills and memory ability between Montessori and non-Montessori preschoolers in the United States. They found that there was no difference between Montessori students and non-Montessori students in social cognitive skills including communication and recognition of emotions. Seefeldt (1981) also studied the social and emotional adjustment of first graders who had Montessori experiences and those without Montessori experiences, but found no differences between these two groups.

Self-esteem is one of strongest elements that characterize Montessori schools. Castellanos (2002) conducted a study to determine whether there were different levels of self-esteem, self-efficacy, pro-social behaviors, and in stances of physical and verbal aggression between 31 Montessori and 58 non-Montessori students from second to sixth grade. The participants in this study attended two different programs, one in Montessori program and the other traditional program. All participants were in highly-regarded schools, the only difference being the teaching philosophy. At the end of study,

Montessori students had higher scores of self-esteem, self-efficacy, and pro-social behavior and lower scores of physical and verbal aggression than traditional students.

This phenomenon is explained by the fact that Montessori classes contained mixed-age groups of students who were able to help their peers. Under these circumstances, the older children acted as role models to the younger children and therefore had more responsibilities to take care of their peers, which could have helped the Montessori students to gain self-esteem and social skills. Castellanos therefore concluded that there was a positive correlation between Montessori students' self-efficacy and academic achievement. Compared to Montessori students, the students from the traditional system tended to compete with their peers rather than cooperate. As a result, physical and verbal aggression of traditional students was higher than those of Montessori students.

In Taiwan, three studies have examined social skills of Montessori students. Huang (1993) compared social development between Montessori and non-Montessori kindergarten students. She collected data from five kindergarten classes in the north of Taiwan and let eight teachers and 73 parents complete teacher's surveys and parent's questionnaires. Huang created a "Social Skills Rating Scale" that included seven categories: "politeness, relationship with teachers, sympathy, verbal communication, cooperation with peers sharing, and self-regulation" (p. 14). Huang found that Montessori students had better interpersonal skills than non-Montessori students. She also found that social skills of girls were better than those of boys. Huang concluded that teaching experiences and methods and their training programs of teachers may be factors that affect the children's interpersonal skills. In addition, mixed-age classes are a benefit

of Montessori education. Huang found that mixed-aged grouping is a factor that influences children's interpersonal skills by allowing older children to be models to younger children and helps younger children to learn from older ones.

Cheng (1993) conducted a study which compared personal-social development between the students in Montessori and non-Montessori programs in Taiwan. Thirty kindergarten children aged three, four, and five in each group participated in this study. The researcher observed the children and administered tests to evaluate their personal-social development. Cheng found that Montessori children had better coping skills than those who were taught by non-Montessori approach. She concluded that Montessori children had better coping skills because in Montessori classrooms, the students had to work individually and correct their mistakes by themselves. Therefore, they had already developed the ability to deal with the problems in the classroom.

Wu (1994) conducted a study to examine whether the children in mixed-age classes benefit from their social and cognitive development. She found that compared to students in traditional kindergarten in Taiwan, the students who were in Montessori kindergarten classes received benefits from mixed-age classes that had a positive impact on social skills. In addition, Wu observed that teachers in Montessori classroom need to work with the same students for three years. During three years, the teachers become familiar with the students' development and learning styles and understand their needs and interests. Based on each student's unique ability, teachers create various teaching materials to fit the students' abilities and development. She also pointed out that in Montessori classrooms, the older children teach younger peers and younger children learn from older ones, which benefits social development and skills. In summary, there

is a misconception that Montessori students usually work individually and they do not interact with others. This is a misunderstanding of Montessori education. Many research studies reveal clearly that Montessori students had better memory skills, interpersonal skills, and coping skills than non-Montessori students.

Conclusion

In Montessori education, the students are encouraged to cooperate with their peers rather than compete with them. In addition, social interaction with teachers and peers is a vital part of the Montessori classroom. Moreover, teachers have responsibility to observe the children and scaffold their efforts and encourage independence so the children can individually complete their work. This philosophy of scaffolding is related to Vygotsky's theory. Although Montessori's philosophy does not foster standardized tests, NCLB policy requires that all public school including Montessori students in the United States take standardized tests. Chattin-McNichols (1992a) noted that in the United States, every public elementary school student is required to take achievement tests, but the results are irrelevant to Montessori students' learning. Other important elements such as attendance and parent involvement are important in Montessori education. Takacs and Clifford (1988) found that Montessori students have good attendance records, which suggest that the most students attend school daily and are on time. Parents are highly involved in the students' learning including attending open houses and teacher-parent conferences. Thus, parents of Montessori students maintain close contact with the school administration.

According to Chattin-McNichols (1992a), even though many public elementary schools in the United States have adopted Montessori education methods, the biggest

problem is a lack Montessori certified teachers. This is a persistent problem because the process of obtaining training Montessori teachers is a long process. The teacher in the public Montessori schools must have both state teacher certification and Montessori teacher certification. In addition, the fee for obtaining the state certification and Montessori certification is expensive. In fact, some teachers who work in the public Montessori schools do not have both certifications. In Taiwan, kindergarten teachers should in addition, receive an early childhood education teacher license from the Taiwan government to teach in the public kindergarten and to receive accreditation to teach in private kindergarten. When teachers want to become Montessori certified teachers, they also have to receive Montessori teacher training. This is the same problem with the teachers who teach in public schools in the United States. Thus, the issue of Montessori teacher certification is a factor that limits Montessori system of teaching in public schools in the United States as well as in Taiwan.

Chapter 3

METHODOLOGY

Introduction

This present study examined whether first, second, and third grade Taiwanese students who received Montessori early childhood education for at least one year and those who received non-Montessori early childhood education obtain different scores in language arts, mathematics, and social studies tests. This study also investigated whether the length of time the students have spent in Montessori early childhood education programs has a positive impact on the students' test performance. This chapter describes the methodology used in this study. It includes the following items: (a) research questions, (b) research hypotheses, (c) research design, (d) setting, (e) participants, (f) instrumentation,(g) data collection, (h) methodology, (i) data analysis, and (j) the results and (k) summary.

Research Questions

The present study raised three questions. They are:

1. Do the first grade students who have attended at least one year of Montessori early childhood education programs (preschool and kindergarten) in Taiwan obtain higher scores on the Chinese version of the Peabody Picture

Vocabulary Test-Revised (PPVT-R) and Social Studies Kindergarten Test (SSK-T) than the first grade students who attended non-Montessori early childhood education programs?

2. Do elementary students (grade one to three) who have attended at least one year of Montessori early childhood education programs (preschool and kindergarten) in Taiwan obtain higher scores on tests in the subjects of Chinese language arts, math, and social studies than students who attended non-Montessori early childhood education programs?
3. Is there a significant difference between the number of years the first grade, second grade, and third grade students have had Montessori early childhood education and their scores on the Chinese language arts, math, and social studies?

Hypotheses

The null hypotheses for this quantitative research were as follows:

1. There is no significant difference in Chinese language ability scores on the PPVT-R, SSK- T, Chinese language arts, vocabulary and reading comprehension scores on the Elementary School Language Ability Achievement Test (ESLAAT), math scores on the Elementary School Mathematics Ability Achievement Test (ESMAAT), and social studies scores on the Social Studies Ability Achievement Test (SSAAT) between the first grade students who have had Montessori early childhood experiences and those who have had non-Montessori early childhood education experiences.

2. There is no significant difference in Chinese language arts, vocabulary and reading comprehension scores on the ESLAAT, math scores on the ESMAAT, and social studies scores on the SSAAT between the second grade students who have had Montessori early childhood experiences and those who have had non-Montessori early childhood education experiences.
3. There is no significant difference in Chinese language arts, vocabulary and reading comprehension scores on the ESLAAT, math scores on the ESMAAT, and social studies scores on the SSAAT between the third grade students who have had Montessori early childhood experiences and those who have had non-Montessori early childhood education experiences.
4. There is no significant difference between the number of years the first grade students who have had Montessori early childhood education and their scores of the PPVT-R, SSK-T, ESLAAT, ESMAAT, and SSAAT.
5. There is no significant difference between the number of years the second grade students who have had Montessori early childhood education and their scores of the ESLAAT, ESMAAT, and SSAAT.
6. There is no significant difference between the number of years the third grade students who have had Montessori early childhood education and their scores of the ESLAAT, ESMAAT, and SSAAT.

