

Contemporary Enlightenment of Zhu Zhixian's Handwriting Teaching Method in Primary School

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Abstract:

Zhu Zhixian's Handwriting Teaching Method in Primary School is the earliest important research work involving handwriting teaching in primary schools in foreign countries. Published by the Commercial Press in 1948, it is divided into 20 chapters, covering handwriting teaching objectives and preparation, handwriting practice, handwriting teaching training methods, teaching materials and copybooks, etc. The last two chapters are teaching experiment catalogue and teaching paper index. After studying and analyzing, it is found that many of them are worth learning from. The research results on the common problems and teaching methods of handwriting practice will help correct the prevailing misconceptions and misunderstandings and improve teachers' ability of handwriting teaching in primary schools.

Keywords: *Zhu Zhixian, handwriting in primary school, Teaching method, Contemporary enlightenment.*

I. THE GOAL AND PREPARATION OF HANDWRITING TEACHING

1.1 The Four Goals of Handwriting Teaching

Handwriting, as a tool, has always been highly valued. Chinese people always worship handwriting, to the extent that they want to have their own style of handwriting although they just start handwriting. In the western culture, reading, handwriting and counting are the so-called "3R". Among them, handwriting is equally important. In modern society, there is not much time for unnecessary pastimes, so the teaching goal of handwriting must be practical.

In the teaching goal, we should first ensure correctness, and then pursue for neatness. Only after the characters are correct and tidy could we pursue for quickness and beauty. 1. Correctness. It refers to "being standard" without increase or decrease of strokes and change of shapes or positions of strokes and parts. 2. Neatness. First, the characters should be neat. Each character should not be crooked or oblique. Then, the ranks should be uniform, and the handwriting should not be messy between words and between lines. 3. quickness. To save time, you can use the most labor-saving and reasonable way to write, and it is better to write quickly and keep characters correct and tidy. 4. Beauty. It refers to symmetrical character arrangement,

delicate and beautiful strokes, proper size and distance arrangement^[1].

The main goal of the handwriting in lower grades of primary school is to be correct, clear and tidy. The latter two items can be considered in the middle and senior grades, and quickness is especially important. Beauty doesn't mean to "have a style of one's own", but still means neat structure and ranks. Yu Ziyi said: "The first step for primary school students to write is to successfully write characters. The second step is to write straight lines. The third step is to write characters which are not only clearly visible, but also not annoying. That is enough^[1]." 150 Therefore, practicality is the most important goal of handwriting teaching.

1.2 Instruments for Handwriting Practice

What pen should primary school students choose when they learn to write at first, and what pen to use after that? Zhu Zhixian analyzed the performance and usage of various pens. This paper affirms the value of handwriting brush from the angle of art appreciation and analyzes the reasons why it is not suitable for beginners. First, the handwriting brush is soft, and the force lies in the vertical and horizontal movements. The muscles of beginners are underdeveloped and difficult to control the brush; secondly, Chinese calligraphy pays special attention to the shelf structure, and it is difficult for beginners to understand it quite well. Thirdly, the tools and equipment of handwriting brushes are complicated, and beginners cannot control many procedures, such as dipping ink, stroke adjusting and paper pressing^[1]. So, what kind of pen is suitable for beginners? Due to physiological limitations, it'd be better for the beginners to use hard-tipped pens with an oblique angle. Among the hard-tipped pens, chalk and stone pens are the most suitable for beginners, which have three advantages: first, the characters written are clear; second, it is easy to demonstrate; third, it is convenient for correction. After a period, crayons and pencils can also be used^①. After the children have more experience in muscle control during handwriting, handwriting brushes and pens can be used. Therefore, it is a reasonable approximate sequence to start to learn handwriting brushes in the third grade and learn pens in the fourth grade. Why is it suggested to learn handwriting by fountain pens from the fourth grade? The first reason is the limitation of current society. Then, compared with other hard-tipped pens, fountain pens are more difficult. In addition, gel pens are easier to control than fountain pens because the characters written by gel pens are easy to dry (for fountain pens, attention should be paid to the tip of the pen, while gel pens have no such limitation). Gel pens are the most popular hard-tipped pen at present^[2]. From the perspective of social function, it is basically unnecessary to use fountain pens, so it is suggested that primary school students of middle and senior grades use gel pens in handwriting practice.

