Major Developmental Characteristics of Children's Name Writing and Relationships with Fine Motor Skills and Emergent Literacy Skills

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Education)
in The University of Michigan
2011

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Dedication

To Chihpeng,

Without you, I could not have gone this far

You are the wind beneath my wings

Acknowledgement

To win the Taiwan Government Scholarship for overseas study was hard, but to decide to accept the SOE Ph. D program admission and come to the United States, in middle age, with two elementary boys, was even harder. Most of my friends and family thought I had made the most foolish mistake of my life when I flew to Ann Arbor.

Dr. Sally Lubeck was my first advisor. She gave me the chance to study here. Sadly, Sally passed away from cancer in 2004.

Dr. Elizabeth Sulzby was my second advisor. She opened the door of Emergent Literacy for me. Although she left because of health issues, I would like to gratefully and sincerely thank her, for her guidance. Her mentorship has been paramount in providing me with a good foundation for becoming an emergent literacy researcher.

I would like to express my sincere gratitude to Dr. Kevin Miller and Dr. Karen Wixson, who willingly shared their time and insights with me during the dissertation study. Thank you for willing to be my co-chairs in the midst of your very heavy workload. Without your participation, this study could not have possibly been done.

I thank Dr. Stone for his valuable assistance and advice from the day I stepped in School of Education building until the day I submitted this dissertation.

I would also like to sincerely thank Dr. Carlisle. She taught me how to write a solid paper. Dr. Carlisle carefully read and commented on my paper word by word, and provided crucial advice on my methodology.

I would like to express my deep gratitude to Dr. Claire Son for her emotional support and help when I needed it most.

Dr. Fred Morrison kindly let me participate in his research lab where I met Dr. Alison Miller. Alison kindly shared her data set with me when I lost my research direction and was in a very bad situation. I had the remarkable fortune to work with Alison. She always smiles and encouraged me to finish the study.

In particular, I thank Alison and E.P. Bradley Hospital, East Providence, Rhode Island, who graciously and generously shared their data with me. Without their help, I could not have finished this dissertation.

Finally, and most importantly, to my husband Chihpeng, and our sons Alec and Andrew, for their love and support, in dealing with all the challenges I have faced.

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Abstract

Major Developmental Characteristics of Children's Name Writing and Relationships with Fine Motor Skills and Emergent Literacy Skills

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This dissertation attempts to contribute to the field of early childhood education by exploring the nature of children's name writing development. Name writing involves not only emergent literacy skills but also fine motor skills. Three studies are included in the dissertation: Study One focuses on identifying the major characteristics in children's name writing development. Study Two validated the name writing scale proposed by the analysis in Study One. Using the proposed name writing scale, Study Three explored the relationships among name writing development, emergent literacy skills and fine motor skills.

The data examined by the dissertation were drawn from the longitudinal project "Enhanced HS-MAP Intervention: Linking Program Evaluation and Child Outcomes"

(Dickstein, Seifer, & Miller, 2002-2006). A total of 641 name writing samples produced by 321 Head Start children as well as their DIAL-3 (Mardell-Czudnowski & Goldenberg, 1998) test scores were included.

The major findings of the study suggest: 1). There are several name writing developmental characteristics; however, not all of them appear as distinctive levels in the development of name writing. After qualitative and quantitative analysis, the dissertation identified five major name writing characteristics that can be distinguished using the criteria of frequent appearance and distinctive age of appearance; they are Aimless scribbles, Flat/wavy scribble or None/refusal, Symbols or letter-like units, One or few letters from name, and Conventional or spelling almost correct. 2). A qualitative examination of the longitudinal data suggested that only a few individual children's showed name writing development that was not a monotonic development. Some children will stay in a level for several months, and some will skip a level or two. 3). Among fine motor skills and literacy skills variables, Letters and sounds has the strongest positive relationship with three-year-olds' name writing development, but copying skills is the most important factor that influences four-year-olds' name writing development. Since most five-year-old children could write their names conventionally, there is apparently a ceiling effect for five-year-old children. The cognitive variables that predict level of name writing vary with development.

Chapter 1

Introduction

Problem Statement

Most children have special feelings toward their names. They hear their names being called from the day they are born and see their names printed on their belongings all the time. Accordingly, children's own names are often the first words they are taught to recognize and write (Clay, 1991; Dunnsmuir & Blatchford, 2004; Dyson, 1981; Ferreiro, 1986; Ferreiro and Teberosky, 1982; Martens, 1999; Purcell-Gates, 1996; Treiman et al., 2007; Villaume & Wilson, 1989; West & Hausken, 1995).

To preschool and kindergarten children, being able to "sign" names on their art work or greeting cards is not only a great personal accomplishment, but is also a significant literacy achievement. Name writing is not just a visual-motor copying of letters or reciting the spelling of a name. Name writing, in fact, is a developmental process that begins with pre-alphabetic forms, and involves fine motor skills, print concepts, letter identification, letter reproduction (Bloodgod, 1999; Treiman & Broderick, 1998; Treiman & Kessler, 2004; Villaume & Wilson, 1989) and knowledge of letter-sound correspondence (Blair & Savage, 2006; Bryant, MacLean, Bradley, & Crossland, 1990; Chaney, 1992; Dodd & Carr, 2003; Ehri & Chun, 1996; Haney et al., 2003; Riley, 1996; Welsch, Sullivan, & Justice,

2003).

The National Research Council suggested that children, by the end of kindergarten, should be able to "write one's own name (first and last) and the first names of some friends or classmates" (Snow, Burns, & Griffin, 1998, p. 80). Since children's own names are often the first words they are taught, their ability to write names could tell us: Has the child been taught to read and write by their parents? Has the child learned letters? Has the child acquired letter-sound correspondence? Has the child had writing tools at home? Has the child acquired age-appropriate fine motor skills? And, does the child have difficulty using writing tools?

Research has shown that name writing relates to children's literacy development. The letters in children's names are often the letters they learn first and are most used in later writing (Bloodgood, 1999; Pollo, Kessler, & Treiman, 2009). Name writing also significantly relates to children's letter knowledge (Haney, 2003; Molfese et al., 2006; Welsch, Sullivan, & Justice, 2003). Once children learn how to write their names, they would likely learn other words and notice the relationship between letters and sounds (Bus & van IJzendorn, 1999; Ferreiro & Teberosky, 1982; Martens, 1999). Children's letter knowledge, phonological awareness and reading skills are reciprocal (Bus, van IJzendoorn, 1999; Carroll, Snowling, Hulme, & Stevenson, 2003; Riley, 1996; Stahl & Murray, 1994); since name writing promotes young children's letter knowledge, it could be hypothesized that name writing might help children develop their phonological and phonemic awareness too.

Some researchers have used children's name writing as a variable to measure children's writing concepts or early writing development. Several early literacy

assessment tools have also adopted name writing as a subtest to evaluate children's literacy development (e.g., DIAL-3, PALS). Although name writing has been used to measure children's early writing development, the scoring criteria to assess children's name writing development vary from study to study, as well as from assessment tool to assessment tool. The scoring criteria that previous studies used include drawings, pictures, shapes, refusal to write, scribbles, separate units, mock letters, number-like units, random letters, the first letters of name, few letters from name, almost correct, and conventional (see Table 2-1). However, most studies did not explain how they came up with those major criteria neither did they explain how these criteria were validated.

In the field of early childhood education, teachers often need to measure or assess children's developmental processes or learning progressions. Thus, many educators often adopt or develop a variety of tests for their own use. The reliability and validity of these tests are open to question. Reliability refers to the consistency or stability of the test scores, whereas validity refers to the degree to which a test or measurement tool measures what it claims to measure. In other words, a good measurement shall measure what it claims to measure, and the scores shall be consistent. Reviewing the existing name writing scales, the criteria embodied in the scales not only vary from scale to scale but also conflict with each other. For example, Hildreth (1936) has three different scribble levels for children, ranging from three years old to four-and-a-half years old, but other scales have only one level for scribbling. Martens (1996, 1999) and Ferreiro (1986) believed that children's refusal to write develops after children could produce recognizable letters but most other scales classified children's refusal to write as the lowest developmental level or treated them as invalid data. If the observations of Martens

and Ferreiro are correct, then the existing name writing scales need to be revised. This dissertation thus intends to explore quantitatively and qualitatively the major characteristics of children's name writing development, with an eye to the development and validation of a comprehensive scale that practitioners can use with confidence.

Name writing not only relates to children's emergent literacy skills but also relates to fine motor skills. Fine motor skills are the coordination of a group of small muscles and are needed to perform daily functions. It is estimated that 30 to 60 percent of a child's activities in a typical elementary school day involves fine motor activities, and writing tasks predominate over other tasks (McHale & Cermak, 1992). Delay in fine motor skills acquisition is thus often the main reason for school children's handwriting difficulties (Berninger, 2000; Berninger et al., 2006). Since writing is not expected in preschool and kindergarten, handwriting problems are thus discussed in the field of early literacy research and early childhood education.

Thus far, the nature of children's name writing development has not been thoroughly studied. Based on the results of a preliminary study, this dissertation intends to develop a better name writing developmental scale and explore the role of fine motor skills in children's name writing development.

Overview of the Study

This dissertation attempts to contribute to the field by providing empirical evidence regarding the nature of children's name writing development. The following research questions frame this dissertation.

Study One: Finding the major characteristics in children's name writing development

1. What are the major characteristics in children's name writing development?
2. Can the major features of name writing be organized into a developmental scale that is sensitive to age?

Study Two: Testing the name writing scale

3. Is it possible to develop a developmental assessment scale for name writing development that represents an improvement on existing scales? If so, how does the new name writing scale compare to other scales?
4. Do the longitudinal data support the name writing scale the dissertation proposed?

Study Three: Using the scale to explore the nature of children's name writing development

5. What are the relative contributions of language and motor skills to the development of name writing?

Chapter 2

Literature Review

Children's early writing or emergent writing often refers to the writing of children in the process of learning to use conventional letters to compose messages (Ferreiro & Teberosky, 1982; Luria, 1978; Teale & Sulzby, 1986; Sulzby, Barnhart, & Hieshima, 1989). However, the form of emergent writing could be scribbles, pictures, shapes, unrecognizable letters, letter-like units or conventional letters (Levin & Bus, 2003; Levin, Korat, & Amsterdamer, 1996; Luira, 1978; Percell-Gates, 1996; Sulzby et al., 1989). Among writing activities, name writing, word writing and story writing are the most common writing activities in early education settings. However, compared to story writing and word writing, name writing is the most assessable and accessible milestone for preschool and kindergarten children (Bloodgood, 1999; Clay, 1990; Ferreiro & Teberosky, 1982; Levin, Vries, Aram, & Bus, 2005; West & Hausken, 1995). As a result, name writing has been used to assess young children's writing development, or as a subtest to measure children's literacy development. In the following literature review, I discuss how children's writing forms reflect their written language concepts as well as the relationships among children's name writing, emergent literacy skills and motor skills.

The Main Developmental Characteristics of Children's Name Writing

Written language is a culturally based symbolism. In a literate society, young children interact with a variety of printed text every day, such as commercial signs, educational TV programs, newspaper and storybooks. As a result, most children "naturally" have an idea of what written symbols might look like in their society. Lavine (1977) found that the younger the Western children, the more symbols (e.g., drawing, Chinese character, number, etc) they considered to be written forms. Thus, it could be assumed that young children might use scribbles, symbols and number, all of which they consider to be written forms that convey messages or write stories.

Searching ProQuest and FirstSearch databases, I found eight studies that used children's name writing as one of their research variables. Their scoring criteria are listed in Table 2-1. In addition to the eight studies, I list another three studies that empirically examined children's name writing samples and confirmed the notion that children's name writing is a developmental process (Table 2-2). From the two tables, we can see that the scoring criteria to assess children's name writing development vary from study to study. Based on these data, I show the range for major developmental characteristics in Figure 2-1. Following this, I will discuss how each developmental characteristic reflects children's written language knowledge.

Table 2- 1 The comparison of different name writing scoring levels

	Blair & Savage (2006)	Bloodgood (1999)	Cabell, Justice, Zucker, & McGinty (2009)
Level 0	None/refusal	None/refusal	1. Drawing/aimless scribbles 2. Drawing with random graphemes 3. Circular drawing with some linear scribbles 4. Continuous, horizontal, zigzag scribbling 5. Continuous, horizontal, zigzag scribbling with separate grapheme 6. Continuous, horizontal, zigzag scribbling with pertinent letters 7. Letter-like graphemes 8. Letter-like graphemes with place holder; place holder could be dots or graphemes 9. Random letters 10. Some ordered letters from name 11. Letters with place holder; have equal number of letters in actual name 12. Using recognizable but not yet conventional letters, in conventional order, and of suitable number. 13. Using conventional letters and suitable number of letters but not conventional order 14. Using conventional letters, in order, and with suitable number of letters (*adapted from Lieberman's (1985) study)
Level 1	Only initial letters	Scribble	
Level 2	Partial with initial letters	Linear scribble	
Level 3	Partial with initial and final letters correct	Separate units	
Level 4	Complete	Mock letters	
Level 5		Name generally correct	
Level 6		Consistent first name	
Level 7		Fluent first and last name	
Note	Samples: 38 Age: 4 to 5	Samples: 67 Age: 3 to 6 1/2	Samples: 59 with language impairment and 23 with typical language development Age: 4 to 6

Table 2-1 (Cont.)

	Haney, Bissonnette, & Behnken (2003)	Molfese et al. (2006)	Purcell-Gates (1996)
Level 0	Recognizable letters All letters present Name spelled correctly Capitalization Letters formation Size of letters Spacing Fine motor control Lack of reversals Name written on line *Each scoring criterion receives one point. Total score is obtained by adding all points. No partial points	No attempt or refuse to write	
Level 1		Drawing, scribble, or random letters	Drawing, pictures, shapes
Level 2		The first letters of name was written, regardless of good form	Scribbles
Level 3		The first letters of name was written with good form	Letter-like and number-like forms
Level 4		More than the first letters of name was written, regardless of good form	Letters mixed with number
Level 5		More than the first letters of name was written with good form	Making letters (ungrouped letters, letters strings)
Level 6		All letters of name were written, regardless of good form	Making words (pseudowords, with spaces in between)
Level 7		All letters of name were written with good form	
Note	Sample: 162 Age: 5	Samples: 78 Age: 4 to 5	Samples: 24 Age: 4 to 6 *From the “Write Your Name and Anything Else You Can” task.

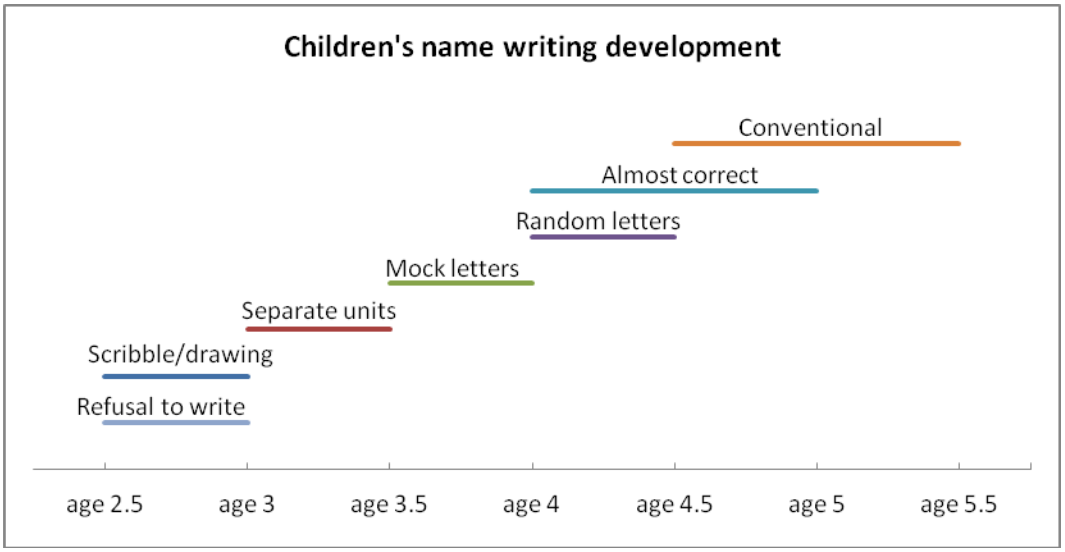
Table 2-1 (Cont.)

	Welsch, Sullivan, & Justice (2003)
Level 0	Scribble or picture represents both picture and written name
Level 1	Writing and drawing are intertwined. May include random letters, letter-like forms or scribble
Level 2	Picture is separated from the written name but the name is unrecognizable scribble
Level 3	Name writing consists of random letters and symbols.
Level 4	Name consists of some correct letters and placeholder
Level 5	Most correct letters from name
Level 6	Generally correct. Some letters may be written backwards.
Level 7	Name is written correctly
Note	Sample: 3,546 Age: 4 *These are PALS name writing scoring criteria

Table 2- 2 Comparison of Hildreth, Ferreiro & Teberosky and Lieberman's research findings on children's name writing development

Hildreth (1936)	Ferreiro & Teberosky (1982)	Lieberman (1985)
Level 0: (3.0 below) Writing is drawing or aimless scribbles Level 1: (3.0-3.6) Horizontal scribbles Level 2: (3.6-3.11) Wavy scribbles Level 3: (4.0-4.5) Scribbles with symbol units or letter-like units Level 4: (4.6-4.11) Random letter units Level 5: (5.0-5.5) Spelling is almost correct; might have incorrect or revered letters Level 6: (5.6-5.11 Mostly correct Level 7: (6.0-6.5) Conventional	Level 1: Wavy scribbles or graphic character Level 2: Start noticing the possibility of letters-sound correspondent Level 3: Start noticing the sounds of syllables of their name Level 4: Try to sound out the syllables and match with letters Level 5: Conventional	1. Drawing/aimless scribbles 2. Drawing with random graphemes 3. Circular drawing with some linear scribbles 4. Continuous, horizontal, zigzag scribbling 5. Continuous, horizontal, zigzag scribbling with separate grapheme 6. Continuous, horizontal, zigzag scribbling with pertinent letters 7. Letter-like graphemes 8. Letter-like graphemes with place holder; place holder could be dots or graphemes 9. Random letters 10. Some ordered letters from name 11. Letters with place holder; have equal number of letters in actual name 12. Using recognizable but not yet conventional letters, in conventional order, and of suitable number. 13. Using conventional letters and suitable number of letters but not conventional order 14. Using conventional letters, in order, and with suitable number of letters 15. Conventional but may contain a reveral of letters order, and/or other adaptive placement. 16. Conventional with first and last name.
Sample: 171 Age: 2 1/2 to 6 1/2	Sample: 76 Age: 4 to 6	Sample: 47 Age: 3 to 4

Figure 2- 1 Children's name writing development



Early Drawing as a Form of Nonverbal Visualized Writing

Excepting refusal to write, drawing has been seen the lowest developmental level in name writing development (Hildreth, 1936; Lieberman, 1985; Molfeses, Beswick, Molnar, & Jacobi-Vessels, 2006; Purcell-Gates, 1996; Welsch, Sullivan, & Justice, 2003). Although drawing and writing are both representational systems, they are quite different from each other. Drawing can be considered a more relatively self-defined symbolic system, which we often refer to as art, whereas writing is a more culturally defined academic skill. From Vygotsky's (1978) perspective, toddlers do not intend to generate art works; on the contrary, they are exploring the drawing tools and enjoying their arm movements. Gradually, with more experience with paper and drawing tools, young children notice that their strokes can record and convey messages. Vygotsky thus claimed that children's drawing is "graphic speech", a visualized thinking, a preliminary stage of

writing.

Luria (1978) also considered children's drawing as pictographic writing which is a necessary pre-stage of writing development. In Luria's study, he asked a number of children who had not yet received formal writing instructions to write sentences he presented and found that children would use simple lines and shapes to visualize the sentences. It indicates that these children, who did not know how to read and write yet, already could use drawings to represent some meaning (Clay, 1975; Dyson, 1982, 1988; Lavine, 1997; Levin & Bus, 2003; Luria, 1978; Martens, 1996; Sulzby et al., 1989; Tolchinsky & Levin, 1985).

The act or movement involved in drawing is different from writing. Brenneman Massey, Machdo, & Gelman (1996) carefully analyzed the ways four- to seven-year-old children draw and write. They found that when drawing, children rotated their paper more often, filled in and scribbled more, whereas when writing, children sounded out and paid attention to choosing the right letters.

Compared to writing, drawing makes fewer cognitive demands. Researchers have found that children who are not yet able to write conventionally attempt to use drawing to convey complicated messages and stories (Dyson, 1982, 1988; Luria, 1978; Sulzby, 1985, 1986; Sulzby et al., 1989; Willats; 2005). Even early elementary children who are able to use letters to write still like to use drawing to quickly express their writing ideas (Anning, 1997; Caldwell & Moore, 1991; McFadden, 1998; McKay & Kendrick, 1999; Norris, Mokhtari, & Reichard, 1998; Sliver, 2001), and to use drawing as illustration to supplement their writing (Dyson, 1982, 1988; Sulzby, 1985, 1986; Wilson & Wilson, 1979).

Considering that young children have not yet mastered any writing system, it is very possible that they use drawing to express themselves. Thus, when we let children write freely, or ask them to write long sentences or compose a story, they often use drawings to express themselves, though they know drawing is different from writing. Some researcher included drawing in their children's name writing scoring classification (Hildreth, 1936; Lieberman, 1985; Molfese et al., 2006; Purcell-Gates, 1996; Welsch et al., 2003). Since name is the most familiar word to most preschool and kindergarten children, I argue that children would not draw for name writing task. I will examine this assumption later in Study One.

Refusal to Write

Some published studies that used children's name writing as one of their research variables did not include None/refusal in their scoring criterion, nor mentioned whether they considered refusal to write a valid response (e.g., Haney, Bissonnette, & Behnken, 2003; Hildreth, 1936; Ferreiro & Teberosky, 1982; Lieberman, 1985; 2003; Purcell-Gates, 1996; Welsch et al., 2003). Other studies considered refusal to write as a valid response and categorized it as the lowest level of name writing development (e.g., Blair & Savage, 2006; Bloodgood, 1999; Mardell-Czudnowski & Goldenberg, 1998; Molfese et al., 2006).

