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Exploring Content Validity of Shore Handwriting Screening and Newly Developed Score Sheet With Pre-Kindergarten Students

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Exploring Content Validity of Shore Handwriting Screening and Newly Developed Score Sheet With Pre-Kindergarten Students

Abstract

Background: Limited tools exist to measure handwriting readiness skills of pre-kindergarten students. This study was a preliminary exploration of content validity of the Shore Handwriting Screening (SHS) and the newly developed Score Sheet with the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2) in 4- and 5-year-old pre-kindergarten students. Because socioeconomic status (SES) is known to impact handwriting skills, data from two different socioeconomic groups were collected.

Method: Students from a Lower SES group (n = 36) and a Higher SES group (n = 14) completed the SHS and fine motor composite of the BOT-2. Pearson's correlation was used to compare scores on the two assessments within the two groups.

Results: SHS overall percentage scores were compared to standard scores and composite scores of the BOT-2. SHS scores displayed moderate to high correlation with fine manual control portions of the BOT-2 for the Lower SES group and low to moderate correlation for the same portion in the Higher SES group.

Conclusion: SHS and the Score Sheet correlate to fine and visual-motor skill subtests on the fine manual control portions of the BOT-2, which supports the need for further research on the reliability and validity of the Score Sheet for use in practice.

Keywords

handwriting, pre-kindergarten students, content validity, assessment

Credentials Display

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Background

Successful handwriting requires a seamless integration of cognition, fine motor control, in-hand manipulation, visual-motor integration, motor planning, visual perception, and sustained attention (Feder & Majnemer, 2007; Rosenblum, Weiss, & Parush, 2003). Handwriting skills begin developing during the pre-school years with universal characteristics that all written languages share. The universal characteristics are demonstrated through abstract writings that include straight lines separated by spaces. Writing then progresses to more language-specific features (Puranik & Lonigan, 2009).

Handwriting Readiness

Handwriting itself is an important task that facilitates improved occupational performance in the educational context. Medwell and Wray (2007) assert that "handwriting, and in particular the automaticity of letter production, appears to facilitate higher-order composing processes by freeing up working memory to deal with the complex tasks of planning, organising, revising and regulating the production of text" (p. 14). A basic level of handwriting competence is required before a child can compose written work that can be read and understood by a wider audience (Dunsmuir & Blatchford, 2004). When students are in kindergarten, their handwriting and spelling skills have been shown to make statistically significant contributions to composing written work (Puranik & AlOtaiba, 2012), which displays the importance of early handwriting skills, even before students enter kindergarten.

Handwriting has also been identified as a contributor to letter recognition for pre-kindergarten students. The process of handwriting involves a visual-motor experience that may strengthen the neural systems used for letter recognition (James, 2010), emphasizing the usefulness of handwriting to learn letters during pre-kindergarten years.

It is evident that handwriting skills have been linked to composition ability and can aid in enhanced letter recognition, thus having an important impact on education. Early identification and attention to students' needs may significantly reduce delayed development (High, 2008); therefore, it is important that students are adequately prepared for kindergarten and that early identification and intervention of handwriting problems be provided.

Components of Handwriting

Since handwriting requires a combination of skills, it is beneficial to see what mechanisms work together to predict handwriting quality in students with and without handwriting difficulties. Several handwriting performance skills have been identified that should be mastered before a child can be successful at handwriting. Prerequisites for handwriting include the ability to cross midline, recognize letters of the alphabet, demonstrate established hand dominance, use functional pencil grasp, copy geometric shapes, use hand-eye coordination, and demonstrate proper sitting posture (Feder & Majnemer, 2007; Marr, Windsor, & Cermak, 2001; Rosenblum et al., 2003). Viewing these prerequisite skills through the International Classification of Function – Children and Youth

version (ICF-CY) can help categorize these skills for measurement and comparison (World Health Organization [WHO], 2007). Helping students master these skills in pre-kindergarten, teaching them developmentally appropriate handwriting skills early, and consulting with teachers are ways occupational therapists can help better prepare children for elementary school.

Research indicates that fine motor skill deficits contribute to handwriting challenges (Cornhill & Case-Smith, 1996; Smits-Engelsman, Niemeijer, & van Galen, 2001). In addition, children who had difficulty with handwriting skills and had slow performance were found to have visual-motor integration challenges (Tseng & Chow, 2000; Volman, van Schendel, & Jongmans, 2006). The fine motor skills of children are often measured by occupational therapists with the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2; Bruininks & Bruininks, 2005), the Peabody Developmental Motor Scales, Second Edition (PDMS-2; Folio & Fewell, 2000), or the Miller Function and Participation Scales (M-FUN; Miller, 2006).