Newsprint is the recommend for handwriting practice with hard-tipped pen. Paper that is too thin, too smooth or too rough is not suitable. Brushed paper and bamboo paper with improved toughness should be used for handwriting practice with brush. In hard-tipped pen handwriting, notebook is commonly used. To avoid tearing by children, it is suggested to perform effective monitoring and comparison. The whole notebook should be numbered, and each page should have enough space for specific date, individual achievement and group achievement. On the back cover of the notebook, a handwriting scale and a progress curve table should be attached, so that children can mark their learning progress^[1].

Handwriting with brush should use ink, and students of senior grades may also try to grind ink by themselves. Beginners lack the experience of using ink in handwriting with brushes, so detailed instructions on the use of ink should be given in advance to avoid soiling and overturning. At present, some people also use water handwriting cloth, which is relatively clean. But it is not easy to preserve for comparison with later teaching. Thus, it can only be used as an assistant, rather than as a main exercise. Inkstone, like ink, is easy to get things dirty. So, it is suggested to pack it in a box or box, cover it when not in use, and wash it frequently. It should not have a too large volume^[1].

In addition, the handwriting with brush is also equipped with auxiliary tools such as felt, ruler and pen holder, which should be used under the guidance.

1.3 Teaching Aids for Handwriting Teaching

Teaching aids should be prepared before handwriting teaching, and those that cannot be purchased can also be replicated.

Basic exercise cards of strokes. For beginners, they may practice basic strokes with their wrists and fingers at first. For example, the teacher may make "jumping candle holder" card (Figure 1) and teach children to sing while drawing lines: first, candle holder; second, let everyone come; third, you jump over; and fourth, I jump over. Or the teacher may choose thick paper and engrave it into curved intaglio (Figure 2). When using, the teacher sings and practices: there is a little sparrow flying here, there, and then flying here and there^[1].

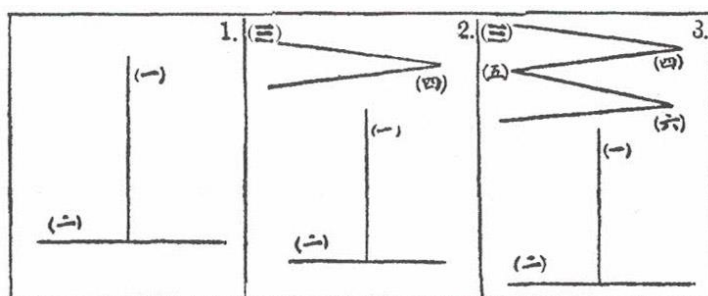


Figure 1. "jumping candle holder" card

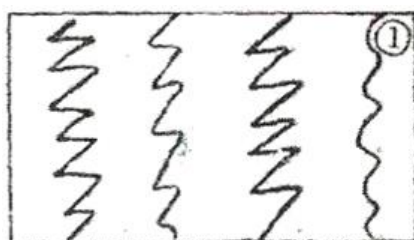


Figure 2. Intaglio line card

Basic stroke practice card. The teacher cut thick paper into square pieces, hollow out Chinese characters and mark the stroke direction (Figure 3), and guide students to draw and write with their fingers at the hollowed-out place. The students may also pad white paper under the practice piece and write with brush. The ink left can be compared with the practice piece.