Children's refusal to write did not get much attention in quantitative research but Ferreiro and Teberosky (1982) and Martens (1996) carefully documented the phenomenon in their longitudinal qualitative studies. They believed that refusal to write

is a significant achievement for young children. Martens (1996) in particular observed the period when her 4-year-old daughter suddenly refused to write after she knew some letters and could apply a little of syllabic- alphabetic principles in her free writing. During this period, even with Martens' fully support and encouragement, the 4-year-old girl still refused to write. Martens wrote: "…. she would say, 'I can't write,' 'I don't know how' or 'I don't want to write.' She was paralyzed by what she perceived as her own inadequacy and lack of knowledge of how to write 'correctly.'" (1996, p. 49)

According to Ferreiro and Teberosky (1982) and Martens' (1999) observation, children's refusal to write happened after they realized that they could not produce the written forms like adults do. In Study One, I will examine quantitatively how frequent is refusal to write and whether refusal to write is the first developmental characteristic of children's name writing.

Scribbles

Scribbles have been observed in children's early writing. Sheridan (2001, 2004) proposed four scribble hypotheses and claimed that scribbles are the seeds for later drawing, writing and other cultural notes. Kellogg (1970) systematically categorized two-year-old children's scribbles into 20 basic developmental forms and 17 scribble placement patterns. According to Kellogg's large-scale observation, the placement of scribbles involves conscious planning and hand movement control. Luria (1978) also observed that after the stage of aimless scribbles, young children would scribble consciously; they would try to differentiate their scribbles to try to record the sentences researchers

presented to them. In other words, children who did not know how to read and write might have already noticed the function of writing and tried to use scribbles to convey messages.

Two different scribbles have been mentioned in children's name writing research, aimless scribbles and wavy scribbles. Aimless scribbles are scribbles without direction, whereas wavy scribbles are zig-zag lines. Aimless scribbles do not require advanced eye-hand coordination, or attention (Kellogg, 1970; Luria, 1978). On the contrary, the appearance of wavy scribbles indicates that children have observed the written forms of alphabetic language and try to mimic adult's writing behavior. Research has shown that children at these scribbling levels believe that they are able to write, and indeed they would write any words or sentences without hesitation upon researcher' request (Dyson, 1982, 1987; Ferreiro & Teberosky, 1982; Hildreth, 1936; Levin, Korat, & Amsterdamer, 1996; Liberman, 1985; Luria, 1978; Martens, 1996; Sulzby et al., 1989; Vygotsky, 1978).

Symbol and Letter-like Units

Scholars have reported that young children use symbols, shapes, number and letter-like units in their writing. Research has suggested that the appearance of individual symbols or letter-like units indicates that children might have started noticing that English writing is composed of individual symbols (Clay, 1991; Dyson, 1982; Ferreiro & Teberosky, 1982; Hildreth, 1936; Levin et al., 1996; Liberman, 1985; Luria, 1978; Martens, 1996; Sulzby et al., 1989). From the studies on children's name writing development, it has been suggested that children's ability to distinguish print is from the

larger units to smaller units. Thus, young children first would produce a whole page of aimless scribbles, then the wavy scribbles, and then individual symbol units.

Letter-like units are advanced forms of symbol units. Since the shapes and figures of the 26 letters might still be too complicated for young children to identify and remember, they might only generate those letters they are most familiar with or that are the easiest to copy. Circles and straight lines (e.g., O, I) are the most common letter-like units that found in children's early writing.

Letter units and Conventional Writing

It is not necessary for children to learn all the 26 letters to start writing words. In fact, children will use the letters they have learned to make words on their own. Ferreiro and Teberosky (1982) reported that most young children who have not yet learned how to read and write believed that a meaningful word should include at least three or four letters. They observed that children might randomly put three or four letter-like units or letters together and consider it a word. Ferreiro and Teberosky (1982) found that the problem of producing random letters would be solved once children know that the letters they write actually associate with certain sounds. And, after children are able to link sounds and letters together, they can produce syllabic words (e.g., "Alec" as "ALK", "Emily" as "EM") and gradually toward to conventional writing.

Alignment, Spacing, Cases and Other Characteristics

In addition to the above characteristics, Haney et al. (2003) and Molfese et al. (2006)

also used legibility, spaces between letters, case of letters and size of letters to evaluate children's name writing development. These characteristics are especially crucial for those children who might spell their names almost conventionally but whose fine motor skills have not been developed enough to print neatly.

Name Writing and Literacy Development

Children could identify their own name at a very young age (Villaume & Wilson, 1989). Scholars have claimed that children's name writing learning could facilitate children's literacy learning in several ways. First, children learn the letters of their name quickly and efficiently. Secondly, children's name provides early concepts of written language. Once children learn how to write their name, they would more likely learn other words and gradually, they would notice the letter-sound correspondences and learn more words (Bus & van IJzendoorn, 1999; Clay, 1979; Ferreiro, 1986; Ferreiro & Teberosky, 1982; Martens, 1999). I next discuss how children's name writing relates to letter knowledge and reading achievement.

Name Writing and Letter knowledge

Many scholars have reported that name writing is an efficient way for young children to learn letters (Clay 1975; Hayes, 1990; Molfese et al., 2006; Riley, 1996). Letter knowledge includes recognizing letters shapes, knowing the letters names and letters sounds, and the ability to print letters.

Clay (1975, 1991, 2001) claimed that letting young children practice their own names is a very efficient way to develop their letter knowledge. She found that the letters children learn from their own name, family member's names, as well as their friends' names could be easily memorized, and later, be used in their writing. Furthermore, Bloodgood (1999) examined 67 preschool and kindergarten children's free writing samples and found that the letters of the children's own name accounted for 41 percent of the total letters they wrote. Treiman and her colleagues (Pollo, Kessler, & Treiman, 2009; Treiman & Broderick, 1998) also found that the lower the level of children's reading skills, the higher the chance they will overuse the letters of their own names in free or story writing. The letters of children's names no doubt are children's beginning letters pool.

Molfese et al. (2006) examined 78 four- and five-year-old children's name writing samples and found that children's name writing ability significantly related to letter naming ($r = .72$, $p < .01$), letter dictation ($r = .57$, $p < .01$) and word reading ($r = .37$, $p < .01$). Welsch, Sullivan and Justice (2003) analyzed name-writing samples of 3,546 four-year-old children in combination with several other tests and found that children's name writing ability significantly relates to letter knowledge ($r = .51$, $p < .01$) and print knowledge ($r = .42$, $p < .01$). Similarly, Haney (2003) found that kindergartener's name writing performance significantly related to letter-word as well as non-word identification.

Name also gives children an early concept of written words. Treiman, Kessler and Bourassa (2001) analyzed 115 kindergartener's written work and discovered that children who have longer names tend to produce longer invented words than children with shorter names. In addition, Treiman and Kessler (2004) found that younger children tended to capitalize the first letters of their names no matter where the letters is located in other

words.

Letter knowledge is essential for phonological awareness (Stahl and Murray, 1994). Research has shown that children's letter knowledge, phonological awareness and reading skills are reciprocal (Bus & van IJzendoorn, 1999; Carroll et al., 2003; Riley, 1996; Stahl & Murray, 1994). One of the most effective ways to teach young children phonemes is teaching phonemes with letters (Stahl & Murray, 1994). Blair and Savage (2006) tested 38 preschool and kindergarten children's phonological awareness, environmental print recognition and name writing ability and found a moderate correlation between name writing ability and phonological awareness (the Pearson's *r* ranged from 0.48 to 0.64, $p<.001$, in five different phonological awareness tasks).

Researchers have agreed that learning letters names and letters-sound correspondence helps children acquire phonological/phonemic awareness, and at the same time, phonological/ phonemic awareness solidifies children's letter knowledge (Carroll et al., 2003; Riley, 1996; Stahl & Murray, 1994). Scholar have claimed that when children practice printing their own name, they are practicing letter forming, letter-naming, and letter-sound correspondence (Chomsky, 1971; Clay, 1975, 1991; Levin et al., 2005; Treiman, Kessler, & Bourassa, 2001; Villaume & Wilson, 1989). Since name writing promotes young children's letter knowledge, it could be hypothesized that name writing might develop their phonological/phonemic awareness too.

Name Writing and Reading Achievement

Name writing was also found correlated with children's reading achievement. Riley

(1996) reported that kindergarten children's name writing ability correlated to their reading performance at the end of kindergarten year (N = 191, r = .57, p< .001). Weinberger (1996) found in her longitudinal study that children's ability to write their name at age five correlates with their book reading level at age 7 (r = .55, p< .001). Badian (1982) conducted a four-year follow-up study (N = 180) and claimed that four-year old children's name writing ability was the third best predictor (r = .55, p< .001) of the children's reading score on the first grade and the fifth best predictor (r = .45, p< .001) for the second grade reading achievement. Although there is no empirical study to prove whether name writing activity could improve children's later reading achievement, it is reasonable to hypothesize that name writing provides children an opportunity to acquire letter knowledge and based on letter knowledge, children learn how to read.

Name Writing and Motor Development

Although early childhood development should be seen as a whole, cognitive development and motor development are often studied as two independent domains. Reviewing the existing literature, most studies on typically developing children's name writing development or emergent literacy skills are published in education or developmental psychology related journals. On the other hand, studies on children's motor development have attracted professionals mainly from occupational therapy and pediatrics. Therefore, unless researcher uses a broader domain of developmental assessment tools to collect data, the possible relationship between children's emergent

literacy skills and motor skills might not be explored. Fortunately, the data examined in this dissertation contains both motor and language development of normally developing young children, the relationships among name writing, motor skills and emergent literacy skills will be explored in detail.

Recently, developmental psychologists and special education researchers have tried to connect the fields of motor development and language development. From the results of their studies, it seems that motor development and cognitive development are more interrelated than we previously believed (Viholainen et al., 2002, 2006). Therefore, studies from special education or psychology might show there is a relationship between cognitive development and motor development in children with certain disorders or who have familial risk factors, but the results might not be generalizable to typically developing children.

In the following literature review, I first address how slow motor development affects young children's everyday life and then I discuss how handwriting mechanism affects children's literacy acquisition. Since the literature is very limited, I included some studies whose participants are school age children with learning difficulties.

Slow Motor Development and Young Children

Motor development starts and could be observed from the day a child is born. Age-appropriate motor developmental changes indicate a child has not only a healthy neural system but also necessary environmental stimuli (Adolph & Berger, 2006). It has been commonly accepted that motor development delay often coexists with language

development delay, cognitive developmental delay, and neuro-developmental disorder (Bishop & Edmundson, 1987; Missiuna et al., 2008; Viholainen et al., 2006).

Delay in motor development might be an early predictor for language impairment. Bishop and Edmundson (1987) compared 87 preschool children with language impairment and 37 typical developing preschool children and found there was a clear association between language impairment and slow fine motor development. Bishop and Edmundson believed that this is due to neurological immaturity and could improve once the child matured.

Viholainen et al. (2006) traced 75 children who have one parent identified as dyslexic and 79 children without familial risk, from birth to six year old. All 154 children were physically and neurologically healthy when they were born. Viholainen and her colleagues (2002, 2006) administrated several cognitive assessments during the research periods (e.g., Wechsler Preschool and Primary Scale of Intelligence-R, The Attention Problem and Hyperactivity Scales, The Boston Naming Test, The Inflectional Morphology Test, The Peabody Picture Vocabulary Test-R) and found that children who have familial risk for dyslexia and slow motor development have a smaller vocabulary and poorer inflectional morphology at the age of 3 and age of 5. In other words, Viholainen's studies (2002, 2006) showed that slow motor development is connected to language development if the child had a familial risk of dyslexia.

Poor motor ability could reduce the chances that children engage in social play with peers and thus influence their social relationship and school adjustment. Bart, Hajami, and Bar-Haim (2007) analyzed 88 kindergarten children's motor development and a year later, first-grade teacher' report on the participants' school adjustment. They found that

children's general motor functions (r = .58, p< .001) and visual-spatial perception (r = .47, p< .001) assessed in kindergarten were significantly associated with children's school adjustment in first grade. Similarly, Bar-Haim and Bart (2006) found that the 88 kindergarten children with low motor ability showed lower frequencies of social play and higher frequency of social reticence than children with average motor abilities.

Fine Motor Skills and Handwriting Mechanism

Fine motor skills are one of the keys to success in school work. McHale and Cermak (1992) analyzed the minute-by-minute record of one whole day's activities in six elementary school classrooms and found that 30 to 60 percent of the day involved fine motor activities, and moreover, writing tasks predominating over other tasks.

Fine motor skills are the coordination of a group of small muscles and are needed to perform daily functions, for examples: dressing (lacing, buttoning, zipping), coloring, knitting, printing and writing, cutting with scissor, picking up small objects, folding paper, and playing with musical instruments. Delay in fine motor skills acquisition often is the main reason for school children's handwriting difficulties (Berninger, 2000; Berninger et al., 2006). Reviewing the existing literature, studies on fine motor skills mainly come from the fields of psychology and occupational therapy. Psychologists have tried to reveal the mechanisms underlying hand writing (Vinter & Chartrel, 2010) and how children's hand writing ability influences their academic learning. For example, Berninger and her colleagues (Berninger, 2000; Berginger, Yates & Lester, 1991; Berninger et al., 2006) found that orthographic coding, which refers to the ability to

retrieve the memory of letters forms during the process of writing, might affect children's writing performance more than children's motor skills. Some psychologists have also been interested in comparing the writing development between typically developing children and children who have special needs (Kim, 2008; Viholainen, Ahonen, Cantell, Lyytinen, & Lyytinen, 2002; Viholainen, Ahonen, Lyytinen, & Cantell, 2006). On the other hand, occupational therapists have attempted to analyze the movements of hand/finger muscles while writing (Chang & Yu, 2009) and tried to integrate new technology (e.g., kinematic pen) into intervention programs to assist children who have writing disorders (Djioua & Plamondon, 2009).

Among the fine motor skills, handwriting skill is no doubt the most important one in academic learning. Handwriting has been a formal lesson in elementary school since the eighteenth century (Ediger, 2002). Handwriting involves visual motor control ability which allows the child to correctly print out the letters forms s/he perceives, visual motor coordination which helps the child to coordinate hand muscles to print the lines and shapes of the letters, and proper hand grasp strength for child to hold and operate writing tools. In addition to the above perceptual-motor process, good writing needs higher-level cognitive processes too. Only if the lower level perceptual-motor process interacts well with higher-level cognitive processes, could writing be completed successfully (Berninger et al., 1997, Volman et al., 2006).

Lack of mature fine motor skills, especially the skills related to handwriting, has been one of the major concerns in elementary children's academic failure (Berninger et al., 1997; Ediger, 2002; Graham, Harris, & Fink, 2000; Hooper, 2009; Oliver, 1989; Reisman, 1991). Research has shown that school children with better handwriting skills

write more and have better composition work (Graham, Berninger, Abbott, Abbott, & Whitaker, 1997; Jones & Christensen, 1999), and they also evaluate themselves as better writers (Berninger, Mizokawa, & Bragg, 1991).

Poor handwriting also relates to children's fine motor skills. Volman, van Schendel, and Johgmans (2006) compared 29 children (Grade 2 and Grade 3) with handwriting problems and 20 children without handwriting problem and found that children with handwriting problems scored significantly lower on visual perception, visual–motor integration, and fine motor coordination in comparison with the children in the control group. Yochman and Parush (1998) analyzed motor development and handwriting samples of 191 typically developing 2nd and 3rd grader and found that visual-motor integration is the best predictor of the quality of handwriting. Change and Yu (2009) compared the handwriting speed and handwriting performance of 33 children with developmental coordination disorder (DCD), 39 children with handwriting deficit and 22 children normal children. They found that DCD children need more time and more practice to learn a new word compared to the other two groups of children.

Since writing is not a focus in preschool and kindergarten, handwriting problems are rarely discussed. Handwriting ability has been long overlooked when assessing young children's writing development. After exploring all the factors (e.g., children's social economic status, home background, school curriculum), Dunsmuir and Blatchford (2004) found that the major factor influencing kindergartener' writing performance is their writing attitude and their competence in writing, which both are strongly affected by the children's handwriting ability.

Including Fine Motor Skills into Early Writing Scales

Reviewing the early writing scales, fine motor skills are either overlooked or simplified as a part of a literacy criteria; for example, “writing with good form” or “regardless of good form” (Table 2-1, 2-2). Generally speaking, scribbles are the most obvious criterion that related to fine motor skills. Scribbles can be distinguished into aimless scribbles, wavy scribbles and flat lines. The three forms of scribbling demonstrate children’s ability to manipulate their arm and wrist movements. The later levels of name writing development, from Symbols, Letter-like units, Print letters to Conventional, represent not only children’s written language knowledge but also their development of visual-motor control, eye-hand-coordination and manual manipulation. That is, to be able to print a string of recognizable letters, children need to recognize and differentiate the shapes of the letters but also coordinate hand and finger muscles to make lines and shapes.

The differences among the levels of the same type of scribbling might not be meaningful, but potential differences within the level of the criterion of “Generally correct” could be significant (Figure 2-2). All of the samples in the Figure 2-2 could be classified as “Generally correct.” Jacob (4; 2) obviously wrote his name with very poor letters alignment, and the letter sizing and the spaces between letters are inconsistent. Brayden (4; 4) has two reversed letters. Katelyn (4; 8) spelled her name correctly, but the alignment is poor. Jade (5; 1) and Justin (5; 9) have inconsistent letter size as well as reversed letters.

There is no doubt that the development of fine motor skills and emergent literacy skills are concurrent. The point at which a child can print recognizable letters means that his fine motor skills are developed enough to facilitate his writing. This dissertation intends to further explore whether fine motor skills criteria should be integrated into name writing scales.

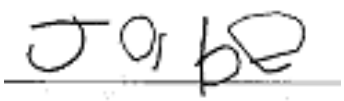
Figure 2- 2 The differences among the level of “Generally correct”

Jacob 4; 2

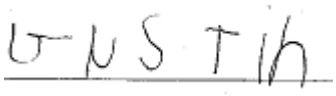
Brayden 4; 4

Katelyn 4; 8

Jade 5; 1



Justin 5; 9



Name Writing as a Baseline Test

In the field of early childhood education, the role of assessment has expanded widely. For example, the U. S. Head Start program started mandatory assessment in 1998 and established its common national reporting system in 2003. In addition to Head Start programs, many states and school districts in the U.S. also have developed or scheduled their own mandatory early assessments (Bordignon & Lam, 2004; Costenbader, Rohrer, & Difonzo, 2000; Gredler, 1997). In England, also since 1998, all four year olds have been required to complete a variety of baseline assessments during their first seven weeks of school (Lindsay & Martineau, 2004). The purposes of early assessment are not only for school accountability and program improvement but also for early identification of children who may be at risk of developing educational difficulties (Lindsay & Desforges, 1998; Gredler, 1997; Meisels & Atkins-Burnett, 2005).

In 1998, the National Association for the Education of Young Children (NAEYC) and the International Reading Association (IRA) made a strong joint position statement which declared it is essential and urgent to include early literacy development in early general assessment (NAEYC, 1998). Furthermore, the National Research Council's Committee on the Prevention of Reading Difficulties not only acknowledges the

importance of early literacy assessment but also urges classroom teacher to use assessment tools to monitor children's literacy learning progress and furthermore, to recognize and meet children's individual needs (Snow, Burns, & Griffin, 1998).

Although early literacy assessment should include reading and writing, assessment tools designed to assess children's writing development are much less common than those that assess children's reading development (Meisels, 1998). Because of a lack of research on children's emergent writing development and because children's own name is often the first recognizable written word they produce, children's name writing thus has been used as a subtest in many readiness tests to assess young children's emergent writing development (e.g., the Phonological Awareness Literacy Screening, the Early Literacy Skills Assessment), as well as a research variable in early literacy studies (Aram & Biron, 2004; Bloodgood, 1999; Clay, 1991; Haney et al., 2003; Molfese et al., 2006; Stuart, 1990, 1995; Treiman & Broderick, 1998; Welsch, Sullivan, & Justice, 2003; West & Hausken, 1995). In England, all early mandatory baseline assessments approved by the Qualifications and Curriculum Authority include a name-writing related task (Lindsay & Martineau, 2004).

In addition to serving as a subtest in readiness assessments, children's name writing has been included in motor development screening tests. For example, the Modified Predictive Index (MPI) and the Developmental Indicator for the Assessment of Learning, 3rd ed. (DIAL-3) both put children's name writing test in the section of motor development. Research has shown that children's name writing is a developmental process, but how children's name writing relates to literacy development as well as to fine motor development is still open to discussion.

Conclusion: A Need to Reexamine the Existing Name Writing Scales

Not only does name writing reflect children's literacy development, but it also links to children's fine motor skills. Research has shown that children's names are often the first words they learn and the earliest word concepts they get. Children's name writing ability is related to phonological awareness and later reading.

Reviewing the existing literature, only three research studies were found that empirically examine children's name writing development; they are Hildreth (1936), Ferreiro and Teberosky (1982), and Lieberman (1985). The three studies examined children's name writing development by different approaches and resulted in different results and name writing developmental scales (Table 2-2). Hildreth's (1936) analysis mainly focused on the written forms children produced, whereas Ferreiro and Teberosky (1982) tried to explore how children's written forms reflected their psycholinguistic development. Lieberman (1985) combined Hildreth and Ferreiro and Teberosky's perspectives and paid attention to how children construct their literacy strategies, which can be also observed through the written forms children produced. Their research results have provided later scholars a basic model to develop name writing scales.

So far, a total number of 17 name writing developmental characteristics can be found in different name writing scales used in previous studies (Table 2-1). It is likely that the 17 characteristics represent all possibilities rather than major features of name writing development that appear repeatedly and reliably over time. If the scoring criteria of a measure do not represent the major developmental traits, the validity of the

measurement will be an issue. Thus, this dissertation attempts to first, identify the major developmental characteristics in children's name writing and furthermore, to propose and validate a children's name writing scale. After the name writing scale is validated, the relationships among children's name writing development, emergent literacy skills and fine motor skills are explored.