Research Design

This study was designed to examine the differences in the learning outcomes of first grade, second grade and third grade Taiwanese students who had Montessori early childhood education experience and those who had non-Montessori early childhood

education experience. Six measurements were considered: the PPVT-R (Chinese version), SSK-T, ESLAAT, ESMAAT, SSAAT, and a Student Background Information Questionnaire.

This research design had three parts. The first part compared the first grade students who had Montessori and those who had non- Montessori experience on the PPVT-R and SSK-T. In order to understand the first grade students' language abilities, the researcher and the first grade homeroom teachers used PPVT-R to assess each individual. Moreover, to compare differences on social studies abilities, the researcher and the first grade homeroom teachers gave each student the test of SSK-T individually. The second part compared first, second, and third grade students' who received Montessori preschool and kindergarten education with those who did not receive Montessori preschool and kindergarten. Learning outcomes were evaluated using language arts, mathematics, and social studies based on the results of each achievement test. In this study, the independent variable was the teaching methods and with two different categories: Montessori and non-Montessori teaching methods. The dependent variable was the students' learning outcomes of language arts, mathematics, and social studies on the achievement tests administered before the end of 2008 fall semester. The third part measured whether there is a significant difference between the number of years of Montessori class attendance of early childhood education programs and students' learning outcomes. The independent variable was the length of years of attending Montessori early childhood education programs whereas the dependent variable was the students' learning test scores in the areas of language arts, math, and social studies.

Setting

The target school in which participants of this study were recruited is a private Catholic elementary school in Taipei City, Taiwan. In Taiwan, the elementary schools have grade one to six. This school in which the study was conducted was founded by "a former Provincial Superior of the Congregation of the Immaculate Heart of Mary (CICM)" in 1959 and this school has kindergarten, elementary school, the music experiment classes, in addition to the special education classes (Guangren Catholic Elementary School and Kindergarten, 2008). Each grade has four sections and includes one music experiment section, and one homeroom teacher. In this school, there are eight sections in kindergarten which use Montessori Method. In kindergarten, each class has two homeroom teachers with 30 children. In elementary school, there are 24 classes, six music experiment classes, and four special education classes. In kindergarten, they serve 210 to 240 children. In the elementary school there are a total of 1,204 students.

Participants

The participants of this study were 196 first, second, and third grade students who are enrolled in the private Catholic elementary school in Taipei City, Taiwan in 2008-2009 academic year. The participants in the present study were 35 first grade students, 35 second graders and 28 third graders who had Montessori early childhood education and 35 first grade students, 35 second graders, and 28 third graders who had non-Montessori early childhood education experience. Thus, there were 98 students who have had Montessori instruction for one or more years and there were 98 students who have had non-Montessori instruction.

Instrumentation

Six instruments were used in this study: ESLAAT, ESMAAT, and SSAAT which were used to measure academic achievement of language arts, mathematics, and social studies of first, second grade, and third grade, PPVT-R (Chinese version) and SSK-T. The last two tests were administered individually to the first graders to evaluate their language abilities and social studies abilities. The Student Background Information Questionnaire designed by the present researcher was used for collecting information about each student's parent's educational levels and backgrounds. Administering the PPVT-R and SSK-T to first graders, who just graduated from kindergarten, allows the researcher to better assess the first graders understanding of language and social studies abilities. For second graders and third graders, PPVT-R and SSK-T may be too easy and inappropriate instruments to them.

Achievement Tests

The ESLAAT for first grade, second grade and third grade and ESMAAT for first grade, second grade and third grade had been developed by two professors (Chou & Yeh, 2007) using the standards of the Nine-Year Integrated Curriculum set by the Ministry of Education in Taiwan.

The ESLAAT (Chou & Yeh, 2007) for First Grade was used for students enrolled in the first grade, The ESLAAT for Second Grade was used for students enrolled in the second grade and the ESLAAT for Third grade was administered to students enrolled in the third grade. Even though each school in Taiwan uses different textbooks, the test is compiled from the test bank drawn from various textbooks.

The ESLAAT has five sections and 40 questions each for first and second graders, and 50 questions for third graders. These tests assess pin-yin, vocabulary, and reading comprehension. The pin-yin test assesses the ability to recognize Chinese characters with the aid of the phonetic symbols. The vocabulary test supplies pin-yin and asks the students to match them with the Chinese characters. The reading comprehension test lets the student read three to four articles and asks them questions from the articles. Students have 40 minutes to complete the tests, including time for the teacher to explain and distribute the instrument. The reliability of ESLAAT was investigated by Chou and Yeh (2007) who administered it to 203 first graders, 218 second grade students, and 203 third graders in northern, middle and southern parts of Taiwan. They report a split-half reliability and consistency of ESLAAT (.69) and Cronbach's alpha (.84) for first grade, split-half reliability (.79) and Cronbach's alpha (.90) for second grade, and split-half reliability (.88) and Cronbach's alpha (.91) for third grade.

In ESMAAT for First Grade, Second Grade, and Third Grade has 30 questions for first and second grades each and 40 questions for the third grade. It is divided into five areas: numbers, algebra, geometry, graphs, and solving problems. The tests for first graders and second graders are administered as group test and take around forty minutes. The test itself takes thirty minutes to complete; 10 minutes are used for the homeroom teachers to explain, administer and collect the tests. The test for third graders takes fifty minutes to complete and ten minutes for teachers to explain the test. In order to see whether the ESMAAT has high consistency and reliability, Chou (2007) administered ESMAAT to 206 first grade, 200 second grade, and 202 third grade Taiwanese students. Based on the students' scores of ESMAAT, the following results were obtained: split-

half reliability (.71) and Cronbach's alpha (.83) for first grade, split-half reliability (.75) and Cronbach's alpha (.74) for second grade, split-half reliability (.80) and Cronbach's alpha (.84) for third grade.

SSAAT was used for measuring measure students' social studies competency. The tests for first grade, second grade, and third grades are compiled by the present researcher from a CD-ROM test bank which was developed by the textbook publisher. The researcher asked the teachers who are teaching social studies to select 55 appropriate questions from the test bank. The researcher randomly selected 33 questions for first grade, 35 questions for second grade, and 39 questions for third grade. A field study was conducted to determine the reliability of the test. A total of 30 students each from first grade, second grade and third grade took the SSAAT. Based on the students' scores, the SSAAT for first grade's Cronbach's alpha was found to be (.74), The SSAAT for second grade's Cronbach's alpha was (.80), and the third grade of SSAAT's Cronbach's alpha was (.83).

Peabody Picture Vocabulary Test-Revised (PPVT-R Chinese Version)

PPVT-R (Chinese Version) is an individual test designed by Lloyd M. Dunn and Leota M. Dunn in 1981. In 1994, Lu and Liu modified Dunn and Dunn's PPVT-R and translated it into Chinese (Lu & Liu, 2008). In the Chinese version, each test has 125 words and each word is associated with four black and white pictures. The homeroom teacher or researcher read the word and then the student selects which one of the four pictures goes with the word. During standardization, the test was administered to 886 children whose age ranged from 3 to 12 years. The split-half reliability of the test is .95 and test-retest reliability is .90. In the present study, the researcher and the first grade

homeroom teachers used this test to assess first graders' Chinese word knowledge individually.

Social Studies Kindergarten-Test (SSK-T)

SSK-T was designed by the present researcher to test the first graders who enter elementary school level for the first time. It may be recalled that Montessori education focuses on Practical Life, Sensorial area, Language Arts are, Math area, and Cultural Studies area. Whether the first graders who had Montessori early childhood experience have a better knowledge than non-Montessori students was determined by using SSK-T. SSK-T has 19 questions and each question has two pictures on the card. The researcher sits across from the student and reads a question. For example, the researcher reads a question "which is a map of Taiwan?" The student has to point out the correct picture on the card. The SSK-T was based on the kindergarten standards and developed by the researcher and examined by a committee member to assure valid testing procedures. The committee member that examined the test was a professor in early childhood education field. Since this test was developed by the researcher, a field study was required. The present researcher did a field study on 23 graduates from Montessori kindergarten in July, 2008. Reliability was .78 on the Cronbach's Alpha.