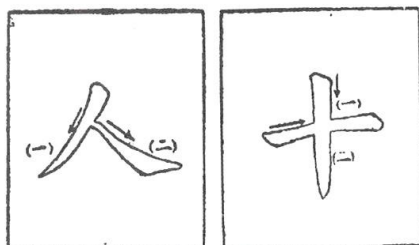


Figure 3 Basic stroke practice card

Typesetting card. The teacher cut paper into horizontal line, top-down vertical line, left-downward slope line, and short pausing stroke. The strokes of different sizes and lengths should be prepared, painted with enamel, and packed in a box. When using, the teacher guides students to typeset freely. At present, there are building blocks in the market, but most of them are radicals, so products of single strokes should be developed for beginners' typesetting practice^[1].

As for the teaching of stroke order, the sequential flash machine and moving stroke order cards were used in the past. At present, the animation video of stroke order can be used instead. In addition, you may also make the stroke order cards of the standard characters, such as the textbook of the standard characters. The teacher can indicate the number of classes or page numbers next to the characters and put them in a paper box for students to facsimile.

For students of middle and senior grades, it is advisable to make teaching aids such as pen use drawing and character structure table to guide practice and hang them in the classroom for observation and study. In addition, the pen holding posture drawing and handwriting posture drawing should be posted on the blackboard or hung in the classrooms of low, middle and senior grades.

1.4 Seat, Posture, Pen Holding and Pen Using

Handwriting seat and posture are related to children's physiological development and achievement progress, which cannot be ignored. A good seat is beneficial to cultivation of good posture. The seat must face the tabletop, and the distance between the seat and the desk should be suitable. It is advisable to straighten the trunk without bending, namely the so-called zero distance or negative distance^[1].

Posture involves the specific placement of body parts such as head, hands, chest, legs and feet. Zhu Zhixian mainly studies the pen holding of hard-tipped pens and handwriting brushes from aspects including finger application, pen tube placement, palm shape and wrist coordination, and puts forward a series of schemes^[1]. With regard to posture and pen holding method, it has been rationally utilized in

contemporary times, and will not be described here.

With regard to pen using, Zhu refers to the research results of G.H.Judd and F.N.Freeman. According to him, the writer mainly relies on the proper joint action of fingers and arms when handwriting and uses elbows and wrists only when moving^[1]. Handwriting requires the cooperation and complex movements of small muscles, so it is lack of scientific basis to advocate using only arm strength and wrist strength, such as hanging elbow or hanging wrist.

II. BASIC PROBLEMS OF HANDWRITING PRACTICE

2.1 The Age of Starting to Write

"Growth" and "learning" are two important factors for children to learn. Zhu Zhixian said: "No growth, no learning. Learning without growth is meaningless. And there will be no growth and progress without learning^[1]." Excellent educators will make an in-depth study of children's growth, so as to give appropriate guidance at the right time^[3]. Regarding the age at which the children can officially start practicing handwriting, Zhu pays attention to the flexibility of children's hands and fingers, and considers the movements of wrist, elbow and arm. By analyzing the experimental results of handwriting physiology by H.W.Nutt and referring to the experimental data of fingers, wrists, elbows and arms by Bryan and Pyle, it is concluded that children should learn to write formally from the age of seven, that is, the second grade of primary school^[1].

At present, the teaching of handwriting has been started in the Chinese class of the first grade of primary schools. It happens that the fingers of young children are sore or even deformed because of handwriting. How to deal with it? At this time, the "huikong" method (handwriting with hand in the air) and singing method, combined with a small amount of handwriting, can not only reduce handwriting fatigue, but also effectively help remember character patterns. In addition, the method of having many practices but little amount at each can be taken to promote the growth of hand muscles in learning, that is, "learning growth".