Chapter 3

Study One: Finding the Major Characteristics of Children's Name Writing Development

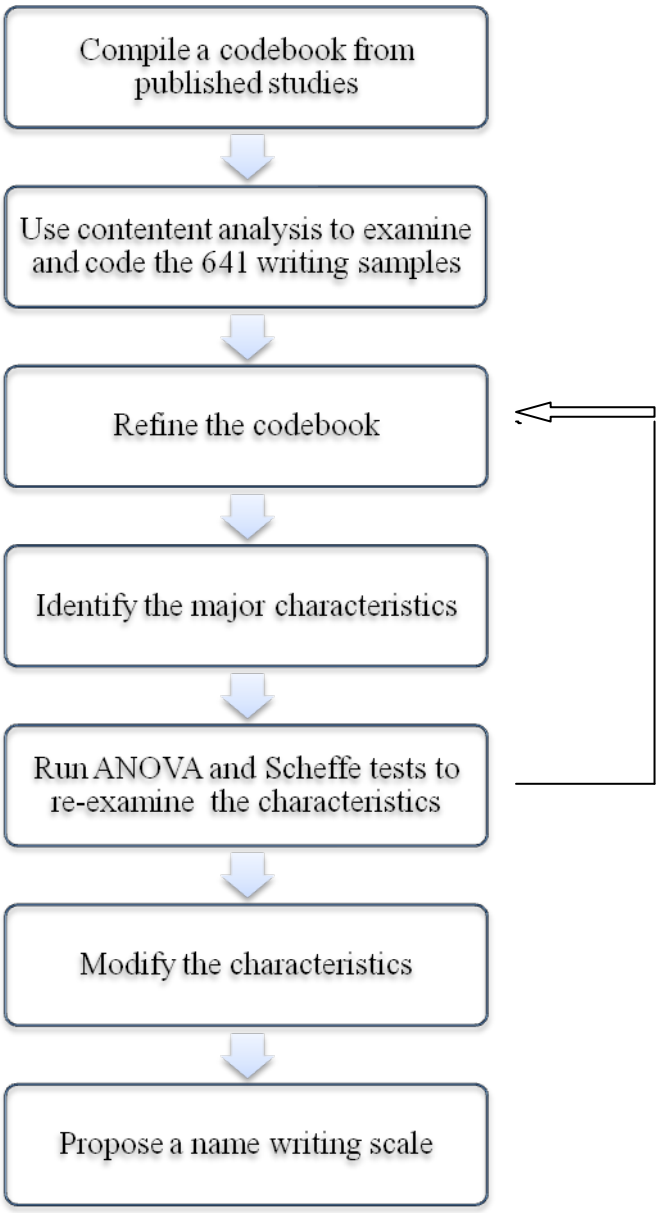
Although early literacy scholars have suggested that children's name writing development contains many different characteristics (see Table 2-1 and Table 2-2), there is no recent study to confirm what major developmental characteristics distinguish children's name writing development. Thus, Study One aims to identify the major characteristics of children's name writing development.

Research Method

To explore the major name writing characteristics, I first used content analysis to examine the key written features (e.g., patterns of strokes, symbols, letters, etc.) evident in the children's name writing samples. Moreover, I also used children's longitudinal data to reexamine the order of the developmental characteristics.

In addition to a qualitative examination, statistical methods are applied to reconfirm the results. For example, Post Hoc Scheffe tests were applied to determine whether there is a statistically significant difference between the ages when two name writing characteristics appear. The research procedure is showed in Figure 3-1.

Figure 3- 1 The research procedure of Study One-A



Data and Participants

The name writing samples examined in Study One were drawn from the longitudinal project "Enhanced HS-MAP Intervention: Linking Program Evaluation and Child Outcomes," which was funded by a grant to E.P. Bradley Hospital, East Providence, Rhode Island, from the Administration on Children, Youth and Families (ACYF), and the Head Start Bureau as part of the Head Start Child Outcomes Research Consortium (Dickstein, Seifer, & Miller, 2002-2006). The use of these data has been approved by the University of Michigan IRB board as well as that of E. P. Bradley Hospital. Note that the "name" examined in the study refers to the children's first name only.

The name writing task is a subtest of DIAL-3 assessment (Developmental Indicator for the Assessment of Learning, 3rd ed.) (Mardell-Czudnowski & Goldenberg, 1998) which has been widely used in Head Start programs. The DIAL-3 includes assessments of motor skills (catching, jumping, blocks building, cutting, copying and name writing), basic concepts (body parts, color, counting, position, shapes), and language (articulation, letters and sounds, rhyming, objects and actions, and problem solving). It is designed to be conducted individually. For Study One, I only used the name writing samples from the name writing task. Data from the other subtests are used in later studies.

The name writing subtest was administered individually. At the beginning of the task, the researcher placed a pencil and a piece of designed DIAL-3 answer paper on the table, and then asked the subject to write his/her name on the designated area. Note that the researcher did not provide any help during the task.

A total of 641 name writing samples produced by 321 children (177 boys and 144

girls) aged from 3 year old to 5 year old were examined in this study (Table 3-1 and Table 3-2). The name writing samples were collected once a school semester (in March and October) from Fall 2002 to Fall 2006. All the subjects were from 23 Head Start classrooms in a northeast US city.

Among the 321 children, 119 children had one name writing sample collected, 126 children had two samples collected, 41 children had three samples collected, 28 children had four samples collected, and 7 children had five samples collected. However, only one name writing sample from each subject was pulled out for the statistical exploration. These cross sectional data were expected to reveal the major name writing developmental characteristics, whereas the multiple name writing samples were used as longitudinal data to reveal individuals' name writing development.

Table 3- 1 Distribution of the subjects' age and gender

Age	Gender	N	%	N	%
3 year old	Boy	70	22	125	39
	Girl	54	17		
4 year old	Boy	83	26	147	46
	Girl	64	20		
5 year old	Boy	24	8	51	15
	Girl	26	8		
Total		321	100%	321	100%

Table 3- 2 The subjects and samples collected

Children who have	N	Age when producing the first name writing sample	Boy N	Girl N	Total N
1 sample collected	119	3-year-old	12	12	24
		4-year-old	30	26	56
		5-year-old	20	19	39
2 samples collected	126	3-year-old	21	13	34
		4-year-old	48	32	80
		5-year-old	5	7	12
3 samples collected	41	3-year-old	19	15	34
		4-year-old	2	5	7
4 samples collected	28	3-year-old	13	12	25
		4-year-old	2	1	3
5 samples collected	7	3-year-old	5	2	7
Total	321		177	144	321

The Codebook and the Coding Process

The first codebook.

In order to include all the possible name writing characteristics, I compiled the characteristics identified in the eight studies listed in Table 1-1 as well as the three studies listed in Table 1-2 and organized a 17-criterion coding list (Table 3-3 and Table 3-4). Some of the criteria from the eleven studies were impossible to apply in the present study because they could not be observed through only written samples, and thus were deleted from the coding list. For example, Ferreiro and Teberosky's (1982) name writing level 2 "start noticing the possibility of letter-sound correspondence", level 3 "start noticing the

sounds of syllables of their names" and level 4 "try to sound out the syllables and match with letters" all need information directly from the interaction with the subjects, and thus, could not be applied in the present study.

In addition to the 17 criteria, two independent coders and I were instructed to add any new characteristics observed in the name writing samples but not included in the coding list. Two graduate students from the School of Education, University of Michigan, were hired to code the first 12 criteria on the 641 name writing samples. Another two graduate students from the School of Education, Tzu Chi University, Hualien City, Taiwan, were hired to code the 5 criteria of the fine motor skills of the 641 name writing samples. In a 40-minute coding training, I explained the purpose of the study, the definition of the coding criteria, and how to code the writing samples. At the beginning of the coding practice session, the coders seemed very confused about the coding criteria, but with more practice, the coders became able to distinguish the codes and reach group agreement.

The "ls" and "Os" found in the written samples were an issue to the coders because the "ls" and "Os" could be letters, numbers or symbols. After discussing with the coders, we decided that the coding of the "ls" and "Os" should be based on the written content. That is, if the name writing samples were composed of scribbles, unrecognizable letters or symbols, then the "ls" and "Os" were coded as symbols; if the name writing samples consisted of numbers, the "ls" and "Os" were coded as number; if the name writing samples were composed with recognizable letters, the "Is" and "Os" were identified as the letters.

Note that every written sample could only be coded under one category, thus if there were several symbols showed in one written sample, the coder had to flag it and the sample would be discussed later in group. The results of the coding were explained as followed.

Reliability

To ensure the quality of findings, establishing intercoder reliability is essential (Hruschka et al., 2004; Neuman, 2006; von Eye & Mun, 2005; Wimmer & Dominick, 2003). Lack of satisfactory intercoder reliability may suggest either the coders need further training, or the measurements are too divergent (Neuendorf, 2002; Popping, 1988). The present study chooses to use Cohen's Kappa, which is the most accurate estimation of inter-coder reliability (Cohen, 1960, 1968; Lombard, Snyder-Duch, & Bracken, 2002). After computing the inter-coder differences by SPSS (17^{th} ed.), the value of Cohen's Kappa was found to be .85 for the 12 spelling criteria and .73 for the 5 fine motor skills criteria. The reliability of the scoring is adequate.

Table 3- 3 Coding criterion from the published studies

Categories	Draw from
1. Refusal	Blair & Savage, 2006; Bloodgood, 1999; Mardell-Czudnowski & Goldenberg, 1998; Molfese et al., 2006
2. Drawing/pictures	Hildreth, 1936; Lieberman, 1985; Molfese et al., 2006; Purcell-Gates, 1996; Welsch et al., 2003
3. Aimless scribbles	Bloodgood, 1999; Hildreth, 1936; Lieberman, 1985; Mardell-Czudnowski & Goldenberg, 1998; Molfese et al., 2006; Purcell-Gates, 1996; Welsch et al., 2003
4. Wavy scribbles	Bloodgood, 1999; Hildreth, 1936, Ferreiro & Teberosky, 1982; Lieberman, 1985; Mardell-Czudnowski & Goldenberg, 1998; Molfese et al., 2006; Purcell-Gates; 1996; Welsch et al., 2003
5. Scribbles with symbol- or letter-like units	Hildreth, 1936; Lieberman, 1985; Welsch et al., 2003
6. Symbol units	Bloodgood, 1999; Ferreiro & Teberosky, 1982; Lieberman, 1985; Welsch et al., 1003
7. Letter-like or number units	Bloodgood, 1999; Hildreth, 1936; Lieberman, 1985; Purcell-Gates, 1996; Welsch et al., 2003
8. Random letters	Mardell-Czudnowski & Goldenberg, 1998; Hildreth, 1936; Lieberman, 1985; Welsch et al., 2003
9. The first letters of name	Blair & Savage, 2006; Molfese et al., 2006
10. Contain Two or Three Letters from name	Blair & Savage, 2006; Mardell-Czudnowski & Goldenberg, 1998; Hildreth, 1936; Lieberman, 1985; Molfese et al., 2006; Purcell-Gates, 1996; Welsch et al., 2003

Table 3-3 Coding criterion from the published studies (Cont.)

11. Spelling almost correct, regardless of good form	Blair & Savage, 2006; Bloodgood, 1999; Mardell-Czudnowski & Goldenberg, 1998; Haney et al., 2003; Hildreth, 1936; Lieberman, 1985; Molfese et al., 2006; Purcell-Gates, 1996; Welsch et al., 2003
12. Conventional, spelling is almost correct with good form	Blair & Savage, 2006; Bloodgood, 1999; Hildreth, 1936; Ferreiro & Teberosky, 1982; Lieberman, 1985; Molfese et al., 2006; Welsch et al., 2003
13. Alignment	Haney et al., 2003; Molfese et al., 2006
14. Spaces between letters	Haney et al., 2003; Molfese et al., 2006
15. Size of letters	Haney et al., 2003; Molfese et al., 2006
16. Case used	Haney et al., 2003; Molfese et al., 2006
17. Reversal letters	Haney et al., 2003; Molfese et al., 2006

Table 3- 4 The first codebook

Categories	Operational definition
1. Refusal	Blank, or have researcher's note said the child refused to write
2. Drawing/pictures	Pictures, drawings
3. Aimless scribbles	Scribbles without direction, no recognizable figures or character
4. Wavy scribbles	One or several zigzag lines
5. Scribbles with symbol- or letter-like units	One or several scribbles with separate individual symbols or letter-like units
6. Symbol units	One or several symbols. Note that symbols children produced might look like "I" or "O". Unless there are other letters or number presented, all the "Is" and "Os" should be counted as symbols.
7. Letter-like or number units	One or several English letter-like or number-like units.
8. Random letters	One or several English letter-like units, but the letters are not from the children's names, nor have any meanings.
9. The first letters of name	The first letters of the child's name. The letters might repeat several times and/or follow with some other symbols/letters.
10. Contain Two or Three Letters from name	Contain at least two letters from the child's name; the letters might be formed poorly
11. Spelling almost correct, regardless of good form	Name writing is completed with recognizable letters. The spelling of the child's name is almost correct but might have some revered letters, or might miss a letters.
12. Conventional, spelling is almost correct with good form	Name writing is complete name with good shaped letters. The letters are formed more firmness, more regularity and better aligned. However, there might be one spelling error or revered letters.

Table 3-4 The first codebook (cont.)

13. Alignment	At least 3 letters could be recognized from the child's name writing sample. Score 0: Not applicable. Score 1: Letters do not align. Score 2: Part of the letters is tilted but aligned. Score 3: Most letters are properly aligned.
14. Spaces between letters	At least 3 letters could be recognized from the child's name writing sample. Score 0: Not applicable. Score 1: The spaces between letters are not even. Score 2: The spaces between letters are not even. Score 3: The spaces between letters are mostly even.
15. Size of letters	At least 3 letters could be recognized from the child's name writing sample. Score 0: Not applicable. Score 1: The size of letters is not inconsistent. Score 2: The size of letters is partly even. Score 3: The size of letters is mostly even.
16. Case used	Score 0: Not applicable. Score 1: The letters are all lower cases. Score 2: The letters are mixed with lower and upper cases. Score 3: The first letters of the children's name is upper cased and other letters are lower cases. Score 4: The letters are all upper cases.
17. Reversal letters	Score 0: Not applicable. Score 1: One or more letters revered. Score 2: No revered letters.

Refining the codebook

Based on the first codebook (Table 3-4), we carefully examined and coded the 641 children's name writing samples. We not only coded the writing samples but also examined the figures and symbols produced by the children. Note that during coding, we were open to add any new criterion, if there was any observed characteristic not on the list.

No Drawing/picture, nor number was found

After carefully examining and coding the 641 children's name writing samples, we found that there were neither pictures/drawings nor numbers (Table 3-5). This suggests that the children might already have a print concept and know that names are composed of letters rather than pictures or numbers. Therefore, when the researcher asked the children to "write your name on the paper," they knew that they should use letters, not pictures or numbers to write their names.

Adding the category of Flat lines

In addition to Aimless scribbles and Wavy scribbles, we found that 30 (4.7%) of the samples were composed of flat lines. Thus, we added "Flat lines" into the coding list.

Deleting the category of Scribbles with symbol- or letter-like units.

"Scribbles with symbol- or letter-like units" (0.8%, N = 5) occurred infrequently suggesting that it might not be a major developmental characteristic. After discussing

with the two coders and Dr. Sulzby, we all agreed that the five samples of “Scribble with symbol- or letter-like units” could be reclassified into the category of “Symbol units” or “Letter-like units” because children who can produce symbol units or letter-like units might have already noticed that English writing is composed of individual symbols or letters. Thus, after re-examination, the five samples were reclassified into Symbol units. As a result, the category of “Scribble with symbol- or letter-like units” was deleted from the coding list.

Combining the categories of Random letters and the First letters of name

The category of Random letters (1.4%, N = 9) did not have enough samples found in the present study to keep in the coding list. Considering that Random letters and the First letters of names (5.0%, N = 32) both suggest that the children have learned letters and are trying to use letters to compose their names, I thus decided to combine the two categories together and renamed it as “Letter units.”

Only a few samples with two or more developmental characteristics

Except the samples in the category of Scribbles with symbol- or letter-like units, there were only 5 name writing samples with characteristics of two or more developmental levels. In the present study, there are two samples with Aimless scribbles and Wavy scribbles, and three samples with Random letters and Symbol units. After examining the five samples, we decided that they should be classified into the most advanced level observed in their name writing samples.

The primary reason to reduce the number of the categories is not only to reveal the

major developmental characteristics but also to increase the statistical significance when computing. Moreover, a less complicated scale will be easier for early educators to use.

Table 3- 5 Distribution of children's name writing characteristics

Characteristics		Frequency	Percent	Mean age (in month)	Age SD (in month)
1.	None/refusal	73	11.3	44.76	5.66
2.	Drawing/pictures	0	0	0	0
3.	Aimless scribbles	19	3.0	41.79	5.34
4.	Wavy scribbles	51	8.0	45.04	5.98
Add	***Flat lines***	***30***	***4.7***	***44.43***	***6.69***
5.	Scribbles with symbol- or letter-like units	5	.8	47.20	6.76
6.	Symbol units	84	13.1	47.39	6.77
7.	Letter-like units	32	5.0	49.47	7.13
8.	Random letters	9	1.4	55.44	4.98
9.	The first letters of name	32	5.0	52.78	6.53
10.	Contain two or three letters from name	102	15.9	54.97	5.83
11.	Spelling almost correct, regardless of good form	113	17.6	59.68	6.88
12.	Conventional or almost correct with good form	91	14.2	63.51	6.07
Total		641	100.0	52.74	9.40

Table 3-5 Distribution of children's name writing characteristics (cont.)

	Characteristics	Frequency	Percent	Mean age (in month)	Age SD (in month)
13.	Alignment score 0: N/A	315	49.1	46.50	6.80
	Score 1: Letters do not align	134	20.9	56.73	6.70
	Score 2: Part of the letters is tilted but aligned	99	15.4	60.23	7.95
	Score 3: Most letters are properly aligned	93	14.5	60.04	6.94
subtotal		641	100	52.72	9.36
14.	Spacing score 0: N/A	315	49.1	46.50	6.80
	Score 1: Spaces between letters are not even	113	17.6	55.85	7.04
	Score 2: Spaces between letters are partly even	113	17.6	59.75	6.49
	Score 3: Spaces between letters are mostly even	100	15.6	60.86	7.61
subtotal		641	100	52.72	9.36
15.	Letters Size score 0: N/A	315	49.1	46.50	6.80
	Score 1: The size of letters is not inconsistent	196	30.6	57.24	6.96
	Score 2: The size of letters is partly even	87	13.6	61.62	7.32
	Score 3: The size of letters is mostly even	43	6.7	59.74	7.35
subtotal		641	100	52.72	9.36
16.	Letters case score 0: N/A	316	49.3	46.56	6.82
	Score 1: The letters are all lower cases	120	18.7	58.31	7.75
	Score 2: The letters are mixed with lower and upper cases	23	3.6	56.96	8.36
	Score 3: The first letters of the child's name is upper cased and other letters are lower cases	90	14.0	57.36	7.28
	Score 4: The letters are all upper cases	92	14.4	61.02	6.27
subtotal		641	100	52.72	9.36

Table 3-5 Distribution of children's name writing characteristics (cont.)

17	Reversal score 0: N/A	316	49.3	46.51	6.79
	Score 1: One or more letters revered	71	11.1	59.24	6.36
	Score 2: No revered letters	254	39.6	58.63	7.59
subtotal		641	100	52.72	9.36

Data Analysis and Results

There are two steps of data analysis in this study. The first step focuses on children's language and literacy abilities and the second step focuses on the factors related to children's fine motor skills, which are the criteria 13 to 17 on Table 3-5. Once the name writing scale is established, the criteria of fine motor skills could be compared and added into the scale.

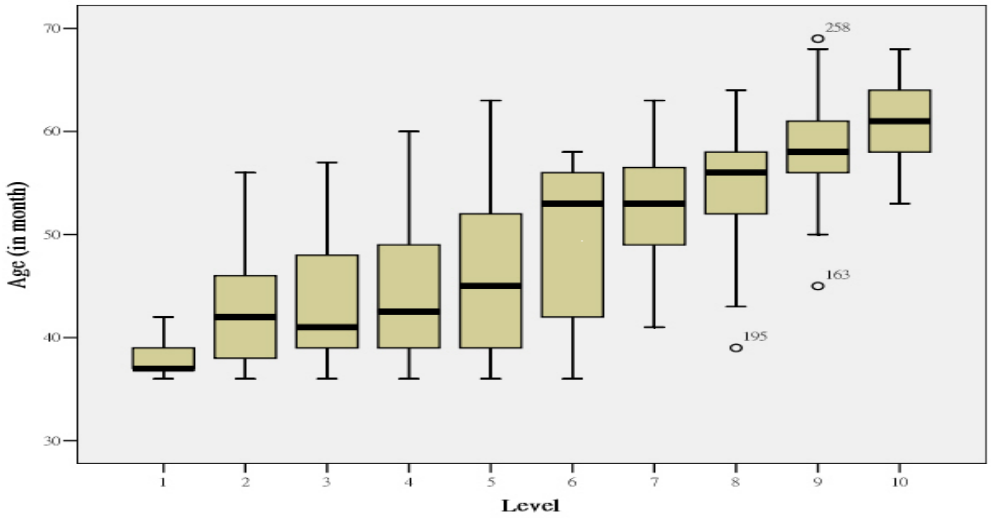
The Distribution of Children's Name Writing Levels

The following cross sectional data analysis is based on the 321 subject's first-collected name writing samples. Except for the criteria of Alignment, Spacing, Letter size, Case used and Letter reversal, all the name writing characteristics were analyzed and discussed in detail as follows. The five criteria that are not from the perspective of literacy but focus more on fine motor skills were analyzed after the first name writing scale was proposed.