Student Background Information Questionnaire

The demographic questionnaire was designed by the present researcher. There were nine questions which sought information about each participant's school, class, gender, date of birth, student ID number, parents' highest education, the length of study at early childhood education programs, the name of early childhood education programs, and whether or not a child attended a cram school which is a after school program to

enhance students' academic performance. All the variables were related to this study. Originally, parents' occupation and family socioeconomic status were included in the Students Background Information Questionnaire. Since most of parents did not want to answers these two questions, the researcher eliminated these two questions. The questionnaire took participant's parents approximately three minutes to answer the nine questions.

Data Collection

At the beginning of the study, a letter seeking the permission to conduct the study was sent to the school's principal. Once permission was obtained, one hour was spent in the school with all the first grade, second grade and third grade homeroom teachers to explain the study and data collection procedures. The researcher gave each homeroom teacher about 50 parent consent forms. After obtaining each parent's permission, parents also needed to fill out the Students Background Information Questionnaires. The researcher spent early morning, break time, and after-school program time to administer each first grader PPVT-R and SSK-T which took about 15 to 20 minutes per child. At the end of the fall semester, the first graders, second graders and third graders were administered the ESMAAT, ESLAAT, and SSAAT as group tests. Each test took about 40 to 50 minutes on three different days. Based on Students' Background Information Questionnaires, the students who were taking the after-school program to receive extra help in academic learning did not take in the present study. Then the researcher randomly selected 98 first grade, second grade, and third grade students with Montessori early childhood education experiences and randomly selected

98 students with similar background who did not have Montessori early childhood education experiences.

Procedures

Prior to conducting this study, the principal in a private elementary school in Taipei City, Taiwan was contacted and given a verbal explanation of this study. A letter asking permission to conduct this study was also sent to the principal. After obtaining the principal's consent, the researcher met with fifteen homeroom teachers of the first, second and third grade and spent one hour in explaining the purpose of this study and the nature of the test instruments. Each homeroom teacher received a packet containing 50 copies of the parental consent forms and 50 copies of the Students Background Information Questionnaire.

During class time, the homeroom teachers distributed parental consent forms to the students. After obtaining parental permission, the homeroom teachers asked students to take Students Background Information Questionnaires to their parents. Students were reminded to return completed surveys to their homeroom teachers. One hundred and twenty one first, 131 second, and 88 third students' parents gave permission to participate in this research and 73 first, 87 second, and 81 third students' parents refused their child to participate in this study. Then, the present research was based on the Students Background Information Questionnaire to select the students who had Montessori early childhood education and who did not have Montessori early childhood education. In addition, the students who were attending the cram school were not included in this study. Each of the first grades was administered PPVT-R and SSK-T individually. The researcher and the first grade homeroom teacher spent 15 to 20

minutes to test each first grader. Each homeroom teacher scheduled 40 minutes on three different days to administer ESMAAT, ESLAAT, and SSAAT for language arts, mathematics, and social studies. Before each test, the teachers told all the students, "this test will not impact your grades. This test will review your learning of first grade, second grade or third grade. If you know the answer to the question, just write it down. If you do not know the answer, it is okay. Do not worry and move on to the next question." During the 40 to 50 minute testing period, the teacher took five minutes to explain and administer the test and the students had the remaining 35-40 minutes to complete the test. After parents and students had completed Students Background Information Questionnaires, ESMAAT, ESLAAT, and SSAAT answers were collected from homeroom teachers. ESMAAT, ESLAAT and SSAAT were scored by the researcher. All tests and surveys were kept in a confidential, secured location. After data collection and analysis, all results will be retained in a secured location for three years.

Data Analysis

Students who have had Montessori experience were put in the experimental group and non-Montessori students were put into the control group. The data were analyzed using *Statistical Package for the Social Sciences* (SPSS) version 16.0.

A One-way Multivariate Analysis of Variance (One-way MANOVA) was used to test three research questions. If MANOVA is significant, it was followed by univariate ANOVA's. The first research questions was whether first grade students who have attended Montessori preschool and kindergarten classes obtain higher scores in PPVT-R and SSK-T than non-Montessori students. The independent variable was teaching method and the dependent variables were the scores of PPVT-R and SSK-T.

The next question was whether students who had attended Montessori early childhood programs obtain higher scores on ESLAAT, ESMAAT and SSAAT of language arts, mathematics, and social studies for first grade, second grade and third grade than students who attended non-Montessori preschool and kindergarten programs. One-way MANOVA was used to examine the differences between students who were attended Montessori classes and those who were in non-Montessori classes. The independent variable was teaching method (Montessori Method and non-Montessori method) and the dependent variable was students' learning outcomes on PPVT-R, SSK-T, ESLAAT, ESMAAT, and SSAAT. One-way MANOVA is a statistical procedure to test the significant differences between two levels (groups) and include multiple dependent variables (Mertler & Vannatta, 2005). The reason for One-way MANOVA was because only MANOVA can include several dependent variables. According to Mertler &Vannatta, "MANOVA tests whether mean differences among groups on a combination of dependent variables are likely to have occurred by chance" (p. 120). Moreover, since there were several dependent variables in this study, MANOVA can measure more than one dependent variable with one independent variable (two levels); it is not just like T-test which is only can test one dependent variable. Therefore, first and second research questions used MANOVA to test the significance of differences between the scores of the two groups, students who attended Montessori kindergarten and the students who attended non-Montessori kindergarten.

The next question was whether the numbers of years of attending Montessori school has a significant difference to the students' learning outcome as seen in their achievement test scores in Chinese language arts, vocabulary, reading comprehension,

math, and social studies. One-way MANOVA was computed to determine whether there is significant difference between the number of years in Montessori classes and achievement scores. First and second grade students who attended Montessori kindergarten were divided into three groups: those who had Montessori education for one year, two years, and three years. However, since there were only very few third graders who attended Montessori kindergarten for more than three years in this sample, the researcher only selected the third grade students who had attended Montessori kindergarten for one year and those who attended Montessori classes for two years. The number of years of Montessori school attendance was the independent variable and students' test scores on PPVT-R, SSK-T, ESLAAT, ESMAAT, and SSAAT were the dependent variable.

The researcher used standard scores to run MANOVA for PPVT-R. and raw scores to run MANOVA for the rest of tests. This is because the researcher developed the SSK-T and SSAAT and two standardized tests which are ESLAAT and ESMAAT did not provide the standard scores. The standard mean of PPVT-R is 100. The researcher used the raw scores to find out the average scores for the other tests. Since the present study is looking for intergrades' academic performance but not comparison of different grade levels, the raw scores may not affect the significant difference between the groups.

Summary

The purpose of the present study was to examine whether Taiwanese students from first grade, second grade and third grade who received Montessori early childhood education obtain different scores on tests of language arts, math and social studies as

compared to students who did not have Montessori experience. The sample was selected from first, second and third grades from one private Catholic elementary school in Taipei City, Taiwan. In this elementary school, a total of 98 first, second, and third graders who had Montessori early childhood education experience were selected as the treatment group. Another 98 first, second, and third graders who did not have Montessori early childhood education experience were chosen at random as the comparison group. Six instruments including Students Background Information Questionnaires, PPVT-R, SSK-T, ESMAAT, ESLAAT and SSAAT were used in this study. Parents who agreed to let their child to participate in this study completed the Students Background Information Questionnaire. The first grade students were tested on PPVT-R and SSK-T individually. All students were administered tests of language arts, mathematics, and social studies (ESLAAT, ESMAAT, and SSAAT). One-way MANOVA were used for statistical analysis of the data.

