Supplementary material:

Handwriting evaluation in general:

Name of the instrument	Age	Scoring method	Script	Criteria	Application
Chinese Handwriting Evaluation Form (CHEF; Chang & Yu, 2012)	Grades 1-2	A 5-point Likert scale (1: never matching to 5: always matching)	Chinese characters	1. Construction: size, spacing, and alignment of characters and components 2. Accuracy: the malformation of characters, i.e., incorrect figuration of components, adding or missing strokes 3. Speed 4. Pencil grasp 5. Directionality	Shin et al., 2018
Chinese Handwriting Evaluation Questionnaire (CHEQ; Chang & Yu, 2005)	Grade 2	Unspecified	Chinese characters	1. Legibility 2. Accuracy 3. Speed 4. Pencil grip 5. Gross movement 6. Attitude	Chang & Yu, 2005
The Tseng Handwriting Problem Checklist (THPC; Tseng, 1993)	Grades 1-4	A 4-point scale, ranging from 1 = always to 4 = seldom	Chinese characters	1. Construction 2. Accuracy [1&2 reflect measures of legibility] 3. Behavior 4. Sequencing 5. Motor 6. Directionality	Shen et al., 2012

The Handwriting Legibility Scale (HLS; Barnett et al., 2013, 2018)	Children aged 8-14	A scale from 1-5, with 1 representing the best performance	Alphabet	1. Global legibility (overall readability of the text on first reading) 2. Layout on the page 3. Letter formation 4. Effort to read the script 5. Alterations to writing (attempts made to rectify written work)	Prunty et al., 2016
The Handwriting Proficiency Screening Questionnaire (HPSQ; Rosenblum, 2008)	Grades 2-8	A 5-point scale (0 refers to never and 4 refers to always)	Alphabet	1. Unreadable handwriting 2. Unsuccessful in reading his/her own handwriting 3. A lack of time to copy 4. Often erases 5. Does not want to write 6. Does not do homework 7. Complains about pain 8. Tired while writing 9. Needs to look often when copying 10. Not satisfied with his/her handwriting Among them, items 3 through 9 represents the factor of 'performance time and well-being', whereas items 1, 2, and 10 denotes 'legibility' factor.	Rosenblum, 2008
Detailed Assessment of Speed of Handwriting (DASH test; Barnett et al., 2007)	Aged 9-16	To calculate the writing speed, the total of legible words divided by the	Alphabet	The quality and speed of writing under different conditions including copying and generating text.	Barnett et al., 2007

		time of the test is counted. The legible letters are counted and in the correct sequence. In task “graphic speed”, the speed is counted by the correct number of “X” inside the circles.			

Computerized handwriting evaluation:

Name of the instrument	Age	Scoring method	Script	Criteria	Application
The Chinese Handwriting Assessment Tool (CHAT; Li-Tsang et al., 2011, 2013)	Grades 1-6	Computerized real-time recording	Chinese characters	1. Accuracy: no. of correctly written characters/90 characters 2. Speed: no. of characters copied per min, pause time to on-paper time ratio 3. Pressure: mean pen pressure and variability 4. No. of characters exceeded grid 5. Average size of characters (mm)	Cheng-Lai et al., 2013; Lam et al., 2011

				6. Variability (SD) of character size (mm)	
The Smart Handwriting Analysis and Recognition Platform (SHARP; Li-Tsang et al., 2022)	Grades 1-6	Computerized real-time recording	Chinese characters	1. Handwriting process (ground time, air time, air/ground time ratio, speed, SD of writing time per character, pen pressure, SD of pressure); 2. Handwriting product (out of grid, size, SD of size, identified words, wrong stroke, additional stroke, missing stroke, concatenated stroke, reverse stroke, wrong stroke sequence)	Li-Tsang et al., 2022
The Computerized Legibility Assessment (CLA; Lee et al., 2016)	Grades 1-6	Computerized real-time recording	Chinese characters	1. Length of every stroke 2. Orientation of every stroke 3. Placement of every stroke 4. Task completion time 5. Stroke velocity 6. Stroke force 7. Pause time per stroke	Lee et al., 2016
Computerized apparatus and handwriting task (Shen et al., 2012)	Grades 1-4	Computerized real-time recording	Chinese characters	The positions, sequence of strokes, and pressure of writing: 1. Total writing time 2. Total in-air time 3. Total on-paper time, which is the length of time the pen touches paper 4. In-air trajectory 5. Speed (cm/s): the length of distance when pen touches paper 6. Axial pen pressure 7. Average character width 8. Average character height	Shen et al., 2012