Table 3- 6 Distribution of children's name writing characteristics

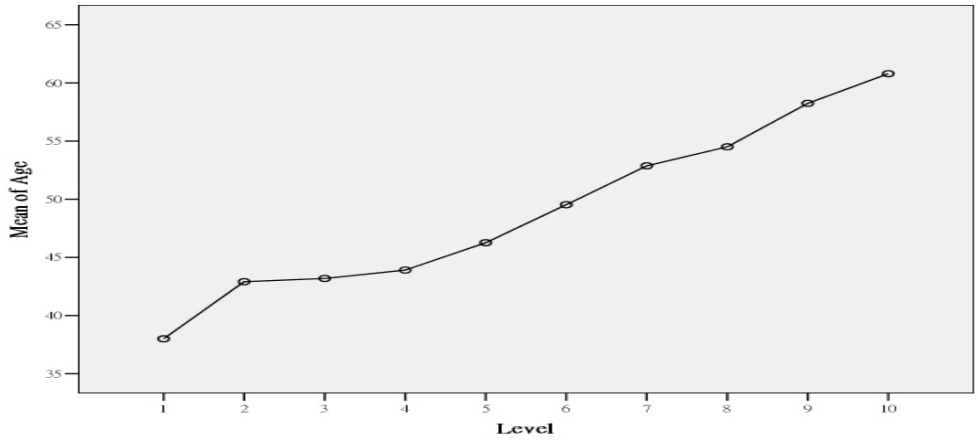
levels/Characteristics		N	%	Mean age (in month)	Age SD (in month)
1	Aimless scribbles	11	3.4	38.00	1.84
2	Flat lines	23	7.2	42.91	6.09
3	Wavy scribbles	32	10.0	43.19	5.87
4	None/refusal	44	13.7	43.91	6.47
5	Symbol units	42	13.1	46.26	7.52
6	Letter-like units	17	5.3	49.53	8.10
7	Letter units (random letters/first letters of name)	24	7.5	52.88	5.39
8	Contain two or three letters from name	49	15.3	54.51	5.81
9	Spelling almost correct, regardless of good form	40	12.5	58.25	4.83
10	Conventional or almost correct with good form	39	12.1	60.79	3.77
Total		321	100.0	50.30	8.96

Figure 3- 2 Distribution of children's name writing levels



Note: 1. Aimless scribbles, 2. Flat lines, 3. Wavy lines, 4. None/refusal, 5. Symbol units, 6. Letter-like units, 7.Letter units, 8. Contain two or three letters from name, 9. Spelling almost correct, regardless of good form, 10. Conventional or almost correct with good form.

Figure 3- 3 Mean age of the children's name writing levels



Note: 1. Aimless scribbles, 2. Flat lines, 3. Wavy lines, 4. None/refusal, 5. Symbol units, 6. Letter-like units, 7.Letter units, 8. Contain two or three letters from name, 9. Spelling almost correct, regardless of good form, 10. Conventional or almost correct with good form.

Analysis of Aimless Scribbles, Flat Lines and Wavy Scribbles.

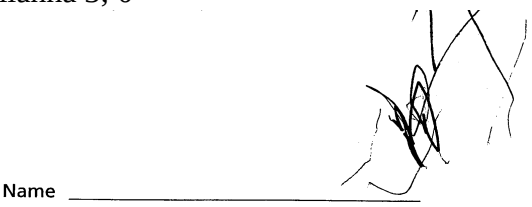
Out of 321 first-collected samples, 3.7 % (N = 11, M = 38.00 months) are Aimless scribbles, 7.2 % (N = 23, M = 42.91 months) are Flat lines and 10.0 % (N = 32, M = 43.19 months) are Wavy scribbles. These three written characteristics are often found in children of younger age and categorized as the earliest written forms.

Aimless scribbles are scribbles without directions, which contain multiple vertical, horizontal, or spiral lines (Figure 3-4). Flat lines are simple horizontal lines (Figure 3-5) and Wavy scribbles look like continuous zigzag lines (Figure 3-6). Compared the formation of the three scribbles, Wavy scribbles are the closest to the English written forms. The data also indicated that the mean age of students using Wavy scribbles is older than the mean age of those using Aimless scribbles and Flat lines.

As for the longitudinal data, out of 321 children with 641 name writing samples, 12 children produced two or more scribbling names (Table 3-7). Among the 12 longitudinal cases, five cases have aimless scribbles before wavy scribbles. Also, the time children stay in a single level varies from subject to subject. For example, both Subject 3 and Subject 4 appear to have stayed in the level of Wavy scribbles for nine months, while Subject 6 appears to have stayed for only six months.

Figure 3- 4 Examples of Aimless scribbles

Julianna 3; 0



Meagan 3; 1

Corey 3; 3

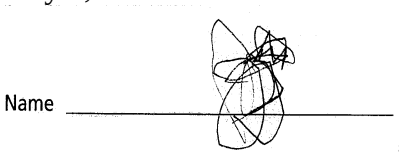
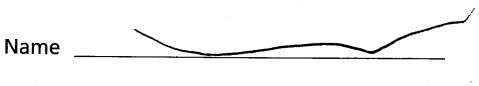


Figure 3- 5 Examples of flat lines

Celine 3; 8



Joseph 4; 2

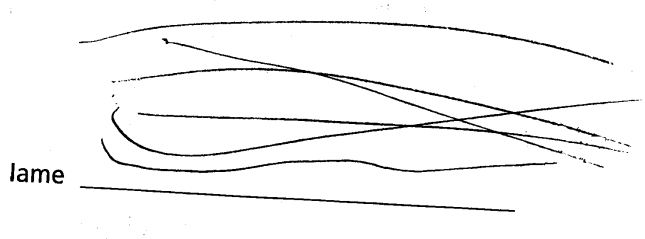
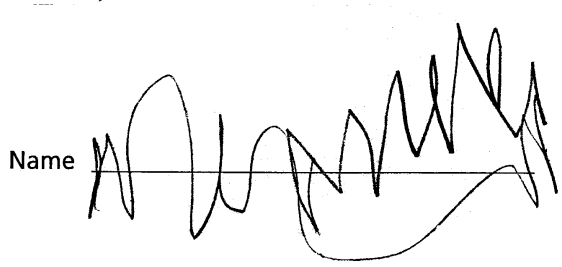
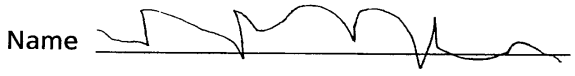


Figure 3- 6 Examples of wavy lines

Collin 4; 1



Jason 4; 3



Ladymarie 3; 10

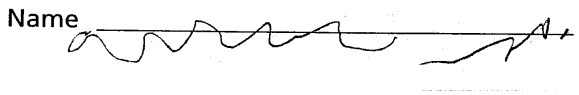


Table 3- 7 Subjects produced two or more scribbling sample

Subject	Age (months)	Category
1	42	2
	46	1
	51	3
2	37	2
	43	3
3	41	3
	50	3
	55	4
4	44	3
	48	3
	53	3
	58	7
	68	9
5	40	2
	44	5
	49	3
	55	6
6	38	3
	44	3
	48	8
7	42	6
	45	1
	51	4
8	42	1
	46	3
9	45	2
	49	3
10	41	2
	46	3
11	36	1
	40	2
	45	4
	51	2
12	39	1
	43	5
	48	2

Note: 1. Aimless scribbles, 2. Flat lines, 3. Wavy lines, 4. None/refusal, 5. Symbol units, 6. Letter-like units, 7.Letter units, 8. Contain two or three letters from name, 9. Spelling almost correct, regardless of good form, 10. Conventional or almost correct with good form.

Analysis of None/refusal.

Out of 321 first-collected samples, 13.7 % (N = 44) are None/refusal. The mean age of students scored as None/refusal is 43.91 months, which is older than the three scribble forms discussed above. The significant number of cases indicates that None/refusal is an important developmental characteristic and not the lowest level of name writing development as most scholars have suggested.

The longitudinal data also support that children's refusal to write is not the lowest level of the name writing development. Out of 321 children with 641 name writing samples, a total of 62 children produced 73 None/refusal responses (Appendix 4). Among the 73 None/refusal responses, 19 have a prior response before the level of None/refusals (Table 3-8), 38 have a followed response after None/refusals (Table 3-9). Out of the 19 responses before None/refusals, 73.7% (N = 14) are Aimless scribbles, Flat lines and Wavy scribbles, and 26.3% (N = 5) are Symbol units, Letter-like units and Letter units. Among the 38 responses followed the None/refusal, 13.1% (N = 5) are Aimless scribbles and Flat lines, 86.9% (N = 33) are levels after None/refusal. The data appear to suggest that most children's None/refusals happened after scribbling levels but before Symbol units or other more advanced levels.

Table 3- 8 Children's responses prior to their refusal response

Children's writing characteristic before refusal		Frequency	%	%
1	Aimless scribbles	5	26.2	73.7
2	Flat lines	3	15.8	
3	Wavy scribbles	6	31.6	
4. None/refusal				
5	Symbol units	3	15.8	26.3
6	Letter-like units	1	5.3	
7	Letter units	1	5.3	
8	Contain two or three letters from name	0	0	
9	Spelling almost correct, regardless of good form	0	0	
10	Conventional, almost correct with good form	0	0	
Total		19	100	100

Table 3- 9 Children's responses followed by their refusal response

Children's writing characteristic followed by refusal		Frequency	%	%
1	Aimless scribbles	4	10.5	13.1
2	Flat lines	1	2.6	
3	Wavy scribbles	0	0	
4. None/refusal				
5	Symbol units	8	21.1	86.9
6	Letter-like units	4	10.5	
7	Letter units	4	10.5	
8	Contain two or three letters from name	7	18.4	
9	Spelling almost correct, regardless of good form	8	21.1	
10	Conventional, almost correct with good form	2	5.3	
Total		38	100	100

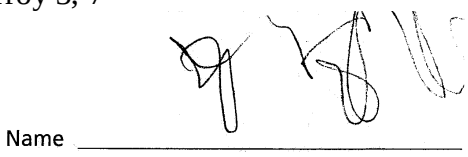
Analysis of Symbol Units and Letter-like Units.

In Study One, out of the 321 first collected name writing samples, 13.1 % (N = 42, M = 46.26 months) are categorized as Symbol units, and 5.3 % (N = 17, M = 49.53 months) are Letter-like units. Symbol units refer to children's name writing composed of one or several symbols (Figure 3-7). The most used symbol observed in the present study is individual circles. Some scholars believed that Symbol units would gradually turn into Letter-like units, which look like malformed letters (Figure 3-8) (Bloodgood, 1999; Molfese et al., 2006; Welsch et al., 2003).

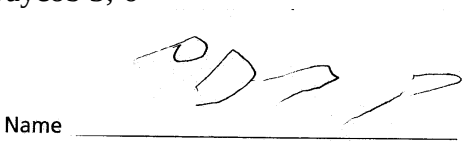
There are a total of 89 Symbol units and 32 Letter-like units observed in the longitudinal data. However, only 6 subjects produced both Symbol units and Letter-like units. Among them, four subjects produced Symbol units before Letter-like units. Due to the fact that children's name writing samples were collected once per semester, some important developmental changes might have been missed.

Figure 3- 7 Examples of Symbol units

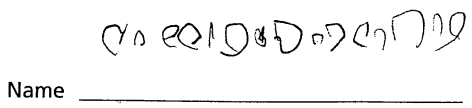
Troy 3; 7



Jaycob 3; 6



Caitlyn 3; 11



Nickolas 4; 7

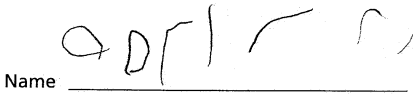
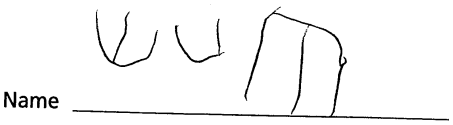
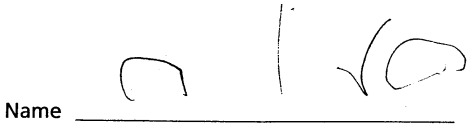


Figure 3- 8 Examples of Letter-like units

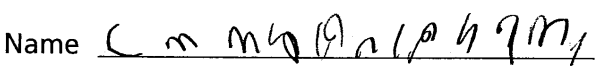
Leann 3; 7



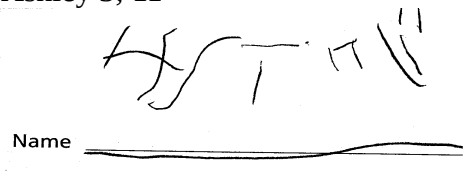
Edward 4; 3



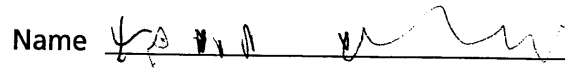
Ladymarie 4; 8



Ashley 3; 11



Taressa 4; 7



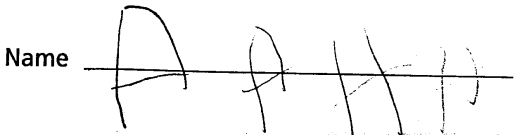
Analysis of the Letter units, and Contain Two or Three Letters from Name

Out of the 321 first collected name writing samples, 7.5% (N = 24, M = 52.88 months) are Letter units, and 15.3% (N = 49, M = 54.51 months) are Contain Two or Three Letters from the child's name. The Letter units might contain the first letters of the subject's name (Figure 3-9), or a string of letters with no apparent meaning and not coming from the subject's name (Figure 3-10)—i.e., Random letters. These two categories have been used by several researchers but in the present study only nine samples (1.4%) out of total 641 longitudinal samples are Random letters, while 32 samples (5.0%) are First letters of name. The appearance of First letters of name and Random letters indicates that children have been able to form recognizable letters.

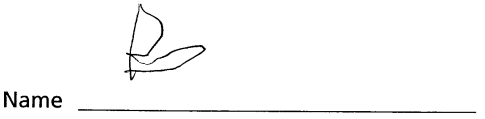
Of the longitudinal data, 88 subjects produced either Letter units or Contain Two or Three letters from name regardless of good form (Appendix 6) (Figure 3-11). Among the 88 subjects, 9 subjects produced both the two levels, and all of the 9 cases produced the level of Letter units before Contain Two or Three Letters from name regardless of good form.

Figure 3- 9 Examples of Letter units--The first letters of name

Alajah 3; 11



Brandon 4; 4



Marisol 4; 5

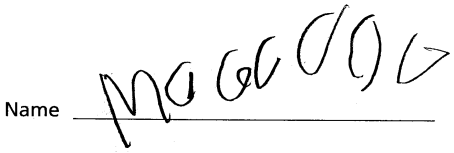
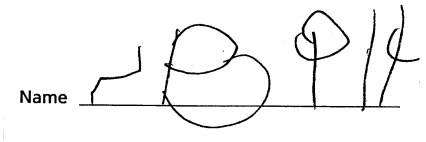
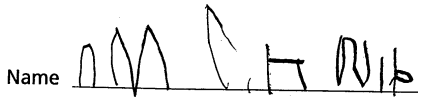


Figure 3- 10 Examples of letter units--Random letters

William 4; 9



Charles 5; 1



Dhruv 4; 0

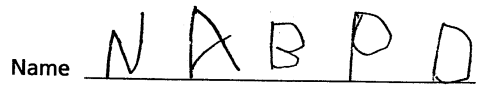
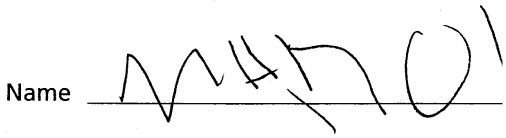
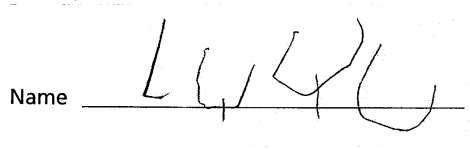


Figure 3- 11 Contain Two or Three Letters from name

Marisol 4; 9



Luis 4; 1



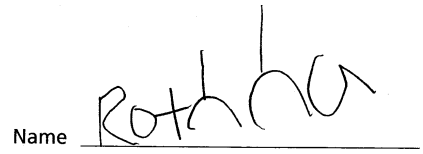
Anthony 4; 6

Analysis of Spelling Almost Correct Regardless of Good Form and Conventional, or Almost Correct with Good Form

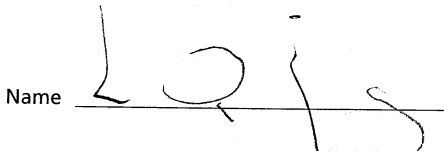
Out of 321 first collected name writing samples, 12.5% (N = 40, M = 58.25 months) are Spelling Almost Correct regardless of good form, and 12.1 % (N = 39, M = 60.79 months) are Conventional or almost correct with good form. The Spelling Almost Correct regardless of good form means that the subject's name is almost correct but might have reversed letters or the letters are formed poorly (Figure 3-12). The Conventional or almost correct with good form means that the spelling is almost correct and the letters are formed more firmly, with more regularity and better aligned (Figure 3-13).

Figure 3- 12 Spelling almost correct, regardless of good form

Roxanna 4; 8

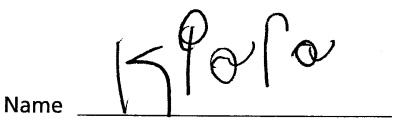


Luis 4; 5



Abbygyle 5; 1

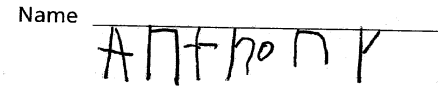
Kiara 6; 1



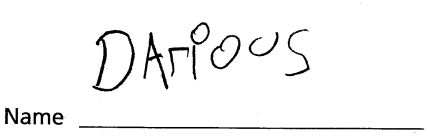
Darious 5; 3

Figure 3- 13 Conventional, or almost correct with good form

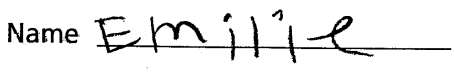
Anthony 4; 10



Darious 6; 2



Emilie 6; 4



A Trial Scale For Preschool And Kindergarten Children's Name Writing Development

From the above preliminary analysis and discussion, Study One identified significant characteristics that distinguish levels of children's name writing development contains several significant characteristics. Ten characteristics were found that distinguished children's name writing development by age. The following discussion focuses on how the ten characteristics should be adjusted. Table 3-10 shows the results of the Post Hoc Scheffe tests of the ten characteristics. The results of the Scheffe tests were an important reference to decide whether a criterion should be merged or kept.

Based on the results, I then ran a one-way ANOVA and followed with Post Hoc Scheffe tests to examine if there are significant mean age differences among the ten name writing characteristics. After computing, the *F* value is 47.497 ($p < .001$), which suggested that there are significant mean age differences among the ten levels (Table 3-10). The discussion of the test results follows.

Table 3- 10 The Post Hoc Scheffe tests of the first 10 name writing characteristics

Scheffe	2-	3-	4-	5-	6-	7-	8-	9-	10-
1	4.913	5.188	5.909	8.262	**11.529**	**14.875**	**16.510**	**20.250**	**22.795**
	(p=.818)	(p=.706)	(p=.456)	(p=.052)	**(p=.003)**	**(p< .001)**	**(p< .001)**	**(p< .001)**	**(p< .001)**
2		.274	.996	3.349	6.616	**9.962**	**11.597**	**15.337**	**17.882**
		(p=1.00)	(p=1.00)	(p=.851)	(p=.203)	**(p< .001)**	**(p< .001)**	**(p< .001)**	**(p< .001)**
3			.722	3.074	6.342	**9.688**	**11.323**	**15.063**	**17.607**
			(p=1.00)	(p=.839)	(p=.176)	**(p< .001)**	**(p< .001)**	**(p< .001)**	**(p< .001)**
4				2.353	5.620	**8.966**	**10.601**	**14.341**	**16.886**
				(p=.944)	(p=.272)	**(p< .001)**	**(p< .001)**	**(p< .001)**	**(p< .001)**
5					3.268	**6.613**	**8.248**	**11.988**	**14.533**
					(p=.928)	**(p=.027)**	**(p< .001)**	**(p< .001)**	**(p< .001)**
6						3.346	4.981	**8.721**	**11.265**
						(p=.955)	(p=.440)	**(p=.003)**	**(p< .001)**
7							1.635	5.375	**7.920**
							(p=.999)	(p=.195)	**(p< .001)**
8								3.740	**6.285**
								(p=.454)	**(p=.004)**
9									2.545
									(p=.930)

ANOVA F (9, 311)=47.494, $p < .001$, α=0.05

Note: 1. Aimless scribbles, 2. Flat lines, 3. Wavy lines, 4. None/refusal, 5. Symbol units, 6. Letter-like units, 7.Letter units, 8. Contain two or three letters from name, 9. Spelling almost correct, regardless of good form, 10. Conventional or almost correct with good form.

Aimless scribble, Flat lines and Wavy scribbles.

Scribbles have been seen as the first characteristic of name writing by many early literacy researchers. In Study One, scribbles are further distinguished as Aimless scribbles (3.4%, M = 38.00), Flat lines (7.2%, M = 42.91) and Wavy scribbles (10.0%, M = 43.19). Although the mean age of the three characteristics was different, the Scheffe tests suggested that there were no significant age differences among the three levels.

Considering the name writing developmental characteristics, I classified Aimless scribbles as the first developmental name writing level because it does not need any advanced fine motor skills, whereas Flat lines and Wavy scribbles were grouped together as the second developmental level because they both required basic fine motor skills. In addition to that, our dataset did not include two-year-olds' name writing samples. It is very possible that the mean age of Aimless scribbles might go lower if the dataset has younger children's name writing samples.

None/refusal.

Both quantitative and longitudinal data of the present study supported that None/refusal was an important developmental characteristic and surely not the first developmental level. Refusal to write has its distinct psycholinguistic meaning; it implies that children have noticed their writing looks different from adults' writing. In other words, children know their writing is "not correct" so they refuse to write. Although None/refusal should be considered an important level in its own right, the mean age is only 0.84 months more than Flat/wavy scribbles. Thus, I decided to combine the None/refusal and Flat/wavy scribbles together as Flat/wavy scribble or None/refusal.

Symbol units and Letter-like units.

Symbol units and Letter-like units are the signs that children have paid attention to individual letters and tried to copy the features they have seen. In the present study, the Scheffe tests showed that there are no significant mean age differences between the two characteristics. Since Letter-like units only occur in 5.0 % of the samples in the present study, I decided to group Symbol units and Letter-like units together as Symbol and Letter-like units.

Letter units.