2.2 The Size and Style of Handwriting

For the size and style of handwriting used when learning to write, we should refer to two factors. One is how to control various fonts, and the other is the social function of fonts. The experimental results of Iwase Rokuro in Japan and Shen Baiying in China are basically the same: big characters are convenient for observation of inter-frame structure and thus are suitable for beginners with underdeveloped movement of small muscles. But it costs paper and has low social utility; compared with big characters, medium characters are more suitable for children's muscle activities, but their handwriting is slow, and their social utility is not as large as that of small characters; small characters are more efficient than big characters and medium characters. They can make children pay attention to the neat rows and columns and are economic with greater social utility. However, it is difficult to practice the inter-frame structure. Besides, due to their underdeveloped movement of small muscles, the beginners will easily get bored. Zhu referred to more

experimental results. Combined with the physiological and psychological laws of children's development, social functions and other factors, he put forward that it is appropriate to write medium characters at the beginning, and then gradually write more small characters. The specific practical scheme should be medium characters in grade one and grade two; big characters and small characters in the third and the fourth grades. At first, paying equal attention to both big characters and small characters, and then gradually focusing on small characters; in grade five and grade six, attention should be paid to small characters first and then big characters, followed by medium characters.^{[1]160-161} What needs to be clarified is that the handwriting practice of big characters is art-oriented and is conducive to improving the aesthetic judgment of the inter-frame structure, and the handwriting practice of small characters tend to be practical and makes preparation for improving handwriting efficiency in the future. Corresponding to the two handwriting teaching goals of "quickness" and "beauty", it is not difficult to find that the above suggestions and practical schemes are strategically advantageous.

However, at present, students of first and second grades in primary schools all use matts to write small characters. Because the bones and muscles of children aged six or seven are immature and the movements of small muscles are inflexible, handwriting of small characters is more likely to cause mistakes in pen holding, even damage to knuckles and change of sitting posture, and lead to a series of problems such as myopia.

2.3 The Methods and Principles of Practice

Handwriting practice is also a kind of mechanical work, and the writers are easy to get bored. Zhu Zhixian discussed the specific problems of handwriting practice, and the main points are as follows^[1].

1. Practice with motivation. Before practice, we should arouse a kind of motivation in terms of life activities of children. If there is motivation, such as applied decorations and documents, they will naturally have an interest in practice.

2. Attractive methods. If the practice methods can adhere to the five principles including, variable teaching materials, variable methods, variable instruments, appropriate practice distribution and reasonable competition, they will naturally be interested in practice^[4].

3. Appropriate allocation of practice. The practice time should not be too long, and 20 minutes of practice every day is enough. For students of lower grades, the practice time should be shortened.

4. Paying equal attention to speed and quality. When children learn to write, if they pay too much attention to speed, they will write carelessly and doodle all over the paper; if they pay too much attention to quality, they will write very slowly, and their character pattern will be extremely heavy. So, equal attention should be paid to both of them.

5. Paying attention to individual guidance. Because children's physiological development and past academic achievements are different, their handwriting ability and difficult points are also different.

Therefore, we should implement differentiated teaching and provide individual guidance for students during the break to improve their ability to solve difficulties.

6. Paying attention to cleanliness. To avoid hunchback, myopia and other physiological damage, we should choose appropriate light, correct bad handwriting habits, and pay attention to the neatness of stationeries.

7. Paying attention to the order when handwriting. We should instruct children to prepare pen, ink and other stationeries before class, and send and receive notebooks by transmission. In addition, it is forbidden to talk at will. Students should develop good habits such as tidying up scraps of paper, collecting stationeries and saving records of performance.

8. Eliminating obstacles in handwriting. Children should be kept focused on practice and never do other things, such as grinding ink and trimming tools.

9. Revealing excellent achievements. On the one hand, revealing excellent achievements is conducive to children's observation and arousing competition; on the other hand, it can motivate children with excellent achievements to work harder^[5].

10. Using more competition methods. The teacher can reveal the results of the competition in public places, encourage students by prizes, and calculate group scores to arouse children's sense of competition.

2.4 The Choice of Tracing, Imitation, Facsimile and Free Handwriting

Tracing, commonly known as tracing in black ink over characters printed in red, refers to that children trace directly on character die, which is strongly opposed by Zhu Zhixian. The reasons for his opposition are that children's attention is focused on "tracing" instead of "handwriting", and that tracing belongs to "external assistance method", which cannot meet the needs of social life^[1]. Why do most common copybooks still use tracing method? First of all, we must understand that the "external assistance method" is easy to take effect, which is in line with the consumer psychology. As a result, copybooks have a market. This is also an important reason why students write well in practice but return to their original forms when writing homework.