Chapter 4

RESULTS

Introduction

The purpose of this study was to examine whether Montessori early childhood education has an impact on the Taiwanese first, second, and third graders' test performance in language arts, mathematics, and social studies. In addition, this study also investigated whether the length of time the students have spent in Montessori early childhood education programs has a positive impact on the students' test performance.

A total of 196 elementary students participated in this study. Ninety-eight first, second, and third grade students who had had Montessori early childhood education experiences were placed in the experimental group. Following this, 98 first, second and third grade students who were taught by early childhood education other than Montessori pedagogies were placed in the comparison group. All participants took the achievement tests on language arts, mathematics, and social studies. Besides taking the achievement tests, the first grade students were also administered the PPVT-R and the SSK-Test individually. The data consisted of the participants' test scores which were analyzed using SPSS version 16.0. The scores of achievement tests including ESLAAT, ESMAAT, SSAAT, and SSK-T were used as raw scores in the analysis. In addition, the

researcher used students' standard scores of the PPVT-R for the statistical analysis. The present study attempted to answer three research questions; corresponding null hypotheses were also set up. The three research questions of this study were:

1. Do the first grade students who have attended at least one year of Montessori early childhood education programs (preschool and kindergarten) in Taiwan obtain higher scores on the Chinese version of the PPVT-R and SSKT than the first grade students who attended non-Montessori early childhood education programs?
2. Do elementary students (grade one to three) who have attended at least one year of Montessori early childhood education programs (preschool and kindergarten) in Taiwan obtain higher scores on the subjects of Chinese language arts, math, and social studies than students who attended non-Montessori early childhood education programs?
3. Is there a significant difference between the number of years the first, second, and third grade students who have had Montessori early childhood experience and their scores on the Chinese language arts, math, and social studies? In other words, does the length of Montessori experience have a positive effect on achievement scores?

Based on three research questions, six hypotheses were tested in this study. The six null hypotheses for this quantitative research are as follows:

1. There is no significant difference on the PPVT-R (Chinese Version) and SSK-T, Chinese language arts, vocabulary and reading comprehension scores on the ESLAAT, math scores on the ESMAAT, and social studies scores on

the SSAAT between the first grade students who have had Montessori early childhood experiences and those who have had non-Montessori early childhood education experiences.

2. There is no significant difference in Chinese language arts, vocabulary and reading comprehension scores on the ESLAAT, math scores on the ESMAAT, and social studies scores on the SSAAT between the second grade students who have had Montessori early childhood experiences and those who have had non-Montessori early childhood education experiences.
3. There is no significant difference in Chinese language arts, vocabulary and reading comprehension scores on the ESLAAT, math scores on the ESMAAT, and social studies scores on the SSAAT between the third grade students who have had Montessori early childhood experiences and those who have had non-Montessori early childhood education experiences.
4. There is no significant difference between the number of years the first grade students who have had Montessori early childhood education and their scores of the PPVT-R, SSK-T, ESLAAT, ESMAAT, and SSAAT.
5. There is no significant difference between the number of years the second grade students who have had Montessori early childhood education and their scores of the ESLAAT, ESMAAT, and SSAAT.
6. There is no significant difference between the number of years the third grade students who have had Montessori early childhood education and their scores of the ESLAAT, ESMAAT, and SSAAT.

Statistical Data Analysis

The hypotheses one through three were set up to answer the first and second research questions. Hypotheses four through six were tested to answer the third research question. Since very little research in Taiwan relate to the Montessori teaching pedagogy and the elementary students' achievement performance, the present study has to be considered exploratory. Multiple One-way MANOVAs with Post Hoc F's were used to analyze the results and effect sizes. If MANOVA is significant, it was followed by univariate ANOVA's.

A one-way MANOVA is used to analyze data when there is one or more independent variables and more than one dependent variables to control the relationship among the dependent variables (Green & Salkind, 2005). In brief, a one-way MANOVA tests "the significance of group differences" (Mertler & Vannatta, 2005, p. 119). If each dependent variable is not correlated with other dependent variables, then separate ANOVAs can be used. In the present study, the independent variables were Montessori method and non-Montessori methods. The dependent variables are the scores of the participants on the following achievement tests: language arts, vocabulary, reading comprehension, math, and social studies. For the first graders, they were also administrated PPVT-R and SSK-T.

The first hypothesis states that there is no significant difference between the first grade students who have had Montessori early childhood experiences and those who did not have Montessori early childhood education experiences in the following tests: Chinese language ability scores on the PPVT-R, Chinese social studies scores on the SSK-T, Chinese language arts, vocabulary and reading comprehension scores on the

ESLAAT, math scores on the ESMAAT, and social studies scores on the SSAAT. As noted earlier, the hypothesis was tested by using a one-way MANOVA.

First Grade Montessori Students versus Non-Montessori Students

The first graders' mean and standard deviations of test scores are presented in Table 4.1. The results of the MANOVA found a significant difference between the two groups in the composite scores of language arts and math. The Wilks's lambda multivariate F was used for interpreting MANOVA results. In the first grade scores, the Wilks's Λ .84 is significant, $F(5,64)=2.44$, $p<.01$. Since the difference was significant, univariate F for the separate variables were calculated (See Table 4.2 and Table 4.3). The univariate ANOVA indicated there were no differences for PPVT, $F(1,68)=.95$, $p>.05$; SSK-T, $F(1,68)=3.49$, $p>.05$ and social studies, $F(1,68)=2.12$, $p>.05$. Language arts and math scores of ESLLAAT and ESMAAT were statistically different between the two groups. Language art scores was $F(1,68)=10.96$, $p<.05$ so was MANOVA of math scores, $F(1,68)=4.46$, $p<.05$. The effect sizes for language arts scores was .75 and math scores was .50.

Since language arts scores are composite scores and there was significant difference between the two groups in vocabulary and reading comprehension, the researcher analyzed further the two components, vocabulary and reading comprehension in ESLAAT. Table 4.4 presents Montessori Method and non-Montessori method in vocabulary and reading comprehension. MANOVA result showed the Wilks's $\Lambda=.84$, $F(2,67)=7.74$, $p=.01$. The group differences were significant for vocabulary and reading comprehension respectively, $F(1,68)=8.69$, $p<.05$, *and* $F(1,68)=330.00$, $p<.05$ (See

Table 4.5). The effect sizes were .75 for language arts, .65 for vocabulary scores, and.59 for reading comprehension scores.

Table 4.1

Descriptive Statistics of the First Grade Students' Scores

	Montessori (n=35)		Non-Montessori (n=35)		
Subject	Mean	*SD*	Mean	*SD*	Effect Size
PPVT-R	115.49	11.84	112.69	12.21	.23
SSK-T	16.86	1.90	15.91	2.31	.41
Language arts	24.03	9.71	16.71	8.75	.75
Vocabulary	14.43	6.21	10.40	5.19	.65
Reading Comprehension	9.60	4.26	6.74	4.86	.59
Math	20.20	7.39	16.49	7.33	.50
Social Studies	23.00	7.16	20.29	8.39	.32

Table 4.2

MANOVA for the First Grade Students' Test Scores

Wilks's Lambda	Value	*F*	Hypothesis *df*	Error *df*	Sig.	Partial Eta Squared
	.84	2.44 a	5.00	64.00	.04	.16

Note: a. exact statistic

Table 4.3

ANOVA Results of between Subjects Factor with Corrected Model

Source	Mean Square	*F*	Sig.	Partial Eta Squared
PPVT-R	137.20	.95	.33	.01
SSK-T	15.56	3.49	.06	.04
Language Arts	936.23	10.96	.00	.14
Math	241.43	4.46	.04	.06
Social Studies	128.93	2.12	.15	.03

Table 4.4

MANOVA of Vocabulary and Reading Comprehension of First Grade Students' Test Scores

Wilks's Lambda	Value	*F*	Hypothesis *df*	Error *df*	Sig.	Partial Eta Squared
	.84	4.74 a	2.00	67.00	.01	.12

Note: a. exact statistic

Table 4.5

Vocabulary and Reading MANOVA Results of between Subjects Factor with Corrected Model

Source	Mean Square	*F*	Sig.	Partial Eta Squared
Corrected Model	284.01	8.69	.00	.11
Intercept	10788.01	330.00	.00	.89

Second Grade Montessori versus Non-Montessori Students

Null hypothesis two states there is no significant difference in Chinese language arts, vocabulary and reading comprehension scores on the ESLAAT, math scores on the ESMAAT, and social studies scores on the SSAAT between the second grade students who have had Montessori early childhood experiences and those who have had non-Montessori early childhood education experience. Table 4.6 presents means and standard deviation of language arts, math, and social studies scores between second grade students who had Montessori preschool and kindergarten experience and those

who did not have Montessori preschool and kindergarten experience. The second graders who had Montessori preschool and kindergarten experience had slightly higher mean scores than second graders who did not have Montessori preschool and kindergarten experience.