In the present study, Letter units include the first letters of name and Random letters. Letter units indicate that children have been learning letters and are able to generate recognizable letters. Since the percentage of Letter units in the present study is low (6.4% of total 641 samples), I thus grouped it with Contain Two or Three Letters from name regardless of good form, and renamed the level as One or Few Recognizable Letters from name.

Spelling almost correct regardless of good form and Conventional or almost correct with good form.

The level of Spelling almost correct regardless of good form indicates that children have been learning letters and trying to use letters to write their names. The level of Conventional or almost correct with good form implies that children are able to use letters to write their name almost correctly. However, the two characteristics did not

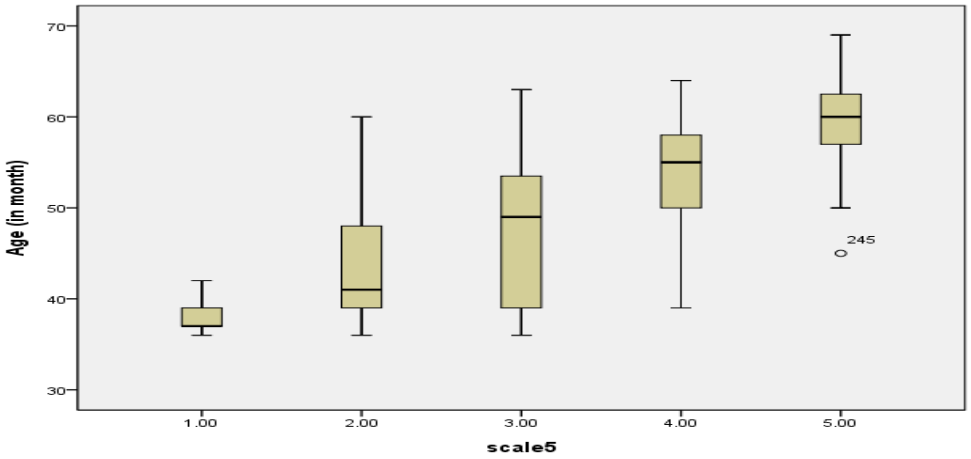
differ significantly from each other with regard to children's age. Thus, I combined the two levels as Conventional or spelling almost correct.

Based on the above discussion, Table 3-11 and Figure 3-14 show the distribution of the revised name writing levels and Table 3-12 shows the results of the Scheffe tests. The changes in scoring criteria over time are listed in Table 3-13.

Table 3- 11 The name writing developmental scale

Levels		Frequency	Percent	Mean age (in month)	Age SD (in month)
1	Aimless scribbles	11	3.4	38.00	1.84
2	Flat/wavy scribbles or None/refusal	99	30.8	43.44	6.15
3	Symbol or letter-like units	59	18.4	47.20	7.77
4	One or few recognizable letters from name	73	22.7	53.97	5.69
5	Conventional or spelling almost correct	79	24.6	59.59	4.41
Total		321	100.0		

Figure 3- 14 Name writing developmental scale and age distribution



Note: 1. Aimless scribbles, 2. Flat/wavy scribbles or None/refusal, 3. Symbol or letter-like units, 4. One or a few recognizable letters from name 5. Conventional or spelling almost correct

Table 3- 12 The Scheffe tests results of the revised scale

Scheffe	2	3	4	5
1	5.444 (p=.082)	**9.203 (p< .001)**	**15.973 (p< .001)**	**21.595 (p< .001)**
2		**3.759 (p=.006)**	**10.528 (p< .001)**	**16.150 (p< .001)**
3			**6.769 (p< .001)**	**12.392 (p< .001)**
4				**5.622 (p< .001)**

ANOVA F (4, 316) = 104.692, p< .001, α=0.05

Note: 1. Aimless scribbles, 2. Flat/wavy scribbles or None/refusal, 3. Symbol or letter-like units, 4. One or a few recognizable letters from name 5. Conventional or spelling almost correct

Table 3- 13 Name writing scale changes over time

Coding criterion from the published studies		After the first time examination		Final scale
1. Refusal		1. Aimless scribbles		1.Aimless scribbles
2. Drawing/pictures		2. Flat lines		2. Flat/wavy scribbles or None/refusal
3. Aimless scribbles		3. Wavy scribbles		
4. Wavy scribbles		4. None/Refusal		
5. Scribbles with symbol- or letter-like units		5. Symbol units		3.Symbol or letter-like units
6. Symbol units		6. Letter-like units		4. One or few recognizable letters from name
7. Letter-like or number units				
8. Random letters		7. Letter units		
9. The first letters of name				
10. Contain Two or Three Letters from name		8. Contain Two or Three Letters from name		
11. Spelling almost correct, regardless of good form		9. Spelling almost correct, regardless of good form		5. Conventional or spelling almost correct
12. Conventional, spelling is almost correct with good form		10. Conventional, spelling is almost correct with good form		

Analysis of Fine Motor Skill Criteria

There are five related fine motor skill criteria examined in the study, Alignment, Spacing, Letter size, Case used and Letter reversal. The five categorical variables are drawn from previous research. The scoring criteria are shown in Figure 3-15. All the samples presented in Figure 3-15 are classified as level 5, Conventional or spelling almost correct. The samples indicate there is a wide range of form in the level of Conventional. In this exploration, I compared the means of the children's name writing level as well as their age in different fine motor skills criteria to try to integrate fine motor skills criteria into the name writing scale proposed in the dissertation.

The means of the fine motor skills criteria

Out of 321 first collected name writing samples, 60.1% (N = 193) are not applicable because they are scribbles or Symbol/ Letter-like units. Thus, only 128 children's name writing samples are examined. The mean name writing level and mean age of each fine motor skill criterion is listed in the Table 3-14.

After removing the non- applicable samples, the Scheffe tests showed that there are no significant differences between categories of Case used (level: F (3, 124)= 1.565, p= .201) (age: F (3, 124)= .975, p= .407) and Reversal of letters (level: F (1, 126)= .001, p= .983) (age: F (1, 126)= .715, p= .399). That is, whether children write their names with upper case letters, lower case letters, mixed order or capitalized the first letters do not relate to their name writing developmental level nor to their age. Also, whether children write their names with upside down letters or backward letters does not relate to

their name writing developmental level nor to their age. Thus, I took these two criteria out of the list.

After removing the criteria of Letter case used and Reversal of letters, I grouped the other three criteria based on the scoring levels and found that children's letter alignment, spacing and the ability to print letter sizes evenly develop almost at the same point in time (Table 3-15). In other words, if children could not align the letters, they probably could not make the spaces between letters evenly and print the letters in same size. And, when children could write their names with aligned letters, they probably could apportion the letter spaces and control the size of letters appropriately.

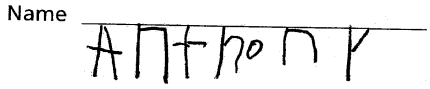
Figure 3- 15 Fine motor skills scoring samples

Alignment: Letters do not align

Kiara 6; 1

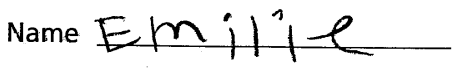
Alignment: Part of the letters is tilted but aligned

Anthony 4; 10



Alignment: Most letters are properly aligned

Emilie 6; 4

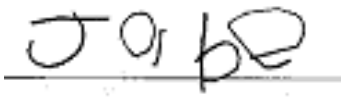


Spacing: Spaces between letters are not even

Kalesta 4; 8

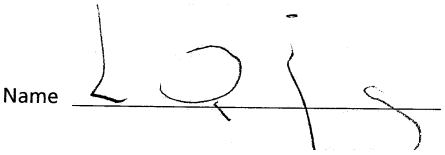
Spacing: Spaces between letters are partly even

Jade 5; 1



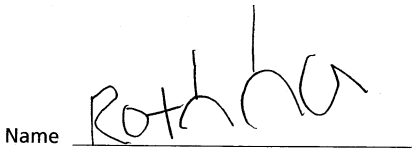
Spacing: Spaces between letters are mostly even

Luis 4; 5



Letter size: The size of letters is not inconsistent

Roxanna 4; 8



Letter size: The size of letters is partly even

Brayden (4; 4)

Letter size: The size of letters is mostly even

Katelyn (4; 8)

Table 3- 14 Distribution of children's fine motor skill related criteria

Characteristics		N	%	Mean age (in month)	Mean CNWS level
1. Alignment	Score 0: N/A	193	60.1	45.60	2.50
	Score 1: Letters do not align	46	14.3	55.52	4.41
	Score 2: Part of the letters is tilted but aligned	37	11.5	57.49	4.62
	Score 3: Most letters are properly aligned	45	14.0	59.16	4.82
2. Spaces between letters	Score 0: N/A	193	60.1	45.60	2.50
	Score 1: Spaces between letters are not even	34	10.6	54.12	4.38
	Score 2: Spaces between letters are partly even	51	15.9	58.08	4.63
	Score 3: Spaces between letters are mostly even	43	13.4	59.09	4.79
3. Letters size	Score 0: N/A	193	60.1	45.60	2.50
	Score 1: The size of letters is not inconsistent	68	21.2	55.66	4.47
	Score 2: The size of letters is partly even	35	10.9	59.51	4.69
	Score 3: The size of letters is mostly even	25	7.8	59.00	4.92
4. Case used	Score 0: N/A	193	60.1	45.60	2.50
	Score 1: The letters are all lower cases	41	12.8	57.34	4.71
	Score 2: The letters are mixed with lower and upper cases	7	2.2	54.86	4.29
	Score 3: The first letters of the child's name is upper cased and other letters are lower cases	47	14.6	56.79	4.57
	Score 4: The letters are all upper cases	33	10.3	58.52	4.61
5. Reversal letters	Score 0: N/A	193	60.1	45.60	2.50
	Score 1: One or more letters revered	26	8.1	58.27	4.62
	Score 2: No revered letters	102	31.8	57.14	4.63

Table 3- 15 The intervention of criteria of spelling and fine motor skills

Criteria from the perspective of spelling	Criteria from the perspective of fine motor skills
Level 1 Aimless scribbles (M = 38.00)	
Level 2 Flay/wavy scribbles or None/refusal (M = 43.44)	
Level 3 Symbol or letter-like units (M = 47.20)	
Level 4 One or few recognizable letters from name (M = 53.97)	4.38* The spaces between letters are not even (M = 54.12**) 4.41* Letters do not align (M = 55.52**) 4.47* The size of the letters is not inconsistent (M = 55.66**)
	4.62* Part of the letters are tilted but aligned (M = 57.49**) 4.63* Spaces between letters are partly even (M = 58.08**) 4.69* The size of the letters is partly even (M = 59.51**)
Level 5 Conventional or spelling almost correct (M = 59.59)	4.79* Spaces between letters are mostly even (M = 59.09**) 4.82* Most of the letters are properly aligned (M = 59.16**) 4.92* The size of the letters is mostly even (M = 59.00**)

*mean level of the Children's Name writing Scale

**means of the children's age

Integrating fine motor skills into the Children's Name Writing Scale

Three fine motor skills criteria each with three levels were considered for integration into the Children's Name Writing Scale (CNWS). Before integrating, I ran the Scheffe tests to assure that the mean age and mean level of each criterion level differed from each other.

After taking out the 193 not applicable samples, the Scheffe tests showed that there are mean level and mean age differences between Alignment 1 and Alignment 3, Spacing 1 and Spacing 3, Letter size 1 and Letter size 3.

From the mean level and mean age of the categories, we can see that children develop their ability to align letters, make even the spaces between letters and control the size of letters at almost the same time. Therefore, based on the homogeneous subsets, I grouped score 2 and score 3 together as "At least three letters from name, letters are partly or almost aligned, spaces and the size of the letters are partly or almost even" (Table 3-16). I also adjusted level 4 from "one or few letters from name" to "contain recognizable letters" so as to make level 5 more meaningful (Table 3-16). A new six-level name writing scale is thus proposed.

Table 3- 16 Combine the spelling and fine motor skills criteria

Criteria from the perspective of spelling	Criteria from the perspective of fine motor skills	Combine the two groups of criteria
Level 1 Aimless scribbles (N = 11, M = 38.00)		Level 1 Aimless scribbles
Level 2 Flay/wavy scribbles or None/refusal (N= 99, M= 43.44)		Level 2 Flay/wavy scribbles or None/refusal
Level 3 Symbol or letter-like units (N = 59, M = 47.20)		Level 3 Symbol or letter-like units
Level 4 One or few recognizable letters from name (N = 73, M = 53.97)		Level 4 Contain recognizable letters
	4.38 The spaces between letters are not even (M = 54.12) 4.41 Letters do not align (M= 5.52) 4.47 The size of letters is not inconsistent (M = 55.66)	Level 5 At least 3 letters from name, regardless alignment, spacing and letters size
Level 5 Conventional or spelling almost correct (N = 79, M = 59.59)	4.70 Spaces between letters are partly or mostly even (M= 58.64) 4.73 Most of the letters are partly or properly aligned (M = 58.51) 4.78 The s size of letters is partly or mostly even (M = 59.45)	Level 6 Conventional or spelling almost correct, and the letters are partly or almost aligned, the spaces and the size of the letters are partly or almost even

Testing the 6-level Children's Name Writing Scale

Based on the results described, a 6-level children's name writing scale was proposed. The scale contained criteria not only focused on the language and literacy perspective but also focused on the fine motor skill development (Table 3-16). I thus recoded the 321 first-collected name writing samples to see if the 6-level scale was better than the 5-level Children's Name Writing Scale proposed previously in this dissertation.

Reliability

Two graduate students from Tzu-Chi University, Hualien, Taiwan were hired to recode the 321 children's name writing samples. The value of Cohen's Kappa was .72. The reliability of the recoding was adequate.

Analysis of the scale

The distribution of the new 6-level scale is listed on Table 3-17. When exploring further, the Scheffe tests showed that there was no age difference between level 5 and level 6 (Table 3-18).

If the levels of the new 6-level scale need to be distinguished from each other in terms of age, then level 5 would have to be integrated with the level 6 as "At least three recognizable letters from name." If so, the criteria from motor skills should be eliminated and the scale will be the same as the scale based on the literacy and language perspective.

Following the above analysis, the 5-level children's name writing scale proposed previous appears to be better than this 6-level.

Table 3- 17 Distribution of the new 6-level scale

Combine the two groups of criteria	N	Mean age (in months)	SD (in months)
Level 1 Aimless scribbles	11	38.00	1.84
Level 2 Flay/wavy scribbles or None/	99	43.44	6.15
Level 3 Symbol or letter-like units	59	47.20	7.77
Level 4 Contain recognizable letters	59	53.41	5.82
Level 5 At least 3 letters from name, regardless alignment, spacing and letters size	41	58.49	4.17
Level 6 Conventional or spelling almost correct, and the letters are partly or almost aligned, the spaces and the size of the letters are partly or almost even	52	59.60	4.81

Table 3- 18 The Scheffe tests of the new 6-level scale

Scheffe	2	3	4	5	6
1	5.444 (p=.42)	**9.203** **(p< .001)**	**15.407** **(p< .001)**	**20.309** **(p< .001)**	**21.673** **(p< .001)**
2		**3.759** **(p=.012)**	**9.962** **(p< .001)**	**14.946** **(p< .001)**	**16.229** **(p< .001)**
3			**6.203** **(p< .001)**	**11.187** **(p< .001)**	**12.470** **(p< .001)**
4				**1.206** **(p= .005)**	**1.128** **(p< .001)**
5					1.283 (p= .977)

ANOVA F (5, 315) = 83.641, p< .001, α=0.05

Note: 1. Aimless scribbles, 2. Flat/wavy scribbles or None/refusal, 3. Symbol or letter-like units, 4. Contain recognizable letters, 5. At least 3 letters from name, regardless alignment, spacing and letters size, 6. Conventional or spelling almost correct, and the letters are partly or almost aligned, the spaces and the size of the letters are partly or almost even.

Discussion and Conclusions

The main purpose of Study One was to find the major developmental characteristics of children's name writing. First, I searched published studies that used children's name writing as one of their research variables and analyzed how they scored children's name writing samples. Then, I compiled the twelve scoring criteria from the literacy and language perspective found in the previous studies as an original codebook to examine qualitatively 641 children's name writing samples produced by 321 preschool and kindergarten children. After careful examination, the characteristic of Drawing/picture was moved out of the codebook because none were found in the 641 samples and the characteristic of Flat lines was added into the codebook.

Following the content analysis, I used ANOVA and Scheffe tests to re-examine whether the 12 characteristics can significantly stand alone as a major characteristic of name writing. In the end, five major characteristics were confirmed by the study.

In addition to the 12 characteristics, which mainly came from the perspective of language and literacy development, I also examined five characteristics from the perspective of fine motor skills. These include letter alignment, spaces between letters, the size of letters, the case used and letter reversal. After qualitative and quantitative examination, I decided not to merge them into the children's name writing developmental scale. The findings are addressed in detail below.

1. *There are five major characteristics in children's name writing development*

Several emergent literacy researchers have suggested different name writing characteristics, which include drawings/pictures, scribbles, separate units, mock letters, random letters, almost correct, and conventional. Although most of the characteristics were found in the 641 name writing samples, not every characteristic has significant frequency and the unique psycholinguistic traits necessary to be a major factor in distinguishing developmental levels. The five major developmental characteristics derived from this study and chosen to be the scoring criteria of the Children's Name Writing Scale are: Aimless scribbles (M = 38 months), Flat/wavy scribble or None/refusal (M = 43 months), Symbols or Letter-like units (M = 47 months), One or few letters from name (M = 54 months), and Conventional or spelling almost correct (M = 60 months).

Aimless scribbles are scribbles without directions; such productions represent the lowest form of early name writing development. Flat/wavy scribbles are simple horizontal lines or continuous zigzag lines. Refusal to write was believed the earliest writing developmental characteristic, but both qualitative and quantitative data from this study showed that Refusal to write often happened after scribbling levels. Symbol or Letter-like units are shapes that look like letters. One or few letters from name contains one or several recognizable letters from the children's name. Conventional or spelling almost correct is defined as when the spelling of the children's name is almost correct but might be revered. The five major characteristics reveal the progress of children's name writing development as well as children's psycholinguistic developments described in literature review. Moreover, the five major characteristics each have statistical significance in the mean age difference from one another. In other words, children who

are in the level of Wavy scribbles are statistically younger than children who are in the level of Symbols or Letter-like units.

2. *Scribbles are the earliest developmental characteristic of children's name writing.*

This study confirms that Aimless scribbles, Flat scribbles and Wavy scribbles are the earliest major characteristics in children's name writing development. Although the three different scribbles have different mean ages, the Scheffe tests suggest there are no significant age differences among them. Based on percentage, attribute and longitudinal data, I distinguished Aimless scribbles from Flat/wavy scribbles. From the formation of scribbles, Aimless scribbles are scribbles without directions and more like arm movements whereas Flat/wavy scribbles require more advanced fine motor skills and attention to print. In addition, compared to Aimless scribbles, Flat/wavy scribbles are more like adult's cursive written forms, which indicate that children might have noticed how adults write and what writing looks like (Vygotsky, 1978). Therefore, it is necessary to distinguish Aimless scribbles from Flat/wavy scribbles even though the age difference between the two characteristics did not reach statistical significance. In the study, the mean age of Aimless scribbles is 38 months (N = 11), Flat lines is 42.91 months (N = 23) and Wavy scribbles is 43.19 months (N = 32). Since the Study recruited children aged three and above, if two-year-olds were included, the mean age of Aimless scribbles might be lower and become a distinguishing major characteristic.

3. *None/refusal is a significant characteristic of children's name writing development*

Researchers have reported that younger children have more confidence about

writing than older children. From experiments reported on published studies, most two- or three-year-old children would use scribbles and drawings to write any words or sentences upon researchers' requests (Luria, 1978). Those young children's "writings" have been seen as early evidence of emergent writing. However, Martens (1996) reported that young children's confidence about writing would suddenly disappear when they noticed that their writing is not "real" writing.

An important finding of the Study One is the role of None/refusal in a name writing developmental scale. In the study, out of 641 name writing samples, 11.3% (N = 73) are None/refusal. Children's refusal to write has not been fully discussed in previous research. All the published quantitative studies either consider children's refusal to write as the lowest level of name writing development, or treat it as invalid or missing data. Reviewing the existing literature, only Ferreiro and Teberosky (1982) and Martens (1996) mentioned in their qualitative studies that children might refuse to write when they noticed they could not write as adults do.

Martens (1996) and Ferreiro and Teberosky (1982) reported that children who refused to write would say: "I can't write. I can't write because I don't know how." According to the observation of Martens (1996) and Ferreiro and Teberosky (1982), children's refusal to write happens after children could write recognizable letters and apply letter-sound knowledge to make simple pseudo words. However, the present study shows that most children's refusal to write happens after scribbles but before they can produce recognizable letters. One of the possible reasons is that the present study asked the child to write their names but Martens and Ferreiro and Teberosky asked their subjects to write sentences. The child's name is easier for children to produce whereas

sentences are more difficult and involve more literacy knowledge and skills.

This study statistically confirmed Ferreiro and Teberosky's (1982) and Martens' (1996) finding in their qualitative research that children's refusal to write is an important developmental characteristic. It is not the lowest level of name writing nor should it be seen as invalid data. The above conclusions are based on the assumption that children's awareness of their limited literacy knowledge is the major factor in refusals to write. However, there are also some other situations that might cause children's refusal to write; for example, children's shyness, the unfamiliar testing environment and the stress of test taking.

4. Children know that names are composed with letters rather than numbers or pictures

Although researchers have reported that children's early writing might include pictures and numbers, neither pictures nor numbers were found in the 641 name writing samples of the study. One possible reason is that children were asked to write their names for the Study and they knew their names should be composed of letters rather than numbers or drawing. In contrast, if children had been asked to write a story or compose a short message, they might have used drawings to represent what they wanted to write (Sulzby, 1986). In other words, even at this young age, children might write differently for different writing tasks. Furthermore, although preschool and kindergarten children might not know all the numbers and letters, they may be aware that letters, numbers and drawings each have different functions and purposes.