Copying is commonly known as "handwriting copying". It is to put the model under paper and imitate characters one by one. Similar to tracing, it also a kind of "external assistance method" in a sense. But it is better than tracing. At least, it pays attention to "handwriting". Imitation handwriting is helpful for grasping the shape of characters. Students can write directly with pencils and fountain pens, while brushes should not be used as far as possible in imitation^[6], otherwise the "handwriting" will be meaningless.

Facsimile is to put the copybook or template beside as a model and try to figure out the pen use and structure of characters while practicing on another piece of paper^[7]. Before learning skills, it is necessary to imitate first. Which imitation method is more valuable? Zhu cited the experimental data of four primary

schools at that time, and the results were that facsimile was better than other methods. As far as imitation is concerned, tracing and copying are more likely to cause dependence, while facsimile is closer to the needs of social life. For the handwriting brush, students can also use the "bone line method", that is, putting the copybook under the paper, tracing out the center (bone) line of the stroke, then put the copybook aside, and facsimile according to the trend and position of the bone line. This method has been commonly used in handwriting teaching in recent years. It not only helps to grasp the character pattern, but also achieves the purpose of "handwriting", thus bringing rapid improvement to students.

Free handwriting is to write freely, either for occasional interest or for certain purposes. The related opportunity, attitude, or method are all natural with considerable freedom. In terms of quality, free handwriting is inferior to copying and facsimile. But in terms of speed and interest, it is better than copying and facsimile.

Four principles can be concluded from Zhu Zhixian's viewpoints: "tracing red" is unavailable; "copying" needs transition; "facsimile" is of good quality; "free handwriting" is the fastest. So which method should we choose in practices? Zhu's suggestion is: free handwriting combined with "copying" is applicable to low level handwriting; the medium level handwriting pays attention to "facsimile" which can be combined with "copying" and "free handwriting"; for high level handwriting, equal attention should be paid to both "copying" and "free handwriting". To stimulate learning interest of students and give attention to quality, the handwriting of students of grade one and grade two focus on freedom with a small of assistance and restraint. For the handwriting of students of grade three and grade four, the focus has changed from "maintaining interest" to "pursuing quality", so priority is given to facsimile, with "external assistance" to improve quality and "free handwriting" to improve speed and maintain interest. The handwriting of students of grade five and grade six and sixth has changed from "pursuing quality" to "focusing on practicality". It pays attention to initiative and speed, ensuring quality with a small number of constraints in "handwriting" and requiring no external assistance^[1].

III. THE STUDY OF HANDWRITING TEACHING METHODS

3.1 The Advantages and Disadvantages of "External Assistance Method"

"External assistance method" is a kind of assisted learning method to give or instruct children for temporary convenience. Although this method can take effect within a short time, the dependence on it should be avoided, otherwise it will not be of any benefit, and will even become an obstacle in study and life.

1. About "hand-holding writing". "Hand-holding writing" is a kind of common external assistance method, which is to hold children's hands by hand and write characters one by one. Although Zhu Zhixian thinks it is better not to use this method, it is not completely useless. Oral explanation or demonstration alone is not easy for children who are just learning to write to understand the main points, which will cause great deviation in operation. Moreover, children will lose confidence and dislike handwriting because they cannot see the effect. Therefore, we can use the method of "hand-holding handwriting" to give effective

instructions, so that children can master the key points of controlling and using brawn. It should be noted that this is only a method of assistance. After children's experience and ability are slightly developed, the method should be stopped immediately. In addition, there are two cases where "hand-holding" is unnecessary. One is the children with handwriting genius, and the other is the children with strong self-awareness. Children who are gifted at handwriting can comprehend the meaning of characters and finish handwriting with high quality after the teacher's guidance and demonstration only. Children with strong self-awareness are unwilling to accept the constraint brought by "hand-holding" and may even get bored. The use of the "handle-holding" method depends on the situation^[1].