Other studies found a strong relationship between visual-motor integration and letter copying ability (Daly, Kelley, & Krauss, 2003). Kaiser, Albaret, and Doudin (2009) found that hand-eye coordination, associated with visual-motor integration, is the best predictor of quality of handwriting. Visual-motor skills have also been found to be important to handwriting readiness in kindergarten students (Marr et al., 2001). Research provides strong evidence that visual-motor integration and motor skills are important in handwriting. The Beery-Buktenica Developmental Test of Visual-Motor Integration (VMI; Beery & Beery, 2010) can be used in addition to the assessments identified above by pediatric occupational therapists to evaluate the visual-motor skills of children.

Assessing Handwriting Skills

When evaluating a student's handwriting skills, it is important to observe the student in the classroom, consult with the student's teacher, and use a valid and reliable standardized tool (Feder & Majnemer, 2003; Feder & Majnemer, 2007). Through a research review, it is evident that adequate handwriting skills are needed for students to fully succeed in school. From the research, a difference of handwriting skills is expected across varying socioeconomic status (SES) groups (Bowman & Wallace, 1990).

Van Hartingsveldt, De Groot, Aarts, and Nijhuis-Van Der Sanden (2011) completed a systematic review of standardized handwriting readiness assessments. The 12 tools in this review are varied in the types of tasks that they require as well as the psychometric properties. Very few of the tools included the paper-and-pencil tasks that are important to observe when assessing handwriting skills as well as fine motor and visual-motor coordination skills, which have been determined to be primary components of

handwriting (Cornhill & Case-Smith, 1996; Daly et al., 2003; Smits-Engelsman et al., 2001; Van Hartingsveldt et al., 2011).

Current handwriting evaluations commonly used by occupational therapists include the Evaluation Tool of Children's Handwriting (Amundson, 1995), the Print Tool (Olsen & Knapton, 2006), the Test of Handwriting Skills-Revised (Milone, 2007), and the Minnesota Handwriting Assessment (Reisman, 1999). None of these tools are designed for use with children under 6 years of age. A standardized way of measuring pre-kindergarten students' early handwriting skills is lacking (Van Hartingsveldt et al., 2011).

Occupational therapy practitioners in schools spend a large amount of time addressing the handwriting skills of students (Asher, 2006); therefore, a standardized handwriting assessment has the potential to greatly benefit occupational therapists and the students that they are serving because it provides a consistent and unified way of assessing students' handwriting skills. However, there is currently no standardized handwriting assessment available for occupational therapists to assess the pre-kindergarten-age student. Establishing a standardized handwriting assessment to assess young writers is important because occupational therapists should be using valid tools in practice to indicate accurate ability and progress (Feder & Majnemer, 2003; Feder, Majnemer, & Synnes, 2000; Van Hartingsveldt et al., 2011) and to identify students with deficits as early as possible (Engel-Yeger, Nagauker-Yanuv, & Rosenblum, 2009; High, 2008).

A handwriting screening tool, the Shore Handwriting Screening for Early Handwriting Development (SHS; Shore, 2003), was designed for use with children aged 3 to 6 years and older. An occupational therapist designed this tool to identify concerns in handwriting readiness skills. However, since this is a screening tool, there are no scoring criteria. This study explored the use of the SHS and a newly developed Score Sheet to examine the potential for the SHS to become a valid measure for handwriting readiness skills of pre-kindergarten students. Examining the content validity of the SHS was accomplished by comparing 4- and 5-year-old pre-kindergarten students' scores on the SHS using the Score Sheet to their scores on a standardized fine motor assessment measure, the BOT-2 (Bruininks & Bruininks, 2005). Because the SHS includes paper-and-pencil tasks, fine motor tasks, and visual-motor tasks, the researchers felt it was important to compare it to a standardized assessment that also incorporated all three components. Based on the systematic review, the BOT-2 meets these criteria (Van Hartingsveldt et al., 2011).

Upon closer examination of the chosen assessments using the ICF-CY framework (WHO, 2007), the specific activities on the SHS and BOT-2 fall under similar criteria. Body structures are used to complete each activity but are not measured directly by either assessment. Body functions and

criteria from the activities and participation category are measured through items on the Score Sheet for the SHS and the BOT-2 and will be discussed in the Methods section. However, activities are the primary skills measured with both of these tools, not participation, which is performance in the naturalistic life situation. Occupational therapists can use the SHS to identify body function, structure, and activity challenges for pre-kindergarten-aged students related to handwriting tasks. Since handwriting skills have been shown to be different across SES, data was collected from two different SES. The purpose of this study was to determine the answer to the research question below.

- Is there a relationship between 4- to 5-year-old pre-kindergarten students' scores on the Score Sheet for the SHS and the Fine Manual Control and Manual Coordination portions of the BOT-2?

Method

Design

This correlational study used a quantitative design to compare students' scores on the SHS to their scores on four fine-motor related subtests of the BOT-2. This design was selected because it allowed an investigation of handwriting skills across SES groups. Although random assignment was not possible, this research design allowed the students to be tested in their naturalistic school environment.