5. *Name Writing Shows Children's Concept of Word*

From the samples of Random letters (N = 9) and One or few letters from name (N = 134), we can find that some children would use three or four symbols or letters to compose their names. For example, Alexis (4; 1) wrote his name as "Aoo," Dhruv (4; 0) wrote as "NABPO," Jeremy (4; 6) wrote as "ETM," Teisha (4; 6) wrote as "Taaa," Haley (4; 1) wrote as "SHr," and Jacob (4; 5) wrote as "JPMMM." These examples echo Ferreiro and Teberosky's (1982) observation—children think a meaningful word should contain at least three letters. In general, children at the level of Random letters or One or few letters from name just start learning letters. Even though the children know only a few letters, they still try to apply their very limited written language knowledge to make their names look like a "real" word. That is why they might repeat the few letters they knew or write down all the letters they knew to try to make a real word.

6. *Name writing reflects children's letter sound knowledge*

Children's name writing also shows their phonological/phonemic awareness. For example, Abigail (3; 11) wrote her name as "AbiMAb," Victoria (4; 5) wrote as "ViC," Kelssta (4; 8) wrote as "Kalesta," and Rory (4; 7) wrote as "ROYY." The samples suggest that in the process of learning how to write their names, children at the same time acquire associated letter-sound knowledge. We do not know whether name writing promotes children's letter-sound knowledge or whether letter-sound knowledge helps children learn their names, but name writing, for sure, provides children a chance to practice their letter-sound knowledge.

7. *Fine motor skills play an important role in children's name writing development but might not show in the name writing scale*

Five criteria from fine motor skill development were examined in Study One. However, only letter alignment, spaces between letters and the size of letters demonstrated significant age differences. Neither the case used nor letter reversals were correlated with age.

Children's fine motor skill development could be easily checked by their handwriting. In the study, alignment of letters, even spaces between letters and consistent sizing of letters are positively related to their age. However, the developmental process, (e.g., from letters that do not align (M = 55.52 months), to partly align (M = 57.49 months) to almost align (M = 59.16 months)), happens quickly and along with children's name writing ability. In the Children's Name Writing Scale proposed in the present study, children's fine motor skills could be evaluated starting from level 4 One or few letters from name (M = 53.97 months) and stop at level 5 Conventional or spelling almost correct (M = 59.59). From the present analysis, the criteria of fine motor skills statistically could not stand alone in the Children's Name Writing Scale unless incorporated with the criteria of emergent literacy indicators. Since there are only two levels of the Scale that involve fine motor skills, it is thus unnecessary to include these criteria into the Children's Name Writing Scale. The importance of fine motor skills will be examined again in Study Two.

Chapter 4

Study Two: Testing the Name Writing Scale

After identifying the major developmental characteristics, Study Two is designed to further validate the Children's Name Writing Scale (CNWS) proposed in Study One. The research questions are:

1. Is it possible to develop an assessment scale for name writing development that represents an improvement on existing scales? How does the CNWS compare to existing scales?
2. Do the longitudinal data support the name writing scale the dissertation proposed?

Research Method

Study Two aims to validate the Children's Name Writing Scale (CNWS) proposed in Study One. Study One qualitatively and quantitatively explored the developmental characteristics of children's name writing development which at the same time constructed the content validity. In Study Two, the correlation between CNWS and the Developmental Indicators for the Assessment of Learning (DIAL-3)

(Mardell-Czudnowski & Goldenberg, 1998) was computed as an evidence of constructing the predictive validity. In addition to the CNWS, three other name writing tests were also compared; they are Phonological Awareness Literacy Screening-PreK (PALS) (Invernizzi, Sullivan, Meier, & Swank, 2004), "Write your name and anything else you can" (WYN) task which was used and described in Purcell-Gates' (1996) study, and the DIAL-3 name writing subtest.

Two graduate students from the School of Education, Tzu Chi University were hired to code the children's name writing samples based on the criteria used by PALS and WYN. After the samples were coded, the Pearson's correlation was applied to examine the relationships among the four children's name writing scales (CNWS, DIAL-3 Name Writing subtest, WYN, PALS), DIAL-3 full scores (minus the Name Writing subtest score) and children's age. To be consistent with later regression model analysis, I chose to report Pearson's correlation instead of Spearman's Rho. However, the results of the two methods correspond with one another in all cases.

Data and Participants

In Study One, a total of 641 name writing samples produced by 321 children (177 boys and 144 girls) aged from 3 to 5 year old were examined. However, among the 321 subjects, only 183 children had participated in the full DIAL-3 test. If the subjects had multiple DIAL-3 test scores and name writing samples, one sample was randomly selected to represent the subjects' development.

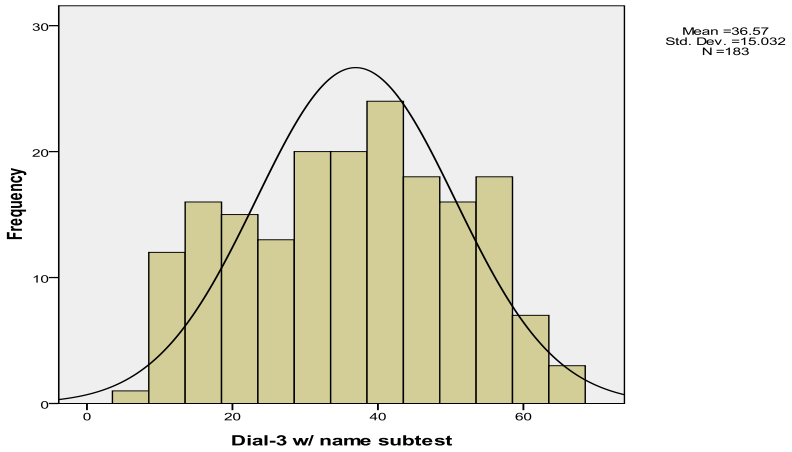
The skewness of the distribution of the 183 subjects' DIAL-3 test score without

name writing subtest is - .070, which approaches the normal distribution (Figure 4-1).

Table 4- 1 Distribution of the Study Two subjects

Age	Sex	N	Percentage %	N
3 year old	Boy	34	19	61
	Girl	27	15	
4 year old	Boy	53	29	93
	Girl	40	22	
5 year old	Boy	10	5	29
	Girl	19	10	
Total		183	100%	183

Figure 4- 1 Distribution of the subject's DIAL-3 test score without name writing subtest



Research Instrument

The main research instrument of Study Two is DIAL-3 (Mardell-Czudnowski & Goldenberg, 1998). DIAL-3 is an individually administered screening test designed to screen preschool and kindergarten children's motor, concept, and language development. The internal consistency of DIAL-3 is .87 and the test-retest reliability is .88. According to its technical manual, the validity of the DIAL-3 total score is also supported by moderate correlations with total scores from other developmental screening tools; for example, the Battelle Screen Test (Newborg et al., 1984), Bracken Screening Test (Bracken, 1984), Brigance Preschool Screen (Brigance, 1985), and Early Screening Profiles (Harrison et al., 1990). In Study Two, the total scale score of DIAL-3 minus the writing score was used to run the correlation with other variables.

Reliability

The scoring criteria of the WYN and PALS are listed in Table 3-15. All the coding was done by two graduate students from the School of Education, Tzu Chi University, Hualien, Taiwan. The inter-coder reliability was computed through Cohen's Kappa, which was found to be .91 for the scale of "Write Your Name and Anything Else You Can" (WYN) task, and .85 for PALS. The reliabilities of the scorings are substantial. Name writing is a subtest of DIAL-3, thus the coding of DIAL-3 was drawn from the dataset.

Data Analysis and Results

The correlation of name writing scales and DIAL-3 scores

Since the four name writing scales and the DIAL-3 test are all ordinal data, the Spearman's rho was used to determine the correlations between the different measures used in the Study Two. However, to be consistent with later regression analysis, the Pearson's *r* was also used and the results of both analyses are shown in the results (Table 4-2). The results showed that the CNWS highly correlates with both DIAL-3 total scores without name writing and children's age.

The DIAL-3 name writing subtest was designed for children aged four and above, so 61 three-year-old children were classified as missing cases. The 29 missing cases in WYN and PALS were all refusal to write which could not be classified based on WYN and PALS scoring criteria. Although PALS has a little bit higher correlation coefficient with DIAL-3 than CNWS, PALS has 29 missing cases whereas CNWS has none.

The results showed that although PALS has the strongest Pearson's correlation with DIAL-3 total scores (r = .756, α= .01, 2-tailed), there were no significance differences for PALS and CNWS relating to DIAL-3 total scores without name writing (r_{PALS}- r_{CNWS} = -0.008, t = -0.436, p= 0.33, α= .01, 2-tailed). However, among the scales, the CNWS has the strongest positive correlation with children's age (r = .799, α= .01, 2-tailed) and the difference between r_{PALS} and r_{CNWS} was significant (r_{PALS}- r_{CNWS} = -0.049, t = -2.865, p= 0.002, α= .01, 2-tailed).

Table 4- 2 The correlation with DIAL-3 among name writing scales

Correlation	Pearson's r with DIAL-3 total scores (without name writing subtest scores)	Spearman's rho with DIAL-3 total scores (without name writing subtest scores)	Missing cases*
DIAL-3 name writing subtest	.593**	.605**	61
WYN	.676**	.679**	29
PALS	.756**	.765**	29
CNWS	.748**	.782**	0

*. The total number of subjects is 183.

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4- 3 The correlation with children's age among name writing scales

Correlation	Pearson's r with children's age	Missing cases*
DIAL-3 name writing subtest	.529**	61
WYN	.649**	29
PALS	.750**	29
CNWS	.799**	0

*. The total number of subjects is 183.

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4- 4 The correlation among name writing scales

Pearson's r	WYN	PALS	CNWS
DIAL-3 name writing subtest	.658**	.794**	.754**
WYN	1	.761**	.811**
PALS		1	.939**

**. Correlation is significant at the 0.01 level (2-tailed).

The differences among the name writing scales

The process of establishing the Children's Name Writing Scale (CNWS) proposed in this dissertation was discussed in the previous chapter. Here, I am going to compare the four children's name writing scales, CNWS, WYN, PALS and the DIAL-3 name writing subtest, and also describe their differences (Table 4-5).

Table 4- 5 Comparison of different name writing scoring levels

Scale	"Write Your Name and Anything Else You Can" task.	PALS name writing subtest	DIAL-3 name writing subtest	The Children's Name Writing Scale, proposed in Study One
	Purcell-Gates (1996)	Welsch, Sullivan & Justice (2003)	Mardell-Czudnowski & Goldenberg (1998)	Children's Name Writing Scale
Level 0		Scribble or picture represents both picture and written name	Refuse, Scribbles, or make a letters or letters that are not part of the name	
Level 1	Drawing, pictures, shapes	Writing and drawing are intertwined. May include random letters, letter-like forms or scribble	At least one letters from name	Aimless scribbles
Level 2	Scribbles	Picture is separated from the written name but the name is unrecognizable scribble	Print all letters in the name, with two error	Flay/wavy scribbles or None/refusal
Level 3	Letter-like and number-like forms	Name writing consists of random letters and symbols.	Print all letters in the name, with only one error	Symbols or letter-like units
Level 4	Letters mixed with number	Name consists of some correct letters and placeholder		One or few letters from name
Level 5	Making letters (ungrouped letters, letters strings)	Most correct letters from name		Conventional or spelling almost correct
Level 6	Making words (pseudo words, with spaces in between)	Generally correct. Some letters may be written backwards.		
Level 7		Name is written correctly		

Write Your Name and Anything Else You Can task

Compared to other name writing scales, the scoring criteria of WYN, from drawing, scribbles, letter-like units, making letters to making words, mostly follows children's name writing development. Although the task is "write your name and anything else you can," the scale sets level 6 Making words (pseudo words, with spaces in between) to assess whether children know that sentences are made of several words and should have certain spaces between words. From level 5 "Making letters" jumps to level 6 "Making words," the range seems too wide to capture children's development of name/word writing ability.

In addition, in the scale of WYN, whether children could produce numbers is seen as an important developmental sign. Considering that children are asked to write their name and anything else they could, it is apparent that children will print numbers if they know how to write it, especially since the shape of the number one is probably the easiest symbol to produce. But if only assessing children's name writing development, numbers and drawings might not appear since children know that drawing, numbers and letters are different written systems that have different functions.

Phonological Awareness Literacy Screening (PALS)

Although the name writing subtest in PALS does not ask children to write anything else they can, it still includes drawings in its scoring criteria. There are seven levels in the name writing subtest of PALS, from scribbles/drawings, random letters, letter-like units, recognizable letters and conventional. The major difference between PALS and other name writing scales is that PALS consider drawing/picture to represent an important

developmental characteristic of name writing. Therefore PALS uses the first three levels to distinguish children's drawing and writing. For example, level 0 (Scribble or picture represents both picture and written name) and level 1 (Writing and drawing are intertwined and may include random letters, letter-like forms or scribble), both illustrate that children produce pictures to represent their names and they may not be aware names are composed of letters. At level 2 (Picture is separated from the written name but the name is unrecognizable scribble), children start having noticed that writing and drawing are different culture systems. If we take out the first two levels, PALS has six scoring criteria for assessing children's name writing.

Developmental Indicator for the Assessment of Learning (DIAL-3)

Unlike WYN and PALS, the name writing subtest of DIAL-3 is categorized under the development of fine motor skills. Moreover, it is only for children aged four and up. The scoring criteria of the DIAL-3 name writing subtest are also very different from the other name writing scales. For example, it grouped refusal to write, scribbles and letter units in level 0. It includes refusal to write but left out the symbols or letter-like units. The level 1 is "at least one letters from name," level 2 is "print all letters in the name, with two error" and the level 3 is "print all letters in the name, with only one error." Instead of flagging children's major name writing developmental characteristics, the scoring criteria reflect how many errors the children made. From the results of Study One, it is very possible that there is no mean age difference between the level with one error and the level with two errors.

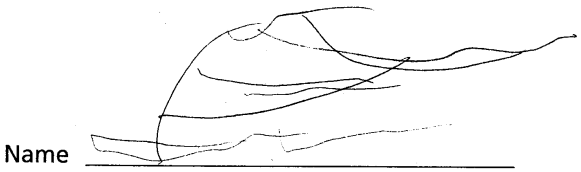
Individual Child's Name Writing Development from the Longitudinal Data

Among the 321 subjects, 7 children were tested five times and 28 were tested four times over four years. The name writing levels of the children who were tested three times and above are listed in Appendix 2. The name writing samples were collected once per semester so the developmental changes in children's name writing between these two sampling dates remains unknown. However, among the 76 children who have at least three name writing samples collected, only 12 children demonstrate name writing development that does not proceed monotonically. Among these 12 children, five who started at level 2 (Wavy/flat scribbles or refusal to write) went back to level 1 (Aimless scribbles) and four who started at level 3 (Symbol or letter-like units) went back to level 2 (Wavy/flat scribbles or refusal to write).

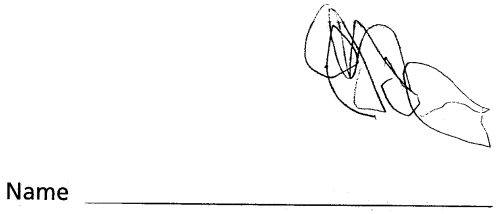
The longitudinal data also show that the time children stay in a level varies. For example, some children stayed at level 4 (One or few letters from name) for 11 months, while other might stay only 4 months. Among the 22 children who have stay-at-the-same-level samples, 8 were in level 3 (Symbol or letter-like units), and 8 were in level 4 (One or few letters from name). This indicates that children might need more time at these levels compared to the other levels. Figure 3-14, 3-15 and 3-16 shows the developmental changes over time.

Figure 4- 2 Jason's name writing development over time

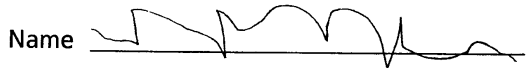
First name writing sample (3; 6)
Level 2 Flat/wavy scribbles



Second name writing sample (3; 10)
Level 1 Aimless scribbles



Third name writing sample (4; 3)
Level 2 Flat/wavy scribbles



Fourth name writing sample (4; 8)
Level 5 Conventional or spelling almost correct

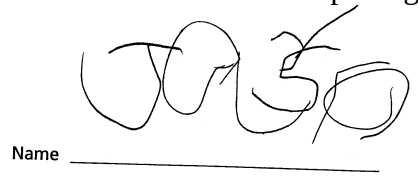
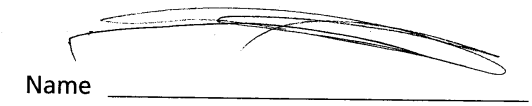
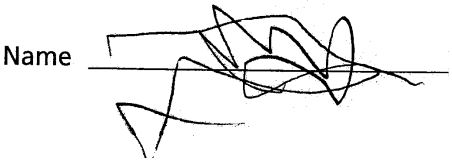


Figure 4- 3 Kalesta's name writing development over time

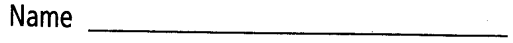
First name writing sample (3; 6)
Level 1 aimless scribbles



Second name writing sample (3; 9)
Level 1 Aimless scribbles



Third name writing sample (4; 3)
Level 2 Refusal



Fourth name writing sample (4; 8)
Level 5 Conventional or spelling almost correct

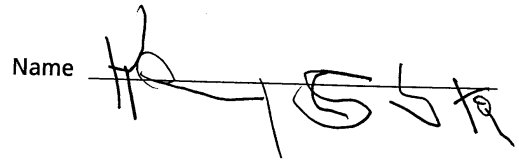
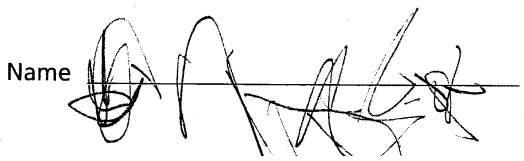
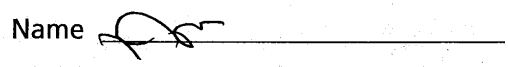


Figure 4- 4 Jade's name writing development over time

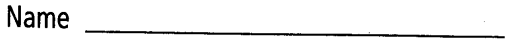
First name writing sample (3; 2)
Level 3 Symbols or letter-like units



Second name writing sample (3; 6)
Level 2 Flat/wavy scribbles



Third name writing sample (3; 10)
Level 2 Refusal



Fourth name writing sample (4; 4)
Level 4 One or few letters from name

Discussion and Conclusion

Research has suggested that children's name writing ability reflects literacy development in general (Aram & Biron, 2004; Bloodgood, 1999; Clay, 1991; Haney et al., 2003; Molfese et al., 2006; Stuart, 1990, 1995; Treiman & Broderick, 1998; Welsch, Sullivan, & Justice, 2003; West & Hausken, 1995). In reality, children's name writing has been used in preschool settings not only for efficient first writing lessons but also as a developmental screening test. One of the main purposes of the dissertation is to establish a valid children's name writing developmental scale.

After discussion and examination, Study One proposed the five-level Children's Name Writing Scale (CNWS). Study Two thus aims to validate the scale. Validity refers to the degree to which a test or a measurement tool measures what it claims to measure. In the revisions of the *Standards for Educational and Psychological Testing* (*the Standards*) by the American Educational Research Association (AERA), American Psychological Association (APA), and National Council on Measurement in Education (NCME) (1999), validity is viewed "the most fundamental consideration in developing and evaluating tests." (p. 9) In the *Standards*, validity is seen as a unitary concept based on various kinds of evidence rather than just reaching those different types of validity. Note that validity is a matter of degree; it does not exist on an all-or-none basis. Furthermore, validity is always specific to some particular use or interpretation; that is, there is no test valid for all purposes (Gronlund & Linn, 1990; Hashway, 1998; Hopkins, 1998).

The validity of the Children's Name Writing Scale this dissertation proposed was

approached in two ways: content validity and criterion-referenced validity.

Content Validity

Content validity is the degree to which items on a test represent the content that the test is designed to measure. In other words, a test with content validity has items that satisfactorily assess the content being examined. For the purposes of this dissertation, content validity was defined as the degree to which the Children's Name Writing Scale properly reflected children's name writing development. In Study One, I first compiled a set of 17 name writing developmental characteristics by researching the literature. Then, through content analysis, I empirically examined and analyzed 641 children's name writing samples. After that, I used ANOVA and Scheffe tests to distinguish and reduce the developmental characteristics. At last, five scoring criteria were identified to be the major name writing developmental characteristics. The process of constructing the content validity of the Scale was already discussed in details in Study One.

Criterion-referenced validity

Criterion validity refers to whether a measurement can accurately predict or will overlap with performance on other measurements that are verified (Kerlinger & Lee, 2000). The main purpose of most measurements with criterion validity is to screen or select certain potential candidates in certain areas. For example, the Phonological Awareness and Literacy Screening (PALS) is used to measure young children's development of literacy knowledge and, at the same time, to screen children who may have literacy developmental delay. There are two types of criterion validity; one is

concurrent validity, which is used to validate a new test, and the other is predictive validity, which is used to predict future performance (e.g., SAT, ACT, etc.). In Study Two, I used DIAL-3total score without name writing subtest score to construct the predictive validity of the CNWS and the correlations between CNWS and other name writing tests as concurrent validity.

Predictive validity refers to the relationship between scores on an assessment and the performance on a relevant test. In Study Two, the Pearson's *r* between DIAL-3 total score without name writing subtest and CNWS is .748 (Table 4-2). The predictive validity is thus established.

Concurrent validity is often used to validate a new test or to substitute an expensive or complex test with an affordable or easier test. In Study Two, the Pearson's r between CNWS and PALS is .939 (Table 4-5). The concurrent validity is thus established.

The longitudinal data

As for the longitudinal data, since the name writing samples were collected twice a school year, children's name writing developmental changes happened between two data collecting dates thus remains unknown. However, the data showed that only few children's name writing development did not increase monotonically over time. The data also showed that some children stayed in a level for several months whereas some stayed for a short time. And, some children skipped one or two levels. Even though there is no definite pattern to describe the phenomenon, all the subjects eventually approached a higher developmental level.

Chapter 5

Study Three: The Nature of Children's Name Writing Development

Based on the results of Study One and Study Two, Study Three addresses the following question: What are the relative contributions of language and motor skills to the development of name writing?