Name Writing Task (Taverna et al., 2020)	Grade 1	Computerized real-time recording	Alphabet	1. Speed/Frequency of strokes: frequency of upward and downward movements in 1 s 2. Stroke pressure 3. Automaticity: no. of inversion of velocity	Taverna et al., 2020
Handwriting Tasks (Wicki et al., 2014)	Grade 4	Computerized real-time recording	(Swiss-German) Alphabet	1. Speed/Stroke frequency: no. of upward and downward movements in 1 s 2. Stroke pressure 3. Automaticity: no. of inversion of velocity	Wicki et al., 2014
The Computerized Penmanship Evaluation Tool (POET; Rosenblum et al., 2003)	Children aged 8-9	Computerized real-time recording	Alphabet	1. Spatial measure: the total path length on the paper of all the characters written in the paragraph 2. Temporal measure: the time taken to write each segment, the total time taken to complete the entire paragraph, on-paper time, and in-air time 3. Pressure measure: the mean pressure applied to the paper	Mekyska et al., 2017
A digital diagnostic tool (Pagliarini et al., 2017)	Grade 1-5	Computerized real-time recording	Alphabet	Kinematics and trajectory of handwriting	Pagliarini et al., 2017
A digital diagnostic tool (Mekyska et al., 2017)	Grade 3 (aged 8 and 9)	Computerized real-time recording	Alphabet	1. Kinematic Measures (speed, velocity, acceleration, jerk, normalized jerk, height, orientation, duration, and length) 2. Nonlinear dynamic features 3. Other Features	Mekyska et al., 2017
A digital diagnostic tool (Asselborn et al., 2018)	Children	Computerized real-time recording	Alphabet (Latin)	1. The geometrical aspect of handwriting, 2. The use of pressure, tilt, and kinematics.	Asselborn et al., 2018

A digital diagnostic tool (Gargot et al., 2020)	Children	Computerized real-time recording	Alphabet	1. Static characteristics (purely geometrical characteristics of the handwriting text: space between words, SD of handwriting density, and median of power spectral of tremor frequencies); 2. Kinematic features (dynamics of the handwriting process: median of power spectral of speed frequencies, distance to mean of speed frequencies, in-air-time ratio); 3. Pressure features (pressure measured between the pen tip and the tablet surface: average pressure, mean speed of pressure change, SD of speed of pressure change); 4. Tile features (tilt between the pen and the surface of the tablet: distance to mean of tilt-x frequencies, the bandwidth of speed of tilt-x frequencies, median of power spectral of tilt-y frequencies).	Gargot et al., 2020

Handwriting legibility evaluation:

Name of the instrument	Age	Scoring method	Script	Criteria	Application
Scale (authors)	Adaptive ages	Rating method	Script type	Criteria and indicators	Research application
The Persian Handwriting Assessment Tool (PHAT; Havaei et al., 2017)	Grades 2-3	A 5-point scale, ranging from very poor to very good	(Tajik) alphabet	1. Formation 2. Space 3. Alignment 4. Size 5. Text slant	Farhangnia et al., 2020; Seyyedrezaei et al., 2021

The Minnesota Handwriting Assessment (MHA, Reisman, 2004)	Children aged 7-12	One point for each correct letter following specified criteria	Alphabet	1. Legibility 2. Spacing 3. Alignment 4. Size 5. Form	Bo et al., 2014; Bumin & Kavak, 2010
The Scale of Children's Readiness In PrinTing (SCRIPT; Weil & Cunningham Amundson, 1994)	Kindergarten	One point for each correct letter following specified criteria	Alphabet	Correct: 1. The letter is recognizable and legible. 2. All parts of the letter are complete, e.g., i must be dotted; f and t must be crossed; m, u, r, d and similar letters (h, b, p, n) all contain the straight line and not just curves (d looking like a reversed 6 is counted as incorrect); g, q, and/must have curves on descenders and ascenders; n, m, and w need to be proportionate to 1/4 in. of the body of the letter's length. 3. The letter is proportionate in size (parts, body). Incorrect: 1. The letter is reversed (typically b, d, p. q). 2. The letter is rotated more than 45° from proper orientation. 3 An uppercase letter is substituted for a lowercase letter or vice versa. 4. The letter contains additional parts (e.g., an m contains more than two humps). 5. The letter is not printed within the box below	Daly et al., 2003; Desai & Rege, 2004