2. Handwriting grids. Some people think that using grids can help arrange strokes and reduce the difficulties of children who are new to handwriting. Some argue that the use of matts will increase the difficulty of operation and increase the pain of learning due to weak control of muscles by children. The fundamental purpose of learning to write is to be practical, while handwriting accounts, letters and application files do not use grids. According to the experiment of Zhejiang First Affiliated Primary School, Zhu Zhixian thinks that the grids is not consistent with real life, and even hinders the learning rate, so it is better not to use it. But children who are new to handwriting are easy to scribble, and the grids is not worthless.[8] The best way is to change "grid" to "line". Similar to "foreign manuscripts", the line is still binding, but it also gives a lot of freedom at the same time. Attention should also be paid to the color and thickness of the line. Old green, deep red, fire yellow and other colors are easy to glare. Light purple, light green, light blue and other colors which look pleasing to the eye can be applied. In addition, the line should not be too thick as well^[1]. At present, most of the hard-pen calligraphy exercise books use red lines, which are thick with deep color. As a result, the lines are dazzling when handwriting, and the written characters are not eye-catching, which should be adjusted in time.

3.2 The teaching Methods of Stroke Order

The difficulty of Chinese characters varies greatly. Beginners often don't know where to start strokes and where to end strokes, which leads to the problem of stroke order. Zhu Zhixian analyzed seven common teaching methods, and thought that the game method, the "huikong" method and the singing method were interesting and better methods, while the others were mostly inflexible and unsuitable for children^[1].

Game method. It is to use games to complete stroke order teaching, such as painting characters in sandbox, painting characters with colors, character blocks, etc. It is a game method to use typesetting tablets to form words in handwriting order.

Huikong method. It is to teach children to write by hand in the air in the order of strokes. This method is also helpful to the teaching of literacy.

Singing method. It is also a kind of game. The method is to sing the content with dynamic plot. It is combined with hand movements (write by hand in the air or handwriting) and is a very interesting teaching method. Zhao Yuren once wrote a set of songs matched with pictures, which is very helpful for children's practice. Excerpts are as follows:

Look! It's raining in the sky: Di, Li, Da, La, Di, Li, Da, La (sounds of rain) (practice of short pausing stroke).

This is a skating rink: he slides over, you slide over, and I slide over (practice of horizontal line).

This is a mountain, and everyone climbs up: climb up, climb down; climb up, climb down, climb, climb, climb (practice of left-downward slope line, and short pausing stroke)!

The above methods should not be used rigidly, and children should be guided to "draw inferences from others" and should be stopped after they have a general understanding of various strokes and sequences. Although there are many Chinese characters, there are several common principles of stroke order, such as top-down, left-right, outside-in, etc.[9] To lead children to understand the structure of Chinese characters, teachers should study the stroke order of Chinese characters in depth and summarize the rules constantly, which will help improve the efficiency of stroke order teaching.

3.3 The Teaching Process of Handwriting

Practice process is often used in handwriting teaching, while appreciation process is used in appreciation by students of senior grades. Construction process is used in planned applied handwriting activities^[1].

3.3.1. Precautions during application practice

(1) For methods planned for children, attention should be paid to: how to write, how to use ink, where to place the inkstone and keep the notebook, how to pay attention to the stroke order, how to maintain character structure well, and how to sit when writing; (2) Teachers should correct children's mistakes in a low voice when looking over and giving guidance. (3) Transfer method can be used to collect and distribute notebooks to avoid disorder; (4) When children tidy up their notebooks and stationeries, they should be instructed to pay attention to cleanliness; (5) After distributing the homework book, the children should be reminded of the shortcomings of the last homework.