Comparison of the second grade students' achievement test scores between those who attended Montessori preschool and kindergarten and those who attended non-Montessori preschool and kindergarten was accomplished using a one-way MANOVA. The overall MANOVA result shows that there was significant difference between the two groups on the dependent variables (language arts, math, and social studies), Wilks's Λ=.88, $F(3,66)$=2.97, p=.03 (See Table 4.7). Table 4.8 shows the results of univariate ANOVA on language arts, math, and social studies. There was significant difference between two groups in language arts, $F(1,68)$=9.16, p=.00, but the scores on math and social studies tests were not significantly different between the two groups. Since language art scores were significantly different between the two groups, two sub-categories (vocabulary and reading comprehension scores) were analyzed using a one-way MANOVA to test the hypotheses. Overall, Wilks's Λ=.85, $F(2,67)$=5.72, p=.00, η^2=.15. Moreover, there was significant difference in vocabulary scores between two groups, $F(1,68)$=11.49, p=.00 (See Table 4.9 and Table 4.10). No difference was found for reading comprehension. The effect sizes were .71 for language arts, and .79 for vocabulary.

Table 4.6

Descriptive Statistics of the Second Grade Students' Scores

	Montessori (n=35)		Non-Montessori (n=35)		
Subject	Mean	*SD*	Mean	*SD*	Effect Size
Language arts	32.83	5.78	28.71	5.60	.71
Vocabulary	19.97	4.04	16.63	4.21	.79
Reading Comprehension	12.86	2.51	12.09	2.25	.31
Math	21.46	4.74	19.57	5.29	.36
Social Studies	31.00	3.99	29.89	2.61	.28

Table 4.7

Overall MANOVA for the Second Grade Students' Test Scores

Wilks's Lambda	Value	*F*	Hypothesis *df*	Error *df*	Sig.	Partial Eta Squared
	.88	2.97 a	3.00	66.00	.03	.12

Note: a. exact statistic

Table 4.8

ANOVA Results of between Subjects Factor with Corrected Model for Second Grade

Source	Mean Square	*F*	Sig.	Partial Eta Squared
Language Arts	296.23	9.16	.00	.12
Math	62.23	2.46	.12	.04
Social Studies	21.73	1.91	.17	.03

Table 4.9

Results of MANOVA of Vocabulary and Reading Comprehension Scores for the Second Grade Students

Wilks's Lambda	Value	*F*	Hypothesis *df*	Error *df*	Sig.	Partial Eta Squared
	.85	5.72 a	2.00	67.00	.00	.15

Note: a. exact statistic

Table 4.10

Results of Vocabulary and Reading Comprehension ANOVA between Subjects Factor with Corrected Model

Source	Mean Square	*F*	Sig.	Partial Eta Squared
Vocabulary	195.56	11.49	.00	.15
Reading comprehension	10.41	1.83	.18	.03

Third Grade Montessori versus Non-Montessori Students

Null Hypothesis three states that there is no significant difference in Chinese language arts, vocabulary and reading comprehension scores on the ESLAAT, math scores on the ESMAAT, and social studies scores on the SSAAT between the third grade students who have had Montessori early childhood experiences and those who have had non-Montessori early childhood education experiences. While the MANOVA did not indicate any significant difference among the dependent variables, the F's ratios were significantly different in the language area for both first grade and second grade led the researcher to question if the conservative properties of the MANOVA masked a continued difference in language skills. The overall MANOVA result shows that there was no significant difference between the two groups, Montessori children and non-Montessori children, on a composite of the dependent variables (language arts, math, and social studies), Wilks's Λ=.88, $F(3,52)$=2.92, p=.08 (See Table 4.11). To clarify, the researcher conducted t-tests to examine possible masked differences.

Table 4.11

Overall MANOVA for the Third Grade Students' Test Scores

Wilks's Lambda	Value	*F*	Hypothesis *df*	Error *df*	Sig.	Partial Eta Squared
	.88	2.92 a	3.00	52.00	.08	.12

Note: a. exact statistic

Table 4.12 presents the means and standard deviations for third grade students' achievement tests scores: language arts, reading comprehension and math of the students

who had Montessori early childhood education experience and those who did not have Montessori early childhood education experience. Language arts, $t(54)=2.69$, $p=.01$, which was less than the α (.05) and an effect size was .56; therefore, the test indicated a significant difference. Moreover, in reading comprehension, $t(54)=2.30$, $p=.03$ and with an effect size of .51(See Table 4.13). This means there was a significant difference between the language arts scores and the reading comprehension scores of the third graders who had Montessori experience and those who had non-Montessori experience.

Table 4.12

Descriptive Statistics of the Third Grade Students' Scores

	Montessori (n=28)		Non-Montessori (n=28)		
Subject	Mean	*SD*	Mean	*SD*	Effect Size
Language arts	39.57	5.09	33.46	10.90	.56
Vocabulary	25.18	3.20	23.29	5.25	.36
Reading Comprehension	14.39	3.47	11.50	5.69	.51
Math	24.64	5.52	22.50	8.09	.26
Social Studies	35.86	4.09	34.04	6.08	.30

Table 4.13

Independent-Samples T-Test Summary for Third Grade Students

Scores	*F*	Sig.	*t*	*df*	Sig. (2-tailed)
Language arts	7.03	.01	2.69	54	.01
Vocabulary	5.06	.03	1.63	54	.11
Reading Comprehension	9.74	.00	2.30	54	.03

Hypotheses four through six focused on significant differences between the number of years the students had Montessori early childhood experience and their scores on achievement tests. A one-way MANOVA was used to analyze the results. Montessori students were in grade one and grade two levels were divided according to students' years of Montessori preschool and kindergarten education experience. However, grade three considered only one year and two years of Montessori preschool and kindergarten education experience because of low number of participants who had more than two years Montessori education experience.

First Grade Students Who Had Montessori Education

Null Hypothesis four states that there is no significant difference between the number of years the first grade students had Montessori early childhood education and their scores of the PPVT-R, SS-K Test, ESLAAT, ESMAAT, and SSAAT. Table 4.14 presents the one-way MANOVA for first grade students who had Montessori early childhood experience. There was no significant difference in math scores among the group with one year Montessori experience (M=18.00, SD=7.52), the group with two years Montessori experience (M=21.46, SD=5.30) and the group with three years

Montessori experience (M=20.91, SD=7.39). On language scores, there was no significant difference demonstrated among the group with one year Montessori experience (M=21.82, SD=11.33), the group with two years Montessori experience (M=26.46, SD=7.62) and the group with three years Montessori experience (M=23.36, SD=10.44). On social studies scores, also there was no significant difference demonstrated among the group with one year Montessori experience (M=21.09, SD=8.04), the group with two years Montessori experience (M=24.62, SD=4.15), and the group with three years Montessori experience (M=23.00, SD=9.02). On PPVT-R scores, there was no significant difference demonstrated among the group with one year Montessori experience (M=110.00, SD=5.57), the group with two years Montessori experience (M=118.69, SD=11.84), and the group with three years Montessori experience (M=117.18, SD=15.09). On SSK-T scores, there was no significant difference demonstrated among the group with one year Montessori experience (M=16.00, SD=2.61), the group with two years Montessori experience (M=17.08, SD=1.44), and the group with three years Montessori experience (M=17.45, SD=1.29) and yielded no significant difference among the three groups, Wilks's Λ=.83, $F(10,56)$=.56, p=.84 (see table 4.15).