Research Method

In Study Three, although the variables examined were measured by ranked scales, I chose to use the Pearson's correlation instead of Spearman's rho to be consistent with the later regression analysis. The stepwise regression was used here to find which factors influence children's name writing development the most.

Participants and Data Collection

The subjects of Study Three were drawn from Study Two. A total of 183 children's name writing, fine motor skills, language development and concept development were statistically analyzed.

Research Instrument

The main research instrument of Study Three is the DIAL-3 developmental test (Mardell-Czudnowski & Goldenberg, 1998). The procedures and scorings of the DIAL-3 subtests are described as followed.

Motor Subtests:

1. Block building: The researcher built a 3-block-tower in front of the child and asked the child to copy. This is repeated three more times for different tower shapes. The scale is: 1= 1-2 points, 2= 3-4 points, 3= 5 points, 4= 6 points.
2. Thumbs and finger:

A. Twiddling thumbs: The researcher folded his/her 10 finger together, interlocking them, and rotated his/her thumbs. After several seconds, the researcher then asked the child to copy the movement. One point was given if the child did it correctly.

B. Touching finger to thumb: The researcher touched each finger to the thumb of the same hand, going in either direction, at the rate of one per second. Then, the researcher asked the child to copy the movement. One point if the child succeeded with one hand, and 2 points if the child succeeded with both hands.

The possible points for this subtest, thumbs and finger test, are 3.

3. Cutting: The researcher first placed a cutting card and a scissor on the table, and asked the child to cut on the three snipping lines (two straight and one curved) on the cutting card. The fourth cutting shape is a dinosaur. One point for each acceptable cutting.
4. Copying: The researcher first placed a pencil and a record form on the table, and then

showed the child 8 figure cards, one at a time, and asked the child to copy the figure. The 8 target figures are ＋, W, E, Δ, b, ◇, □, and s. Based on the accuracy of the shapes the child copied, one or two points would be given. The possible points for this subtest are 16. The scale is: 1= 0 point, 2= 1-2 points, 3= 3-6 point, 4= 7-10 points, 5= 11-16 points.

Language Subtest:

1. Articulation: The researcher showed the child 13 picture cards, one at a time, and asked the child to repeat the word after the researcher said it. The 13 words are cup, ring, toast, spoon, cheese, leaf, zebra, fish, truck, dress, thumb, glove, and jar. While the child was pronouncing the words, the research paid attention to the way the child pronounced the underlined consonants. One point for each correct pronunciation. The scale is: 1= 0-9 points, 2= 10 to 22 points, 3= 23 to 24 points, 4= 25 to 26 points.
2. Object naming: The researcher showed the child 7 picture cards, one at a time, and asked the child: “What’s this?” The seven pictures are plane, car, clock, pencil, hanger, whistle, and thermometer. Two points would be given for each correct answer. The scale is: 1= 0-6 points, 2= 7-9 points, 3= 10-11 points, 4= 12-13 points, 5= 14 points.
3. Letters and sounds: Three tasks are included in this subtest.

A. Alphabet song: The researcher asked the child to sing the alphabet song. 0 point if the child could only sing from a to f, 1 point if the child can sing from g to o, 2 points if the child can sing from p to y, and 3 points if the child could sing the whole song.

B. Letter naming: The researcher pointed to a letter and asked the child the name of the letter. The letters tested in this task are S, B, K, f, G, R, and W. One point for each

correct answer.

C. Letter-sound correspondence: This task was only given to the children aged five and above. The researcher pointed to a letter and asked the child what sound the letter makes. S, B, K, f, G, R, and W, same letters as the above task, are the sounds tested in this task. One point for each correct answer.

The total possible points for this subtest are 10 points for children aged five and below, and 17 points for children aged five and above. For children aged five and below, the scale is: 1= 0 point, 2=1 to 3 points, 3= 4-5 points, 4= 6-10 points. For children aged five and above, the scale is: 1= 0 point, 2= 1-4 points, 3= 5-9 points, 4= 10-14 point, and 4= 15-17 points.

4. Rhyming and "I Spy": This test is only given to children aged four and above.

A. Rhyming: The researcher asked the child to give a word that rhymes with the following words, cat, bake, wag, ring, kite and kite, one at a time. The acceptable answer can be either a real word or a nonword that rhymes. One point for each acceptable answer.

B. I Spy: The researcher placed some picture cards on the table and said: "I spy. What do I spy? Something that begins with /t/." Then, the child was expected to point to the picture that begins with /t/ (e.g., table) on the table. The sounds that tested in this task are /d/, /b/, /sh/, /ch/ and /p/. One point for each correct answer.

The total possible points for rhyming and "I spy" are 10. The scale is: 1= 0 point, 3= 1 to 3 points, 4= 4-8 points, and 5= 9-10 points.

Data Analysis and Results

The data for Study Three were analyzed by children's age within one-year groups. I explored: 1) What characterizes 3-, 4- and 5-year-old children's name writing development? 2) Does children's name writing development relate to their motor skills and emergent literacy skills? 3)What factors are related to children's name writing development?

The name writing development of three-year-old children

1). What characterizes three-year-old children's name writing development?

There were a total of 61 subjects in the three-year-old group and the mean age was 42.0 months. For three-year-olds, 8% are in the level of Aimless scribbles, 58% are Flat/wavy scribbles or None/refusal, 26% are Symbol or letter-like units and 8% are One or few letters from name (Table 5-1).

2). Does the three-year-old children's name writing development relate to motor skills and emergent literacy skills?

The relationships between CNWS and the 7 variables from DIAL-3 subtests were examined by Pearson's *r* (Table 5-2). Among the 7 variables, letters and sounds (r = .446, p=.001, α= .01), copying skills (r = .444, p=.001, α= .01), thumbs and finger twiddling/touching (r = .333, p=.009, α= .01) and cutting skills (r = .292, p=.022, α= .05) have the strongest positive relationships with three-year-olds' name writing development.

Table 5- 1 Three-year-old children's name writing development

Name writing development	N	%
Level 1: Aimless scribbles	5	8
Level 2: Flat/wavy scribbles or None/refusal	35	58
Level 3: Symbol or letter-like units	16	26
Level 4: One or few letters from name	5	8
Total	61	100

Table 5- 2 The correlation of three-year-old children's name writing development, motor skills and emergent literacy skills development

Variables	Pearson's r With CNWS	p value
Motor skills		
Blocks building	.009	.944
Thumbs & Finger	.333**	.009
Cutting	.292*	.022
Copying	.444**	.001
Language development		
Articulation	-.046	.723
Object naming	.170	.191
Letters & sounds	.446**	.001
Rhyming (no data)+		

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).
+Notes: According to DIAL-3 manual, the subtest of rhyming should not be conducted if the subjects are under age 4.

3)What factors influence three-year-old children's name writing development?

Through stepwise regression, three-year-old children's name writing development could be predicted mainly by the variables of letters and sounds and copying skills. This model could explain 27.6% of the variation in three-year-old children's name writing development. The copying skills added around 10% to the variance accounted for.

The regression equation for model 2 is:

Y = 1.995 + .286 (letters and sounds) + .437 (copying skills)

R= .547 R Square = .300 adjusted R Square = .276 R Square change= .100

F= 12.408 df= 58 *p*= <.001

Models		*b*	*SE b*	Beta	p
1	(Constant)	2.034	.119		.001
	Letters and sounds	.378	.099	.446	.001
2	(Constant)	1.995	.113		.001
	Letters and sounds	.286	.098	.312	.005
	Copy	.437	.152	.290	.006

The name writing development of the four-year-old children

1). What characterizes four-year-old children's name writing development?

There were a total of 93 subjects (53 boys and 40 girls) in the four-year-old group and the mean age was 54.2 months. Out of 93 subjects, 33% could not produce recognizable letters whereas 32% could write their names using conventional or almost correct spelling (Table 5-3).

Table 5- 3 Four-year-old children's name writing development

Name writing development	N	%
Level 1: Aimless scribbles	0	0
Level 2: Flat/wavy scribbles or None/refusal	8	8
Level 3: Symbol or letter-like units	22	25
Level 4: One or few letters from name	33	35
Level 5: Conventional or spelling almost correct	30	32
Total	93	100

2). Does four-year-old children's name writing development relate to motor skills and emergent literacy skills?

Among the 8 variables examined, copying skills (r = .601, p< .001, α= .01) had the strongest positive relationship with four-year-old children's name writing development; other significant factors included letters and sounds (r = .484, p< .001, α= .01), cutting skills (r = .375, p< .001, α= .01), blocks building (r = .351, p= .001, α= .01), object naming (r = .304, p= .003, α= .01), thumbs and finger twiddling/touching (r = .254, p= .014, α= .05), rhyming (r = .235, p= .025, α= .05) and articulation (r = .209, p= .045, α= .05) (Table 5-4).

Table 5- 4 The correlation of four-year-old children's name writing development, motor skills and emergent literacy skills development

Variables	Pearson's r With CNWS	p value
Motor skills		
Blocks building	.351**	.001
Thumbs & Finger	.254*	.014
Cutting	.375**	.001
Copying	.601**	.001
Language development		
Articulation	.209*	.045
Object naming	.304**	.003
Letters & sounds	.484**	.001
Rhyming (no data)+	.235*	.025

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

3).Which factors influence four-year-old children's name writing development?

Among the 8 variables examined, four-year-old children's name writing development, through stepwise regression, could be predicted mainly by the variables of copying skills (*b*= .412) and letters and sounds (*b*=.275). This model could explain around 41.2% of the variation of four-year-old children's name writing development. The variable of letters and sounds added around 6.9% to the variance accounted for.

The regression equation for model 2 was:

Y = 2.684 + .412 (copying skills) + .275 (letters and sounds)

R= .652 R Square = .425 adjusted R Square = .412 R Square change= .069

F= 32.512 df= 88 p< .001

Models		*B*	*SE b*	Beta	p
1	(Constant)	2.961	.160		.001
	Copy	.512	.073	.596	.001
2	(Constant)	2.684	.174		.001
	Copy	.412	.076	.479	.001
	Letters and sounds	.275	.084	.289	.002

The name writing development of the four-year-old children

1). What characterizes the five-year-old children's name writing?

There are a total of 29 subjects (10 boys and 19 girls) in the five-year-old group and the mean age is 61.83 months. Out of the 29 subjects, 22 (76%) of the children could write their name conventionally or almost could spell their names (Table 5-5). The high percentage of children reaching the final level indicates a ceiling effect.

Table 5- 5 Five-year-old children's name writing development

Name writing development	N	%
Level 1: Aimless scribbles	0	0
Level 2: Flat/wavy scribbles or None/refusal	0	0
Level 3: Symbol or letter-like units	2	7
Level 4: One or few letters from name	3	17
Level 5: Conventional or spelling almost correct	22	76
Total	29	100

2). Does five-year-old children's name writing development relate to motor skills and emergent literacy skills?

Among the 8 variables examined, only copying skills (r = .484, p= .008, α= *.01*), correlate with five-year-olds' name writing development (Table 5-6). Considering that 76% of the 5-year-old children reached the top level of name writing scale and the distribution is thus skewed, the correlation and later regression model are unlikely to reach statistical significance. Apparently, there is a ceiling effect on five-year-old children's name writing assessment.

Table 5- 6 The correlation of five-year-old children's name writing development, motor skills and emergent literacy skills development

Variables	Pearson's r With CNWS	p value
Motor skills		
Blocks building	.049	.802
Thumbs & Finger	.137	.479
Cutting	.097	.615
Copying	.484**	.008
Language development		
Articulation	.264	.166
Object naming	.294	.122
Letters & sounds	.241	.208
Rhyming (no data)+	.162	.400

*. Correlation is significant at the 0.05 level (2-tailed).

Discussion and conclusion

A total of 183 children's name writing development, fine motor skills and emergent literacy skills were examined in Study Three. Through correlation and stepwise regression, the three age groups' name writing development was revealed. For most three-year-olds, who are in scribbling levels, their knowledge of letter-sound correspondence is the key factor to name writing development. And, for most four- and five-year-olds, who could already produce recognizable letters, their copying skill is the key factor to name writing development. The results indicate that children's name writing development involves not only emergent literacy skills but also fine motor skills. It confirms that learning letters is an essential step toward name writing development, and

after children can produce the letters of their names, writing them neatly, which includes the criteria of letter alignment, spacing and the size of letters, becomes important. Although emergent literacy skills and fine motor skills are two different domains, they develop concurrently during early childhood and both are essential for name writing development.

The results of the dissertation also show that name writing may not be a good measure for five-year-olds, who mostly could write their names conventionally or spell their names almost correctly. Since most five-year-olds can write their name, there is a ceiling effect on name writing measures for this age group. Thus, for five-year-old children, more specific readiness tests or screening batteries will be more beneficial than name writing test.

Chapter 6

Findings and Discussion

Most people have emotional bonds with their own names. For young children, the bond is even greater and more special (Clay, 1991; Dyson, 1981; Ferreiro, 1986; Martens, 1999; Villaume & Wilson, 1989). Not only do names represent the children themselves but children also feel a sense of "ownership" about their names (Ferreiro, 1986). Accordingly, children's own names are often the first written word that they can recognize and are taught (Aram & Biron, 2004; Clay, 1975; Ferreiro & Teberosky, 1982; Levin, Vries, Aram, & Bus, 2005; Martens, 1996; Villaume & Wilson, 1989).

Research has shown that name writing is one of the most common ways that parents and teachers help young children acquire the basic concepts of written language (Aram & Biron, 2004; Bloodgood, 1990; Clay, 1991; Haney et al., 2003; Molfese et al., 2006; Stuart, 1990, 1995; Treiman & Broderick, 1998; Welsch, Sullivan, & Justice, 2003; West & Hausken, 1995). Name writing is not just copying letters or reciting the spelling of the name. Name writing, in fact, is a developmental process that begins with pre-alphabetic forms such as scribbles, symbols, letter-like forms or drawing. It also involves fine motor skills, the concepts of print, letter identification, letter forming (Bloodgood, 1999; Treiman & Broderick, 1998; Martens, 1996; Treiman & Kessler, 2004; Villaume &

Wilson, 1989) and the knowledge of letter-sound correspondence (Blair & Savage, 2006; Bloodgood, 1999; Bryant, MacLean, Bradley, & Crossland, 1990; Chaney, 1992; Dodd & Carr, 2003; Ehri & Chun, 1996; Haney et al., 2003; Riley, 1996; Welsch, Sullivan, & Justice, 2003). The National Reading Panel (2000) confirmed from 52 correlational studies published in peer-reviewed journals that letter knowledge and phonological/ phonemic awareness were the two best predictors of children's later reading achievement. Even though there is no direct evidence showing that name writing promotes children's literacy skills, many educators and scholars have assumed that name writing can lead to an increase in children's letter knowledge as well as phonological/phonemic awareness. Therefore, name writing has been considered an efficient way to evaluate young children's basic literacy skills (Welsch, Sullivan, & Justice, 2003; West & Hausken, 1995).

In England, it is mandatory for all four-year-old children to take a variety of baseline assessments during their first seven weeks in school. All baseline assessments approved by the Qualifications and Curriculum Authority include a name-writing related task (Lindsay & Martineau, 2004). In the United States, the Committee on the Prevention of Reading Difficulties in Young Children (Snow, Burns, & Griffin, 1998) suggested that a child should be able to write "one's own name (first and last) and the first names of some friends or classmates" by the end of kindergarten year (p. 80). In addition, several state-provided early screening tools, for example DIAL (the Developmental Indicator for the Assessment of Learning), PALS (the Phonological Awareness Literacy Screening), and ELSA (the Early Literacy Skills Assessment), contain a name writing task as well.

Although a name writing task has been a part of many screening batteries and a

research variable to evaluate children's literacy skills, the issue of validity is still open to discussion. Reviewing the existing literature, only three studies were found from Proquest and First Search databases that empirically examine children's name writing development. They are Hildreth (1936), Ferreiro and Teberosky (1982), and Lieberman (1985). Based on their research findings and classroom observations, early literacy researchers have developed several name writing scales, with different scoring criteria used in their studies.

Children's name writing tests, by definition are readiness tests. Unlike developmental screening tests evaluating children's potential ability to acquire certain skills, readiness tests focus on the actual academic skills children have acquired (Costenbader, Rohrer, & Difonzo, 2000; Gredler, 1997; Meisels, 1987; Meisels & Atkins-Burnett, 2005). Readiness tests can reflect what children know currently and what they are able to learn in the near future. Thus, the ideal of using screening tests or readiness tests is for educators to easily evaluate and record children's developmental progress and, further, to design or adjust their curriculum based on the screening test outcomes (Lindsay & Desforges, 1998; Meisels, 1987; Meisels & Atkins-Burnett, 2005; NAEYC, 2003; Thurlow & Gilman, 1999; Wortham, 1995). Research has shown that before receiving formal instruction, children's name writing is a developmental process rather than a dichotomous academic skill (Clay, 1975, 1991; Ferriro & Teberosky, 1982; Hildreth, 1936; Lieberman, 1985; Martens, 1996; Villaume &Wilson, 1989). Moreover, the degree of proficiency in name writing is associated with several observable behavior and psycholinguistic developments (Ferreiro, 1984; Lieberman, 1985). Thus, children's name writing, as a readiness test, has been believed to be a window onto early literacy

development.

Reviewing the existing name writing scales, at least 17 developmental characteristics have been adopted as scoring criteria (Table 2-1 and Table 2-2). Theoretically, all 17 features could be found during children's name writing development but not all of them are likely to significantly discriminate between levels of name writing development among children of different ages. It seems that scholars chose several possible major features, arranged them in a reasonable order and created a name writing scale.

In a children's name writing developmental scale, the term "development" describes the patterns or sequences of changes that relate to age. To identify suitable, acceptable and satisfactory scoring criteria is the most critical task when developing a children's name writing scale. Thus, the main purposes of this dissertation are, first, to reveal the main developmental characteristics of preschool and kindergarten children's name writing development. Using the scale, I explored the relationships among children's name writing development, fine motor skills and emergent literacy skill. There are three studies included in the dissertation. Study One was designed to find the major characteristics in children's name writing; Study Two was designed to test and validated the name writing scale; and the goal of Study Three was to explore the nature of children's name writing development in relation to both emergent literacy and fine motor skills.

The name writing samples and the children's DIAL-3 test scores examined in this dissertation were drawn from the longitudinal project "Enhanced HS-MAP Intervention: Linking Program Evaluation and Child Outcomes," which was funded by a grant to E.P. Bradley Hospital, East Providence, Rhode Island, from the Administration on Children,

Youth and Families (ACYF), and the Head Start Bureau as part of the Head Start Child Outcomes Research Consortium (Dickstein et al., 2002-2006).

A total of 641 name writing samples produced by 321 children were quantitatively and qualitatively examined in Study One. Drawn from Study One, 183 children who had attended DIAL-3 test were the focus of Study Two and Three. The findings of the three studies are discussed below.

Study One: Finding the major characteristics in children's name writing

1. What are the major characteristics in children's name writing development?

In Study One, I first used content analysis to examine 641 children's name writing samples produced by 321 preschool and kindergarten children. From the coding results of the Study One, there are a total of 17 developmental characteristics found in children's name writing samples. However, not everyone could stand alone as a primary characteristic that would discriminate children of different ages. When examined further, only six of them occurred frequently and discriminated among age groups. The six name writing major characteristics are Aimless scribbles (M = 38 months), Flat/wavy scribble or None/refusal (M = 43 months), Symbols or letter-like units (M = 47 months), One or few letters from name (M = 54 months), and Conventional or spelling almost correct (M = 60 months).

Each of the five developmental characteristics identified in this dissertation not only were frequently found in the 641 written samples but can also signify children's psycholinguistic development. This development begins with children's aimless scribbles, which Vygotsky (1978) called a pre-stage of children's writing development. Vygotsky

believed that young children's gestures were actually "writing in air" (1978, p. 107), and that this arm waving is linked to future scribbles, which Vygotsky claimed to be the origin of written signs. Luria's (1978) experiments and observations on children's early writing also support the idea that children's undifferential scribbles are the developmentally earliest form of writing. These undifferentiated scribbles, from Luria's perspective, are also acts of play and the imitation of adults' writing behaviors. In other words, aimless or undifferentiated scribbles indicate that the children have seen someone write and it triggers their imitation of the writing behaviors (Sheridan, 2001, 2004).

Children's observations of adults' writing behaviors and their interactions with environmental print or picture books make them further realize that writing is not just body movements; writing consists of arm/finger movements as well as written forms. The English written forms that children first notice are wavy or flat lines. To young children, a page of English text looks just like several continuous lines, so they make wavy or flat lines in order to pretend that they are writing. Kellogg (1970) and Luria (1978) reported that children would try to "arrange" their scribbles in particular places on the paper or to have relations with other scribbles or symbols on the paper so that they could recall what they wrote. Once children consciously arrange their scribbles and can "read" from their scribbles, the scribbles are no longer an act of imitation but meaningful symbolic writing. Furthermore, this behavior indicates that they have realized the function of writing (Ferreiro, 1986; Liberman, 1985). This milestone happens in the level of Wavy/flat scribbles.

Children's ability to distinguish print progresses from larger units to smaller units. Gradually, children will discover that the "lines" actually consist of individual symbols.

And, the symbols they produced first are mostly circular, corresponding to the basic shape of English letters. They make circles or simple shapes to represent English letters. The writing developmental process from symbol units, letter-like units to letter units shows that children are in the process of obtaining the ability to distinguish shapes of letters and to coordinate their visual information processing with fine motor control to write letters.

As for the levels of One or few letters from name, and Conventional or spelling almost correct, they both reflect children's literacy development and written language knowledge. Scholars have found that the letters of the children's names are often the letters they mostly used in free writing (Bloodgood, 1999; Pollo, Kessler, & Treiman, 2009; Treiman & Broderick, 1998). Moreover, the number of the letters children produced in their name writing indicates the word concept they have acquired (Ferreiro, 1986; Ferreiro & Teberosky, 1982). Ferreiro and Teberosky (1982) observed that children realize that there must be a certain number of letters, around three or four, to consist a meaningful word. Thus, children who have very limited letter knowledge will try to produce enough units of letters to reach the sufficient length for them to think that they have written a meaningful word. For example, Alajah (3; 11) wrote his name as "AAHA" and Dhruv (4; 0) wrote his name as "NABPO." Treiman, Kessler and Bourassa (2001) also reported that children who have longer names tend to produce longer invented words than children with shorter names. The average age for children to print recognizable letters is 4 years 5 months and the average age for children to write their name almost correctly is 4 years 10 months (Table 3-6). That is, once children acquire letter knowledge, they can write their names almost correctly in a short time.