				the model letter. 6. The letter is in two or more distinct parts. A break in a line of less than 1/16 in. is permitted. 7. In the letters a, b, d, m, n, p, q, and r, the straight line extends more than 1/4 in below or above the body of the letter or is not proportionate.	
The Hebrew Handwriting Evaluation (HHE; Erez et al., 1996)	Grades 1-4	A scale from 1-4, with 1 representing the best performance	Alphabet (Hebrew)	1. Legibility: global legibility, letter formation [e.g., closure, reversals] 2. Spatial arrangement/organization [e.g., consistency, spacing--absence of gaps or overlaps of letters/words, letter size, alignment, margins, and straight lines] 3. Direction: writing letters in the appropriate direction 4. Speed 5. Posture [e.g., positioning of the paper and stability of head and neck]	Gilboa et al., 2010, 2014; Parush et al., 2010; Preminger et al., 2004; Rosenblum, 2008; Yochman & Parush, 1998
The Handwriting Evaluation Scale (Malloy-Miller, 1985)	Grade1 1-6	Percentage of errors versus total number of letters printed or written	Alphabet	1. Spacing within words (overlapping letters or letters too far apart) 2. Spacing between words (too little, too much or no space between words) 3. Size of letters within words (whole or part of letter is too big or too small) 4. Size between words (some words are small and some words are big)	Malloy-Miller, 1985

				5. Baseline orientation (letters overshoot or undershoot the baseline) 6. Closure (improper closure of letter parts) 7. Line quality (curves are angular or straight lines are wavy	
The Concise Assessment Scale for Children's Handwriting (BHK; Hamstra-Bletz et al., 1987); The revised version: the Dutch tool Systematic Screening of Handwriting (Dutch: 'Systematische Opsporing van Schrijfmotorische Stoornissen', i.e., SOS; Van Waelvelde et al., 2009, 2012)	Grades 2-3	An ordinal scale from 0 to 5, a high score indicating deviance	Alphabet	1. Letter size too large for the child's age 2. Left margin widening 3. Poor word alignment 4. Insufficient word spacing 5. Acute turns in connecting letters 6. Irregularities in joining letters 7. Collision of letters 8. Inconsistent letter size 9. Incorrect relative height 10. Odd letters 11. Ambiguous letter forms 12. Correction of letter forms 13. Unsteady writing trace	Duiser et al., 2014; Hellinckx et al., 2013; Kaiser et al., 2009; Overvelde & Hulstijn, et al., 2011; van Hartingsveldt et al., 2015; Volman et al., 2006
The Tseng Handwriting Problem Checklist (Tseng, 1993)	Grades 4-5	A 3-point Likert scale (0 = most legible, 2 = least legible)	Chinese characters	1. Square configuration (i.e., out of grid) 2. Number of strokes (i.e., superfluous/missing strokes) 3. Spatial relationship (i.e., incorrect position of components, poor alignment of characters)	Linda et al., 2014

				4. Spacing and size (i.e., disproportional spacing and size between components of a character) 5. Word formation (i.e., malformation of components)	
The Evaluation Tool of Children's Handwriting-Manuscript (ETCH-M; Amundson, 1995)	Grades 1-2	Illegible words/letters/numerals are counted and converted to a word/letter/numeral percentage; total ETCH-M word, letter, numeral legibility scores are obtained and expressed as total legibility percentages.	Alphabet (and numerals)	1. Letter formation 2. Size 3. Horizontal alignment 4. Spacing 5. Letter case 6. Speed	Amundson, 1995
Self-developed handwriting evaluation 1 (Klein et al., 2011)	Grades 3-6	The number of errors made	Alphabet	1. Letter formation 2. Size 3. Spacing 4. Alignment 5. Slant 6. Order 7. Reversals 8. Omissions 9. Insertions 10. Tremulous/jerky lines 11. Margin widening and/or narrowing	Klein et al., 2011

				12. Pressure	
Self-developed handwriting evaluation 2 (Maeland, 1992)	Grade 4	A 7-point scale	Alphabet	1. Accuracy of letter formation 2. Uniformity of letter size 3. Uniformity of letter slope 4. Spacing between letters and words 5. Alignment of the lines of writing	Maeland, 1992
Self-developed handwriting evaluation 3 (Tseng, 1994)	Grades 3-5	A 7-point scale	Chinese characters	Global legibility sorting	Tseng, 1994
Self-developed handwriting evaluation 4 (Jameel et al., 2017)	Grades 4-5	A 5-point scale, with 1 to 5 being given to poor and excellent legible handwriting	Alphabet	1. Readability 2. Margin 3. Similarity 4. Line 5. Space 6. Size 7. Shape 8. Slant 9. Roundness 10. Alignment 11. Recognition	Jameel et al., 2017

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