Table 4.14

Mean and Standard Deviation for the First Grade Montessori Students

	Montessori Years	Mean	*SD*	*n*
Math	one year	18.00	7.52	11
	two years	21.46	5.30	13
	three years	20.91	9.35	11
	Total	20.20	7.39	35
Language	one year	21.82	11.33	11
	two years	26.46	7.62	13
	three years	23.36	10.44	11
	Total	24.03	9.71	35
Social	one year	21.09	8.04	11
	two years	24.61	4.15	13
	three years	23.00	9.02	11
	Total	23.00	7.16	35
PPVT	one year	110.00	5.57	11
	two years	118.69	11.84	13
	three years	117.18	15.09	11
	Total	115.49	11.84	35
SSK	one year	16.00	2.61	11
	two years	17.08	1.44	13
	three years	17.45	1.29	11
	Total	16.86	1.90	35

Table 4.15

Overall MANOVA for the First Grade Montessori Students' Test Scores

Wilks's Lambda	Value	*F*	Hypothesis *df*	Error *df*	Sig.	Partial Eta Squared
	.83	.56 a	10.00	56.00	.84	.09

Note: a. exact statistic

Second Grade Students Who Had Montessori Education

Null Hypothesis five states that there is no significant difference between the number of years the second grade students had Montessori early childhood education and their scores of the ESLAAT, ESMAAT, and SSAAT. This was tested using a one-way MANOVA. The mean scores include math, language arts, and social studies. On math, the second grade students who had one year Montessori experience had the follow up scores: (M=21.58, SD=4.34), the second grade students who had two years Montessori experience had the following scores: (M=22.58, SD=3.63), the second grade students who had three years Montessori experience had the following scores: (M=20.10, SD=6.14). Analysis MANOVA yielded no significant difference among three groups. On language, there was no significant difference demonstrated among the groups with one year of Montessori experience (M=32.5, SD=3.94), the group with two years of Montessori experience (M=34.17, SD=2.98) and the group with three years of Montessori experience (M=31.73, SD=9.11). On social studies, there was no significant difference demonstrated among the group with one year Montessori experience

(M=30.17, SD=2.95), the group with two years Montessori experience (M=32.75, SD=2.01), and the group with three years Montessori experience (M=30.00, SD=5.88) (See Table 4.16). Overall, there were no differences among the three groups. Wilks's Λ=.88, $F(6,60)$=.68, p=.67 (see Table 4.17). The results of one-way MANOVA statistical analysis showed that the number years of Montessori learning did not create significant differences on the second grade students' test scores on language arts, vocabulary, reading comprehension, math, and social studies. The null hypothesis five was therefore not rejected. This means in the present study, the number of Montessori learning years do not have strong impact on the academic achievement of the second grade students.

Table 4.16

Mean and Standard Deviation for the Second Grade Montessori Students

	Montessori Year	Mean	*SD*	*n*
Math	one year	21.58	4.34	12
	two years	22.58	3.63	12
	three years	20.09	6.14	11
	Total	21.46	4.74	35
Language	one year	32.50	3.94	12
	two years	34.17	2.98	12
	three years	31.72	9.11	11
	Total	32.83	5.78	35
Social	one year	30.17	2.95	12
	two years	32.75	2.01	12
	three years	30.00	5.88	11
	Total	31.00	3.99	35

Table 4.17

MANOVA for the Second Grade Montessori Students' Test Scores

Wilks's Lambda	Value	*F*	Hypothesis *df*	Error *df*	Sig.	Partial Eta Squared
	.88	.68 a	6.00	60.00	.67	.06

Note: a. exact statistic

Third Grade Students Who Had Montessori Education

Null Hypothesis six states there is no significant difference between the number of years the third grade students had Montessori early childhood education and their scores of the ESLAAT, ESMAAT, and SSAAT. One-way MANOVA was used to answer the difference between the number years of Montessori early learning and third grade students' learning outcomes. Because there were few students was attended Montessori preschool and kindergarten for three years, the researcher selected only the students who attended one and two years Montessori kindergarten program. The mean and standard deviation summary is shown in Table 4.18 which shows that there is no significant difference in math between the students who had one year Montessori kindergarten experience (M=25.14, SD=4.09) and the students who had two years Montessori kindergarten experience (M=24.14, SD=6.79). There is also no significant difference between the students who had one year Montessori kindergarten experience (M=37.57, SD=5.35) and the students who had two years Montessori kindergarten experience (M=41.57, SD=4.09) on language arts. There is also no significant difference in social studies scores between the students who had one year Montessori kindergarten

experience (M=35.21, SD=5.39), the students who had two years Montessori kindergarten experience (M=36.50, SD=2.18) (See Table 4.18). Overall, there is no significant difference among three groups, Wilks's Λ =.84, F (3,24)=1.56, p=.23 (see Table 4.19).

Table 4.20 shows the results of univariate ANOVA on language arts, math, and social studies. There was significant difference between two groups: one group with one year Montessori education and one group with two years Montessori education, in language arts, F(1,26)=4.95, p=.04, but the scores on math and social studies tests were not significantly different between two groups.

Since language art scores shown in univariate ANOVA were significantly different between the two groups, two sub-categories (vocabulary and reading comprehension scores) were analyzed using a one-way MANOVA to test the hypotheses. Overall, Wilks's Λ=.71, F(2,25)=5.04, p=.01, η^2=.29 (See Table 4.21). Moreover, there was significant difference in reading comprehension scores between two groups, F(1,26)=10.42, p=.00 (See Table 4.22). No difference was found for vocabulary scores. This means that the third grade students who have spent two years in Montessori preschool and kindergarten experienced had higher scores on their reading comprehension compared to the third grade students who had only one year Montessori preschool and kindergarten experience.

Table 4.18

Mean and Standard Deviation for the Third Grade Montessori Students

	Montessori Years	Mean	*SD*	*n*
Math	one year	25.14	4.09	14
	two years	24.14	6.79	14
	Total	24.64	5.53	28
Language	one year	37.57	5.35	14
	two years	41.57	4.09	14
	Total	39.57	5.09	28
Social	one year	35.21	5.39	14
	two years	36.50	2.18	14
	Total	35.86	4.09	28

Table 4.19

MANOVA for the Third Grade Montessori Students' Test Scores

Wilks's Lambda	Value	*F*	Hypothesis *df*	Error *df*	Sig.	Partial Eta Squared
	.84	1.56a	3.00	24.00	.23	.16

Note: a. exact statistic

Table 4.20

ANOVA Results of between Subjects Factor with Corrected Model

Source	Mean Square	*F*	Sig.	Partial Eta Squared
Language Arts	7.00	.22	.64	.00
Math	112.00	4.95	.04	.16
Social Studies	11.57	.68	.42	.03

Table 4.21

MANOVA for the Third Grade Montessori Students' Language Arts Scores

Wilks's Lambda	Value	*F*	Hypothesis *df*	Error *df*	Sig.	Partial Eta Squared
	.71	5.04a	2.00	25.00	.02	.29

Note: a=Exact statistic

Table 4.22

ANOVA Results of between Subjects Factor with Corrected Model

Source	Mean Square	*F*	Sig.	Partial Eta Squared
Vocabulary	.89	.08	.77	.00
Reading Comprehension	92.89	10.42	.00	.29

Summary

In the present study, three research questions were raised. They were as follows. (1) Do the first grade students who have attended at least one year of Montessori early childhood education programs (preschool and kindergarten) in Taiwan obtain higher scores on the Chinese version of the PPVT-R and SSK-T than the first grade students who attended non-Montessori early childhood education programs? (2) Do elementary students (grade one to three) who have attended at least one year of Montessori early childhood education programs (preschool and kindergarten) in Taiwan obtain higher scores on the subjects of Chinese language arts, math, and social studies than students who attended non-Montessori early childhood education programs? (3) Is there a significant difference between the number of years the first, second, and third grade students have had Montessori early childhood experience and their scores on the Chinese language arts, math, and social studies?