To form a letter needs not only letter knowledge but also mature fine motor skills. In addition to examining the criteria based on literacy development, I also examined five criteria based on fine motor skills. Children's name writing development, from aimless scribbling, symbols, letter-like units, letter units, to conventional, is actually also a development of fine motor skills. From arm/wrist control to more mature eye-hand coordination, young children gradually progress to printing a string of letters with good form. The fine motor skill criteria--for example, letter alignment, spacing, letter size--are not required before children could print recognizable letters. However, when children can spell their names almost correctly, children will then be asked to write as neat as possible. The results of Study One showed that children's ability to align letters, apportion spaces and control the size of letters develops almost simultaneously. That is, when children could align letters properly, they often made even spaces between letters and printed the letters in an equal size. However, when the fine motor skills criteria were integrated with the spelling criteria in Study One, the Scheffe tests showed the scale lost its significance on age differences. In other words, children's name writing performances were related to their fine motor skills, but the addition of fine motor skill criteria in the name writing scale does not improve its ability to differentiate stages in children's name writing performance.

The necessity of including fine motor skills criteria in name writing scales relates to the question: how long do children need from when they can write at least 3 recognizable letters in bad form to when they could print their name conventionally in good form? Based on the analysis of 128 children's name writing samples in Study One, the answer was around four months. Thus, if we need a very detailed 10-level name writing scale, we

must include fine motor skills criteria. However, if the scale we need focuses on those significant developmental characteristics, fine motor skills criteria could be excluded and be represented indirectly by children's letter forming ability.

2. Could the major features of name writing be organized into a developmental scale that is sensitive to age?

In addition to psycholinguistic traits, the five major levels constituting the scale also show statistically significant relations with age (r = .799, α= .01, 2-tailed). Except the level of Aimless scribbles, each of the other four levels is comprised of two or three characteristics (Table 3-13). For example, the level of Flat/wavy scribbles or None/refusal contains flat scribbles, wavy scribbles, and children's refusal to write. And the level of One or few recognizable letters contains random letters, the first letter of name, and contains two or three letters from name. The main reason to group several developmental characteristics together is because those characteristics either did not have enough cases (e.g., out of 641 samples, only 9 (1.4%) are Random letters) or the mean age of the level is very close to the level next to it. The grouping not only makes statistical exploration more meaningful but also allows us to distinguish different developmental groups. This feature makes the Children's Name Writing Scale more valid than the other scales. In other words, children who are in level 2 of the Children's Name Writing Scale will be statistically different in age from the children who are in level 3.

Study Two: Testing the name writing scale

3. Is it possible to develop a developmental assessment scale for name writing

development that represents an improvement on existing scales?

The main problem of using the existing name writing scales is the issue of validity. A name writing scale, as a readiness test, should be able to identify children's major developmental levels. The validity of the Children's Name Writing Scale proposed in Study One was established through content validity and criterion-referenced validity. The finding of the major developmental characteristics constructed the content validity. After identifying the major name writing developmental characteristics, I then used DIAL-3 as the comparison to validate the Children's Name Writing Scale. After running the Pearson's correlation, the scale was found highly correlated with DIAL-3 total score without name writing subtest (r = .748, α= .01, 2-tailed) and children's age (r = .799, α= .01, 2-tailed). Also, CNWS and PALS is strongly correlated (r = .939, α= .01, 2-tailed). The criterion-referenced validity thus was constructed.

4. Do the longitudinal data support the name writing scale the dissertation proposed?

Among the 321 subjects, 76 children have at least three name writing samples collected (Appendix 2). Among those 76 children, only 12 children's name writing samples fail to show consistently more advanced name writing over time. The longitudinal data also showed that the time children stay in a level varies. For example, some children stayed at a certain level for over 10 months, while others might stay at a given level for only a few months. In addition, many children are shown to skip levels. However, the name writing samples were collected once per semester, so any name writing developmental changes that happened between two waves of data collection were unknown.

The longitudinal data indicate that children stay a longer time at the pre-letters levels, but once they could produce recognizable letters (M = 53.97 months), they could reach the conventional level (M = 59.59 months) very quickly.

Most children could write their names conventionally before age six. The progress of development, from scribbles to conventional, takes only two to three years. Therefore, to reveal the developmental progression in detail would require long-term regular data collection in order to avoid missing any of children's developmental changes. The data of this dissertation were collected once a semester so it is very possible that we missed some important developmental changes in between.

Study Three: Using the scale to explore the nature of children's name writing development

5. What are the relative contributions of language and motor skills to the development of name writing?

Research has shown that children's name writing relates to their emergent literacy skills (Bloodgood, 1999; Clay, 1975; Ferreiro, 1986 Molfese et al., 2006; Treiman, Kessler, & Bourassa, 2001). Study Three explored how children's name writing relates to fine motor skills as well as literacy skills. A total of 183 children's name writing samples as well as their eight DIAL-3 subtest scores were examined by correlations and regression models. The eight subtests include four fine motor skill subtests (block building, thumb/finger twiddling, cutting and copying) and four literacy skill subtests (articulation, letters and sounds, object naming and rhyming).

Out of 61 three-year-old children, 66% are in scribbling levels and only 8% could

produce recognizable letters. When examined further, the variable of letters and sounds (r = .417, p=.001, α= .01) has the highest positive relationship with name writing, followed by the variable of copying skills (r = .401, p=.001, α= .01) and thumbs/finger touching and twiddling skills (r = .350, p=.006, α= .01). Letters and sounds, and copying skills could explain 27.6% of the variation in three-year-old children's name writing development. The results suggest that the most important factor influences three-year-old children's name writing development is children's letter knowledge.

Among the 93 four-year-old children, 35% could produce recognizable letters, 32% could spelling their name almost correct or conventionally and only 8% stayed in the level of Wavy/flat scribbles. When examined further, four-year-old children's copying skills (r = .617, p<.001, α= .01) is the most important factor that influences name writing development, followed by the variable of letters and sounds (r = .489, p<.001, α= *.01*). The variable of copying skills and letters and sounds could explain 41.2% of the variation of four-year-old children's name writing development. The findings indicate that once four-year-old children's fine motor skills are well developed and have acquired basic letter knowledge, they can print recognizable letters or even write their names conventionally.

Out of the 29 five-year-old children, 76% could write their name almost correctly or conventionally. It indicates that name writing has a ceiling effect on five-year-old children.

The overall findings of the Study Three showed that name writing correlates with emergent literacy skills and fine motor skills differently for different age groups. For three-year-old children, to be able to print their names requires letter knowledge, and

after they acquire basic letter knowledge, they need more mature fine motor skills to facilitate their name writing. Without properly developed fine motor skills, children's letter knowledge and their name spelling ability could not be performed. Therefore, from the perspective of children's literacy development, a name writing test is a very efficient way for preschool teachers to quickly screen both children's letter knowledge and fine motor skills development.

Although the name writing test has been a part of baseline assessments for preschool and kindergarten children, early educators have worried that parents might coach their children at home and thus impair the validity of the test (Lindsay, Martineau, & Lewis, 2004). It is true that parents' or teachers' teaching will likely lead to improvements in children's name writing scores. If name writing test is the only language and literacy test children will take, it is very possible to be misled by the results because name writing cannot represent all of children's general language and literacy development, especially for children over age five.

Up to now, the definition of the term "emergent writing" in the literature has remained vague. The term often refers to children in the process of learning using conventional letters to compose messages. Thus, writing produced by preschool and kindergarten children can be seen as emergent writing (Teale & Sulzby, 1986). Among those common writing activities (e.g., story writing, journal writing, word writing, etc.), name writing is an assessable and reachable milestone for most preschool and kindergarten children. This dissertation explored the nature of preschool and kindergarten children's name writing development. Compared to other language and literacy assessment tests, I believe that children's name writing is the best test to examine

children's early knowledge of written language. It reflects how children perceive English text (e.g., from wavy scribbles, flat line, symbols, letter-like units, to letter units) and at the same time, how they control their fine motor skills to print what they perceive. Since children's own names are often the first written word they learn, it makes itself the best test to quickly and roughly screen preschool children's general literacy development as well as fine motor development.

Implications and Significance

The results of the dissertation add a substantial piece to the field of early writing research. To the field, the dissertation provides empirical evidence supporting that children's name writing is a developmental process and contains several major characteristics. Each of them reflects not only the children's understanding of written language knowledge but also their fine motor skills development. Among the major developmental characteristics, the role of refusal to write, which has been seen as the lowest early writing level or as invalid data, was proved to be an important characteristic. The findings provide a rationale for early literacy researcher to adjust their name writing scales.

This dissertation also bridges the gap between emergent literacy skills and fine motor skills by examining the factor from both domains. The findings suggest that children's early writing development needs not only the knowledge of letters and sounds but also the skills from fine motor development.

For educational practice, the Children's Name Writing Scale proposed in the dissertation provides preschool teacher an efficient way to roughly screen their students' literacy development. Based on the screening, teacher could design individualized lesson to scaffold the children's future learning.

Limitations

The findings of this dissertation have provided insights of preschool and kindergarten children's name writing development. However, to generalize the results might be limited due to several methodological issues. First, the demographic characteristics of the participants might limit the generalization of the findings. All the 321 children participated in the dissertation were from Head Start programs. A number of studies have demonstrated that children's social economic status would directly and indirectly influence children's literacy performance (Duncan, Brooks-Gunn, & Klebanov, 1994; Hoff, 2003; Stipek & Ryan, 1997; West & Hausken, 1995). Thus, it is highly possible that name writing development might be affected by the children's social economic status. Therefore, the interpretation of the results might be biased and cannot be generalized to other populations.

In addition to children's social economic status, lack of the children's home literacy data might skew the nature of children's name writing development. There is abundant evidence documenting the potential impact of home literacy on children's literacy development, for example, the quality and quantity of mother-child interactions and storybook sharing (Molfese, DiLalla, & Lovelace, 1996; Murray & Yingling, 2000). It is

possible that children's name writing development influenced by their home literacy.

The lack of classroom information might also is influenced the results of the dissertation. Research has suggested that the quality of early education settings and curriculum might influence children's literacy performance (Dickinson & Smith, 1994; Whitehurt & Lonigan, 1998). Therefore, children who come from a literacy-rich classroom might have better name writing performances than the children who come from a classroom without literacy curriculum.

In addition, the data collection was planned twice a year, therefore, it might miss children's name writing developmental changes in between. The longitudinal data of the present study showed that some children skipped one level or two, but we do not know whether the skip actually happened between the two data collection dates or if it is natural for children to skip levels. It will need further longitudinal studies to confirm.

The variables examined in the dissertation should be explained under the definition of the DIAL-3 manuals. Children's literacy learning could be profound influenced by their parents, teacher and communities. Therefore, the correlation outcomes presented indicate the relationships among the variables rather than the cause and effect.

Although research has shown that children's name writing is a developmental process, it is possible that the development can be speeded by formal instruction. Lindsay and Marineau (2004) reported that in order to pass the compulsory preschool baseline assessments in England, some parents push their four-year-old children to recite the spelling of their names and to practice letters writings. However, Ferreiro (1986) reported two longitudinal literacy learning cases and argued that children need to "interact" with written language in order to learn written language; children will not just accept adults'

instruction and learn. Ferreiro (1986) concluded: “it is not information, as such, that creates knowledge. Knowledge is the product of construction of the knowing subject.” (p. 26) In other words, it is possible that children skip the natural learning process and are taught to write their own names directly. Although their name writing looks conventional, they may have no phonological awareness or other written language knowledge. Accordingly, name writing alone cannot adequately reflect children’s literacy or writing development. Name writing should be combined with other literacy assessments to accurately reflect children’s emergent writing development.

Directions for Further Research

Although the present study did have some notable limitations, it can be expended upon in a number of ways. First, it would be beneficial to explore how the results of the current study might vary when a higher SES sample is the focus.

It would be especially worthwhile to examine how name writing promotes three- and four-year-old children’s literacy learning, for example, children’s letter knowledge, phonological/phonemic awareness and other literacy learning factor. This dissertation pointed out that there are significant relationships between children’s name writing development and knowledge of letters and sounds. It will be beneficial to design a quasi experiment in preschool classrooms to clearly identify the possible causes and effects. It is also exciting to know how fine motor skills activities promote children’s name writing development in a well designed experiment.

As for children’s drawing, which appeared in many other name writing scales, it is

interesting to explore how young children treat the picture they produce. Do they use drawing as a form of writing or use drawing to express themselves but not taking it as a form of writing? The role of drawing is an interesting subject waited for further discovering.

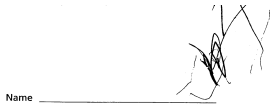
Also, it will be interesting to compare children's name writing development among different written languages. The name writing development in an alphabetic language society might be different from societies using logograms (e.g., Chinese). In particular, Wavy/flat scribbles as a significant psycholinguistic developmental trait might not happen in Chinese young children, because Chinese characters consist of distinctly two-dimensional shapes comprised of separate strokes. As with spoken language (e.g., Werker & Tees, 1984) children's early writing likely reflects some of the most salient features of the writing system they will learn, even before they grasp how writing really works. Because one's name is central to his or her identity, learning to write one's own name can provide a key entry point to the world of written language..

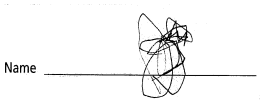
Appendices

Appendix 1 The codebook for Study One

1. Aimless scribbles

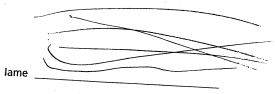
Aimless scribbles are scribbles without directions, which might contain multiple vertical, horizontal, or spiral lines.





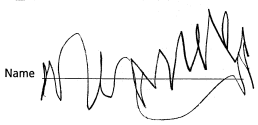
2. Flat lines

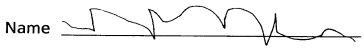
Flat lines are simple horizontal lines; it may contain one or several lines

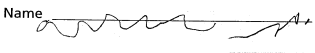


3. Wavy scribbles

Wavy scribbles look like continuous zigzag lines.





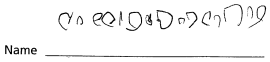


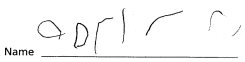
4. None/refusal

   A blank answer paper. Children refuse to write or say they do not know how to write their name.

5. Symbol units

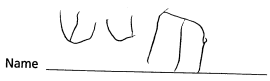
   Name writing is one or several individual symbols. Sometime might be mixed with scribbles.

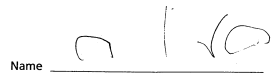


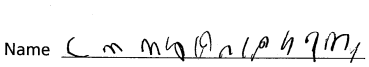


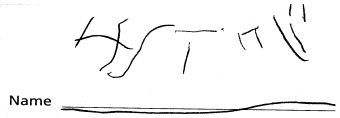
6. Letter-like units

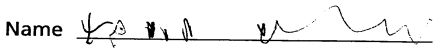
   Name writing is one or several letter-like units.





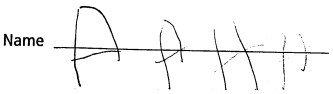


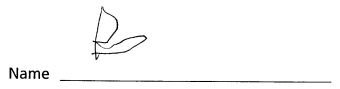


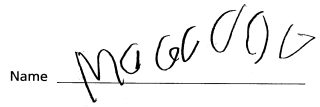


7. The first letters of name

Name writing contains the first letters of the child's name. Sometimes the letters might be repeated, or mixed with individual symbols.

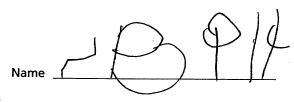


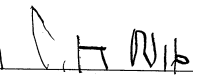


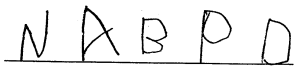


8. Random letters

Name writing is a string of letters with no apparent meaning and not coming from the subject's own name.

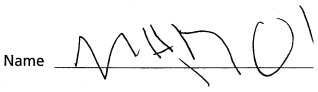


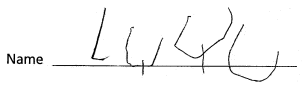
Name 

Name 

9. Contain Two or Three Letters from name

   Contain at least two letters from the child's name; the letters might be formed poorly.

Name 

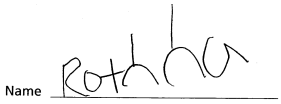
Name 


Name _____

10. Spelling almost correct, regardless of good form

    Name writing is completed with recognizable letters. The spelling of the child's name is almost correct but might have some revered letters, or might miss a letters.

Roxanna

Name 

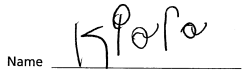
Luis

Name 

Abbygyle

Name 

Kiara

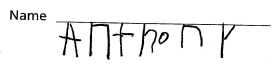


Darious

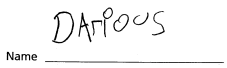
11. Conventional or almost correct with good form

Name writing is complete name with good shaped letters. The letters are formed more firmness, more regularity and better aligned. However, there might be one spelling error or revered letters.

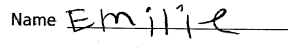
Anthony



Darious



Emilie



Appendix 2 Children's name writing development over the testing time

ID	Test time	Age (Months)	CNWS Level
4	1	41	3
	2	47	3
	3	53	5
	4	72	5
20	1	42	2
	2	46	1
	3	51	2
	4	56	5
	5	67	5
32	1	46	4
	2	49	4
	3	55	4
	4	61	5
35	1	43	4
	2	47	4
	3	52	4
	4	58	5
39	1	39	1
	2	44	2
	3	49	2
40	1	43	4
	2	47	5
	3	52	5
	4	58	5
41	1	36	1
	2	40	2
	3	45	2
	4	51	2
42	1	49	4
	2	51	4
	3	57	4
	4	62	5
45	1	42	3
	2	45	5
	3	51	5
	4	56	5
47	1	37	2
	2	43	2
	3	64	5
	4	76	5
50	2	44	2
	1	41	4
	3	49	5
52	1	37	2
	2	43	2
	3	69	5
53	1	37	3
	2	41	3
	3	46	3
	4	53	4
62	1	39	2
	2	44	2
	3	49	3
69	1	36	2
	2	58	4
	3	69	5
70	1	36	2
	2	58	4
	3	69	5
71	1	38	2
	2	43	4
	3	48	4
	4	53	5
73	1	45	2
	2	50	5
	3	71	5

82	1	41	2
	2	50	3
	3	55	2
83	1	44	2
	2	48	2
	3	53	2
	4	58	4
	5	68	5
86	1	44	2
	2	48	3
	3	54	5
87	1	38	3
	2	42	3
	3	47	4
	4	52	5
92	1	40	2
	3	49	2
	2	44	3
	4	55	3
94	1	38	2
	2	44	2
	3	48	4
95	3	45	2
	1	36	3
	2	41	4
97	1	39	1
	2	43	2
	3	48	2
99	1	42	2
	2	45	1
	3	51	2
	4	56	5
	5	66	5
107	1	44	4
	2	48	5
	3	53	5

111	2	41	2
	3	46	2
	1	38	3
	4	52	4
113	1	40	2
	2	44	1
	3	49	2
	4	55	4
	5	74	5
115	1	45	2
	2	54	3
	3	59	4
	4	68	4
116	1	43	2
	2	47	3
	3	52	3
	4	58	5
117	1	38	3
	2	42	3
	3	47	2
	4	52	5
	5	71	5
119	1	37	1
	2	40	3
	3	45	2
	4	51	3
	5	72	5
120	1	44	2
	2	53	1
	3	58	5
	4	67	5
121	1	50	2
	2	55	3
	3	61	5
	4	73	5
122	1	42	1

	2	46	2
	3	51	3
	4	56	5
	5	66	5
125	1	45	2
	2	49	2
	3	54	3
	4	59	3
127	1	40	1
	2	44	5
	3	49	1
	4	55	4
133	1	57	3
	2	62	5
	3	74	5
134	1	48	2
	2	51	4
	3	57	3
	4	62	5
135	1	44	2
	2	48	2
	3	53	4
142	1	46	2
	2	49	3
	3	54	3
	4	60	2
143	1	43	2
	2	47	4
	3	52	5
145	1	44	4
	2	47	5
	3	52	5
	4	58	5
148	2	54	2
	1	52	3
	3	59	3

152	1	45	2
	2	48	2
	3	54	5
	4	59	4
153	1	40	3
	2	44	3
	3	49	3
	4	54	5
154	1	41	2
	2	46	2
	3	51	4
157	1	37	2
	2	42	4
	3	48	5
	4	68	5
160	1	36	2
	2	41	3
	3	64	5
	4	75	5
171	1	49	3
	2	54	3
	3	75	5
172	1	36	3
	2	41	3
	3	64	5
	4	76	5
176	1	46	2
	2	51	3
	3	71	5
178	1	47	2
	2	52	3
	3	72	5
181	1	40	2
	2	45	3
	3	64	5
184	1	36	3

	2	40	3
	3	62	5
	4	73	5
187	1	38	1
	2	44	3
	3	64	5
188	1	52	3
	2	57	5
	3	67	5
189	1	41	2
	2	47	3
	3	66	5
191	1	41	2
	2	46	2
	3	67	5
192	1	39	2
	2	44	2
	3	64	5
195	1	46	2
	2	52	3
	3	72	5
198	1	42	2
	2	47	2
	3	68	5
199	1	39	2
	2	44	3
	3	64	5
203	2	44	1
	1	39	2
	3	65	4

204	1	54	2
	2	55	2
	3	60	4
208	1	38	2
	2	44	3
	3	63	5
209	2	49	2
	1	44	3
	3	69	5
211	1	57	2
	2	62	5
	3	72	5
212	1	39	2
	2	44	3
	3	63	5
225	1	53	5
	2	59	5
	3	68	5
226	1	47	2
	2	53	5
	3	72	5
227	1	39	2
	2	44	3
	3	65	5
239	2	44	2
	1	39	3
	3	63	5
246	1	37	1
	2	61	3
	3	72	5

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