3.3.2. Precautions in the appreciation process

(1) Posting and hanging famous inscriptions and words to arouse children's motivation to appreciate; (2) When appreciating on the spot, the teacher should lead the children to analyze and study the essence of pen use, structure, composition form and ink use method, so as to arouse children's interest in the wonderful points of characters, deepen their understanding of powerful and aged strokes, and form a deep impression on model works; (3) When guiding children to imitate the model characters, the teacher should intentionally or unintentionally imitate the structure and form of the model characters with fingers or pens to guide students to appreciate the meaning of characters.

3.3.3. Precautions in the construction process

(1) There must be a construction environment first, such as a natural construction environment for handwriting assembly slogans and flags, and teachers can also make a construction environment according to circumstances; (2) When planning the construction method, special attention should be paid to the construction format, tools, demonstration and explanation; (3) During patrol guidance, it is necessary to correct the delay at any time. (4) After the construction is completed, the notebooks of students should be collected for correction, and then sent back to children for further practice; (5) All achievements of designed construction should be practically applicable, such as marks on cleaning tools and class slogans.

3.4 Performance Correction and Assessment

The correction and assessment of handwriting performance can be divided into three aspects: correctness, speed, and quality. When giving scores, teachers can only recognize correctness and quality^[10]. In case of wrongly written characters, they should be marked to urge students to correct them. If students are found to have common wrongly written characters, the teacher can also collect them and compile them into teaching materials for students to practice. It is necessary to combine "handwriting" with "reading", such as dictation practice, handwriting while reading, etc^[11].

To evaluate the speed of handwriting, the number of words written at the same time is calculated in general. And several problems should be concerned: (1) before handwriting, the tools should be prepared properly, and the words should be carefully read for several minutes; (2) The written content has been read but not practiced; (3) Do not teach students how to write; (4) students of higher grades can copy texts directly^[11].

Handwriting scale should be used to check the quality. The performance of writing each time should be compared to the scale for degree, and the degree should be marked on the performance schedule, which can be used to calculate the average degree or draw a progress graph according to the progress and regression^[11]. To make comparison among students, a handwriting schedule can be made for a certain grade or a certain class to analyze the progress and regression as a whole. Primary schools that do not have a handwriting schedule can also set standards for marking grades for application. For example, we may use “○○○” for characters with both good inter-frame structure and strokes, and use “×” for characters with bad inter-frame and strokes. We may also mark “○○○” on the right of the character or on the stroke for good strokes, and mark “/” for bad strokes.

IV. CONCLUSION

Handwriting teaching is an important part of Chinese teaching in primary schools, aiming at cultivating students' handwriting application ability and aesthetic judgment. Zhu Zhixian quoted a large number of experimental data, carried out a detailed and objective analysis, made clear the basic problems such as handwriting age, size and style of writing, training time and specific methods, and analyzed and studied the effective teaching methods such as external assistance method, stroke order teaching method, teaching

process and performance correction. Many significant viewpoints are put forward. They are of some reference value and have important guiding significance for correcting wrong handwriting teaching methods and innovating teaching ideas.

COMMENTS

① At present, most pencils used by primary school students are hard. Although handwriting with pencil is clean, it is not black enough and not easy to write characters clearly. Most children press hard, which easily leads to distorted holding of pens and even deformation of joints. It is recommended to use 2B and V pencils with moderate hardness and blackness.

② Experimental results: when children learn to write, they often use their fingers, and only when they are 12 or 13 years old do they start to use their arms to help their fingers move.

③ Bryan's experimental results: When children are five or six years old, their muscles of fingers, wrists, elbows and arms are not very developed; when they are seven to ten years old, they grow rapidly, especially the fingers. The percentage of rate increase at the age of four is 29.28% for fingers, 23.91% for wrist, 19.57% for elbow and 14.14% for arm. Pyle's experimental conclusion: When children are six or seven years old, the muscles of their hands are not well developed. But from seven to eleven years old, their muscles develop rapidly, and increase by 32.14% in four years.

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