The first research question tested whether the first grade students who have attended at least one year of Montessori early childhood education programs (preschool and kindergarten) obtain higher scores on the Chinese version of the PPVT-R and SSK-T than the first grade students who attended non-Montessori early childhood education programs. Analysis of the test scores shows that in PPVT-R, the mean score of the first grade students who attended Montessori early childhood education program was slightly higher than that of students who did not attend Montessori early childhood education program (M=115.49, SD=11.84 vs. M=112.69, SD=12.21). In SSK-T, the students who attended Montessori programs (M=16.86, SD=1.90) had higher sores than those who

attended non-Montessori programs (M=15.91, SD=2.31). However, there was no significant difference in both PPVT-R and SSK-T between two groups.

The second research question was "do elementary students (grade one to three) who have attended at least one year of Montessori early childhood education programs (preschool and kindergarten) obtain higher scores on the subjects of Chinese language arts, math, and social studies than students who attended non-Montessori early childhood education programs?" In first grade, there was statistical significance in language arts (M=24.03, SD=9.71 vs. M=16.71, SD=8.75), vocabulary (M=14.43, SD=6.20 vs. M=10.40, SD=5.19), reading comprehension (M=9.60, SD=4.26 vs. M=6.74, SD=4.86), and math (M=20.20, SD=7.39 vs. M=16.49, SD=7.33) between the students who had Montessori early childhood experience and those who did not have Montessori early childhood experience. In the second grade, there was significant difference in language arts (M=32.83, SD=5.78 vs. M=28.71, SD=5.60) and vocabulary scores (M=19.97, SD=4.04 vs. M=16.62, SD=4.20) between the two groups. In third grade, there was difference in language arts (M=39.57, SD=5.09 vs. M=33.46, SD=10.90) and reading comprehension (M=14.39, SD=3.47 vs. M=11.50, SD=5.69) between the students who had had Montessori experience and students who did not have Montessori experience (See Table 4.23).

The last research question was "is there a significant difference between the number of years the first, second, and third grade students have had Montessori early childhood education and their scores on the Chinese language arts, math, and social studies?" Data show that there is no significant difference between the number of Montessori education years and the students' scores in language arts, math, social

studies in first and second grade as well as first grade's PPVT-R and SSK-T. However, in the third grade, there was significant difference between reading comprehension scores and the number of years the third grade students had had Montessori early childhood education, $F(1,26)=10.42$, $p=.00$. It means that the third grade students who had two years of Montessori education have higher scores in reading comprehension than other third grade students who only had one year Montessori early childhood education experience (See Table 4.24).

Table 4.23

Summary of the Results for First and Second Research Question

Groups	Tests	Outcome	Effect Size
Grade 1	PPVT-R	No difference	.23
Montessori vs.	SSK-T	No difference	.41
Non-Montessori	ESAAT (language arts)	Montessori higher	.75
	ESAAT (vocabulary)	Montessori higher	.65
	ESAAT (reading compression)	Montessori higher	.59
	ESMAAT (math)	Montessori higher	.50
	SSAAT (social studies)	No difference	.32
Grade 2			
Montessori vs.	ESAAT (language arts)	Montessori higher	.71
Non-Montessori	ESAAT (vocabulary)	Montessori higher	.79
	ESAAT (reading compression)	No difference	.31
	ESMAAT (math)	No difference	.36
	SSAAT (social studies)	No difference	.28
Grade 3			
Montessori vs.	ESAAT (language arts)	Montessori higher	.56
Non-Montessori	ESAAT (vocabulary)	No difference	.36
	ESAAT (reading compression)	Montessori higher	.51
	ESMAAT (math)	No difference	.26
	SSAAT (social studies)	No difference	.30

Table 4.24

Summary of the Results for the Third Research Question

Groups	Tests	Outcome
Grade 1	PPVT-R	No difference
Montessori Years	SSK-T	No difference
	ESAAT (language arts)	No difference
	ESAAT (vocabulary)	No difference
	ESAAT (reading compression)	No difference
	ESMAAT (math)	No difference
	SSAAT (social studies)	No difference
Grade 2		
Montessori Years	ESAAT (language arts)	No difference
	ESAAT (vocabulary)	No difference
	ESAAT (reading compression)	No difference
	ESMAAT (math)	No difference
	SSAAT (social studies)	No difference
Grade 3		
Montessori Years	ESAAT (language arts)	No difference
	ESAAT (vocabulary)	No difference
	ESAAT (reading compression)	Two years Montessori higher
	ESMAAT (math)	No difference
	SSAAT (social studies)	No difference

Chapter 5

SUMMARY, DISCUSSION, AND RECOMMENDATIONS

The present research examined whether or not first grade, second grade and third grade elementary students in Taiwan who have had received a Montessori education in preschool and kindergarten had better achievement test scores on tests of language arts, math, and social studies than students who did not receive Montessori education in preschool and kindergarten. The research also investigated whether or not the number years of Montessori education has a positive correlation on the students' scores when they are in elementary grades. Three research questions were raised in the present study.

They are:

1. Do first grade students who have attended at least one year of Montessori early childhood education programs (preschool and kindergarten) in Taiwan obtain higher scores on the Chinese version of the PPVT-R and SSK-T than the first grade students who attended non-Montessori early childhood education programs?
2. Do elementary students (grade one to three) who have attended at least one year of Montessori early childhood education programs (preschool and kindergarten) in Taiwan obtain higher scores on the subjects of Chinese

language arts, math, and social studies than students who attended non-Montessori early childhood education programs?

3. Is there a significant difference between the number of years the first grade, second grade, and third grade elementary students who have had Montessori early childhood education and their scores on the Chinese language arts, math, and social studies?

Brief Description of Participants

In the present study, 196 elementary students from a private elementary school in Taiwan who were enrolled in the 2008-2009 academic year in first, second, and third grade were selected as participants. Of these, 98 students had attended Montessori preschools and 98 had attended non-Montessori preschools. The test scores of 98 students (35 first grade students, 35 second grade students, and 28 third grade students) who had received Montessori preschool and kindergarten were compared to those of the other 98 students (35 first grade students, 35 second grade students, and 28 third grade students) who did not have Montessori education experience.

The test instruments used in this study were: the PPVT-R (Chinese version), SSK-T, ESLLAAT, ESMAAT, and SSAAT. Each first grade student was administrated the PPVT-R and SSK-T by his or her homeroom teacher. The researcher administered the rest of the tests including ESLLAAT, ESMAAT, and SSAAT for first graders, second graders, and third graders and each test required about 40 minutes.

Summary of Research Findings

In the present study, the students who have had Montessori preschool and kindergarten experience were placed in the experimental group and the students did not

attend Montessori preschool and kindergarten were put in the comparison group. To find answers to the research questions and hypotheses, the SPSS version 16.0 was used to analyze the test scores. The statistical tool was one-way multivariate analysis of variance (MANOVA) for three research questions. State analysis yielded the following results.

In first grade, the results of the study showed that there was no significant difference on the Chinese version of the PPVT-R and SSK-T between the first grade students who had attended a Montessori preschool and kindergarten program and those who did not attend a Montessori preschool and kindergarten program. However, on the achievement tests of ESLAAT and ESMAAT, the first grade students who had Montessori early childhood education experience had higher scores on tests of language arts including vocabulary and reading comprehension, and math.

In second grade, there was no significant difference between the social studies scores and math scores of the two groups of students. However, there was significant difference in the scores of the achievement tests of ESLAAT in language arts and vocabulary parts of second grade students who had received Montessori preschool and kindergarten compared to the students who did not attend Montessori preschool and kindergarten. However, there was no significant difference in the reading comprehension scores of these two groups.

In third grade, there was significant difference on language arts and reading comprehension of ESLAAT with Montessori students getting higher scores. However, there were no statistical difference on math scores and social studies score for third graders. In other words, in this study, Montessori education had a direct positive

learning impact on the third grade students' test scores on language arts and reading comprehension parts.

With regard to the significant difference between the number years of Montessori education and the test scores of first, second, and third grade students, the results show that there was no significant difference between the length of Montessori education and the first and second grade students' test outcomes with one small exception. There was a significant difference between the number of years of Montessori education in third grade students and their reading comprehension scores. It means that in third grade, the students who have received more years of Montessori early childhood education have higher scores on reading comprehension achievement.

Discussion

The present study looked at whether the students who attended Montessori preschool and kindergarten programs have better scores on language arts, math, and social studies at elementary grades than the students who attended non-Montessori preschool and kindergarten. Additionally, the study examined the possibility that the length of years of Montessori learning experience may enhance the students' learning outcomes at early elementary grades. First, it is important that the early childhood learning is important for the elementary school students to have successful learning outcome and positive effects on socialization in later life (Cohen, 2004; Jacobson, 2005; Westchester Institute For Human Services Research, 2007; Wilgoren, 1999; Zeller, 2007). One important research study, the High/Scope Perry Preschool Study stated "a scientific experiment has identified both the short- and long-term effects of a high-quality preschool education program for young children living in poverty" (Schweinhart,

2008, p. 1). In many early childhood education pedagogies, one teaching method that is still very popular is the Montessori approach. In Montessori education classrooms, children are encouraged to explore language including writing and reading, mathematics and cultural studies at an early age (Morrison, 2004).

The present study showed statistically significant differences between elementary children in first grade with Montessori experience and those with non-Montessori preschool experience in Chinese language arts, vocabulary, reading comprehension scores on the ESLAAT and in math scores on the ESMAAT. Students with Montessori experience obtained high scores than those who did not have such an experience. However, no significant differences were found in PPVT-R, SSK-T, and social studies scores on the SSAAT in first grade students.

In the second and third grade students, there were significant differences in favor of Montessori students in Chinese language arts scores on the ESLAAT but not math scores on the ESMAAT and social studies scores on the SSAAT. The results showed that the first grade students who have received Montessori preschool and kindergarten program showed better performance on Chinese language arts, vocabulary, reading comprehension, and math than those who have received non-Montessori preschool and kindergarten program. The results also showed that the second grade students and third grades students who attended Montessori preschool and kindergarten performed better than students who attended non-Montessori preschool and kindergarten in language arts. The results were, therefore, mixed with Montessori students doing better in some areas but not in others. It should, however be noted that the Montessori children secured consistently higher scores in all the tests of academic achievement than the non-

Montessori children even though not all of them attained statistically significant. This is in general agreement with the review of literature that shows children from Montessori education program are doing better in some respects than other programs. (Chattin-McNichols, 1992b; Roopnarine & Johnson, 2005). Some studies have found that in the United States, Montessori students have strong academic outcomes especially in language arts than non-Montessori students (Daux, 1995; Hobbs, 2008; Lillard & Else-Quest, 2006; Manner, 1999). In conclusion, the present study partially supports the findings of other studies and shows that Montessori education has some long-term impact on the students' language arts learning.

Considering math alone, only first grade students with Montessori experience showed an advantage on math scores over those who did not attend Montessori programs. This finding is also supported in the literature review conducted by Lillard and Else-Quest (1995) who tested the primary students (three to six years old) in the United States at the end of kindergarten. Their review also shows that Montessori students obtain better scores than non-Montessori students in math. In Taiwan, the study shows that Montessori kindergarten children are better in formal mathematics skills such as reading numbers and writing numerals and performing subtraction facts than non-Montessori kindergarten children (Hsu, 1995).

With reference to the last research question which addressed the impact of the length of Montessori education, one-way MANOVA showed that there was no significant difference in the number of years in Montessori programs by first, second grade students and their academic achievement in elementary grades. However, third grade students who spent more years in Montessori schools obtained significantly higher

scores in reading comprehension. Glenn (1989) and Dohrmann (2003) conducted the longitudinal study of Montessori students on their academic performance. Their findings supported the expectation that Montessori education has a strong and positive long-term impact. In the present study, perhaps the first and second grade students just entered elementary school level and they are trying to adapt to their schools and catching up with their academic learning. However, the single positive result obtained in the third grade suggests that the students who the longer the Montessori education experience the higher is the reading comprehension scores.

In conclusion, in the United States, many Montessori schools claim that Montessori education results in higher academic achievement (Dohrmann, 2003). However, in Taiwan, there are many Montessori preschool and kindergarten programs but very few in elementary schools or middle schools. In the United States, most researchers conducted the research which studied students from Montessori elementary schools and Montessori middle schools whose students have had Montessori education since kindergarten. On the other hand, because of the difference in the education systems between Taiwan and the United States, the Taiwanese students do not have an opportunity to continue their Montessori education beyond kindergarten into elementary and middle schools. Therefore, the present study used participants who had only Montessori education experience in preschool and kindergarten. Even though the present study yielded mixed results in students' learning outcomes, it still supported the position that Montessori education has some positive influence on achievement in elementary grades.

Implications

Montessori education has existed for over one hundred years in the world and this pedagogy has been introduced in Taiwan only 24 years ago. Montessori education is still one of the many major teaching pedagogies used in preschool and kindergarten in Taiwan. Since parents have fewer children in Taiwanese society, parents focus on their children's education. Therefore, many choose Montessori kindergarten for their children. As a result, there are many kindergarten classes which are based on Montessori education. However, little research had been conducted about Montessori education and most research focused only on children at preschool and kindergarten levels, but not at elementary school levels. Although the present study showed mixed results which did not entirely support the hypotheses that students who attend Montessori preschool and kindergarten program demonstrate consistently superior academic learning outcomes, there was weak support for the hypothesis that Montessori preschool program has certain advantages. In fact, in the present study, three grade levels of students who had Montessori early childhood experience demonstrated better learning outcomes in language arts; the first grade students who had Montessori learning experiences also had better math scores. These findings provide initial evidence that Montessori education is a beneficial and effective pedagogy in early childhood education and may not have any noticeable adverse effects. As this study is exploratory, the results can enhance the understanding of Taiwanese educators concerning the potential benefits of Montessori education. Moreover, elementary school principals can come to appreciate that Montessori education may have some impact on students' future learning outcomes.

Once the advantages of Montessori education are appreciated, more students would receive Montessori education learning experience.

Recommendation for Future Studies

The study presents the following recommendations for future research:

1. The present study was conducted in one private school in Taipei City, Taiwan, and the sample size is somehow small. In future studies, researchers may include more participants from other cities across Taiwan.
2. There has not been much research done related to this topic in Taiwan. The researcher found only two studies which were related to mathematics achievement for kindergarten and first grade students with Montessori background. There is also corresponding lack of research about language arts and social studies achievement. It means that in the future research, the researcher should conduct additional study in the areas of language arts and social studies.
3. In the present study, the researcher did not look at gender difference as a factor that can affect academic achievement. It is recommend that future studies attempt to compare the learning outcomes of female and male elementary students who have had Montessori preschool and kindergarten and those who did not have Montessori preschool and kindergarten.
4. Longitudinal follow-up studies may be extended into upper elementary grades. In the present study, the researcher focused only on the learning outcome between first, second, and third grade students who received Montessori education and those who did not receive Montessori education in

their preschool and kindergarten. In the future researchers may examine if there is a difference or long-term impact between the same groupings but higher grades.

5. In Montessori education, there are five main learning areas: practical life, sensorial materials using, language arts, math, and cultural studies. The present researcher focused only on the students' academic performance and learning outcome. However, in the three to six years old Montessori classrooms, one important learning area is to learn to manipulate the materials of practical life. The practical life means children learn to carry out everyday living activities including how to take care of himself/herself, the environment, and also learn about graceful behavior and courtesy. In future studies should examine children's social behaviors and daily life skills.
6. The goal of Montessori education is to train children to be independent, to develop concentration, to learn positive learning behaviors, to develop manipulating skills, and to learn self- correcting skills. In future studies, the researcher may look at the behaviors of the children who have had Montessori early childhood education how they independently complete their work and concentrate on doing work as well as at the length of time children can attend to tasks on hand.

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