Subjects

For participation in this study, subjects were selected from two convenience samples; therefore, non-probability sampling was used. These two samples include a Higher SES group and a Lower SES group of students. Within the Lower SES group, there were data available from 47 possible students from two federally funded pre-kindergarten classrooms in rural Eastern North Carolina (families were at or below the federal poverty line). The data were collected for a different study in the fall of 2010. Eleven students were excluded from the Lower SES group: students under the age of 48 months (n = 8), students who did not complete the SHS (n = 2), and one student who was an outlier. The remaining 36 students were in the Lower SES group.

The Higher SES group came from a sample of 16 students from a private pre-kindergarten classroom in Eastern North Carolina (families paid over $6,000 per year in tuition), who were recruited specifically for this study. The Higher SES data were collected fall 2012 and only excluded two students because parental consent was not received, resulting in 14 participants.

Students from both groups were similar in age. The Lower SES group students ranged from 48 months to 60 months in age, with an average age of 54.5 months (n = 36; SD = 3.98), and the Higher SES group students were 50 to 60 months in age, with an average age of 54.9 months (n = 14; SD = 4.01). There were 19 female (53%) and 17 male

(47%) participants from the Lower SES group and eight female (57%) and six male (43%) participants in the Higher SES group.

Instrumentation

Shore Handwriting Screening. The SHS is a non-standardized, checklist-style screening tool that requires observation of a student completing tasks related to handwriting (Shore, 2003). The SHS has not been previously tested for validity and reliability and, as published, it has no quantitative scoring method. The SHS requires the administrator to observe and score a combination of body functions as well as activities and participation. Although the body function and structures are required in the execution of the activities and participation skills, it is primarily the performance of the activities that is quantified by the Score Sheet. While many of the items on the SHS are classified by the ICF-CY (WHO, 2007) as activities, a few body functions are also included. However, many of these activities are direct replicas of activities that may be done in a preschool classroom. The SHS includes two options based on age: one set of directions and forms with tasks for 3- to 5-year-olds and one set of directions and forms with tasks for students who are aged 6 years and older (Shore, 2003). The coloring and cutting activities are the same for both age groups. The option for 3- to 5-year-olds was used for this study.

A Score Sheet was created to assign a numerical value to a student's handwriting-related tasks to quantify performance for the body function and activity components and allow for comparison and progress monitoring. The Score Sheet has not been tested to determine appropriate age-level cut scores at this time. The student may score between zero and four points on most of the handwriting-related tasks, with a maximum possible score of 47. The student's total raw score is divided by 47 to generate an overall percentage score. The more advanced a student's handwriting skills are, the higher the score will be. Reliability of the Score Sheet has not been established and is planned for a future study. The definitions of the scoring criteria on the Score Sheet were determined and reviewed by two experienced pediatric occupational therapists but have not yet been made available for larger review. The scored items are listed in Table 1.

Bruininks-Oseretsky Test of Motor Proficiency, Second Edition. The BOT-2 is a standardized tool used to evaluate motor performance, which also requires the use of body structures, but the measurement outcomes are based on body functions and activities. Subtests of the BOT-2 include multiple readiness skills related to both fine and visual-motor skills that are important for handwriting and are paralleled in the SHS. The complete BOT-2 measures four composite skills, including fine manual control, manual coordination, body coordination, and strength and agility (Bruininks & Bruininks, 2005). This study used two of the four composites: Fine Manual Control (which includes Fine Motor Precision and Fine

Table 1

ICF-CY Classification of Assessment Activities

ICF-CY Classification	Assessment Activity	
	SHS	BOT-2
1. *Body Functions*		
Memory (b1442)	Draw a Person	None
Manual dominance (b1473)	Hand Dominance	None
Visual perception (b1561)	Copying Four Shapes Draw a Person Copy a Word Color a Balloon	Copying Eight Shapes+ Filling in Shapes* Drawing Lines through Paths* Connecting Dots* Folding Paper*
2. *Activities and Participation*		
Maintaining a sitting position (d4153)	Postural Control	None
Acquiring skills to use writing implements (d1450)	Coloring a Balloon Hand Control Copying Four Shapes	Filling in Shapes* Drawing Lines through Paths* Copying Eight Shapes+ Connecting Dots* Making Dots in Circles-
Maintaining a body position, unspecified (d4159)	Non-Dominant Hand Use	None
Grasping (d4401)	Hand Control	Transferring Pennies- Placing Pegs into Pegboard- Sorting Cards- Stringing Blocks-
Manipulating (d4402)	Rotating Pencil	Transferring Pennies- Placing Pegs into Pegboard- Sorting Cards- Stringing Beads-
Releasing (d4403)	Rotating Pencil	Transferring Pennies- Placing Pegs into Pegboard- Sorting Cards- Stringing Beads-
Copying (d130)	Vertical Lines Copying Four Shapes Copying a Word	Copying Eight Shapes+
Fine hand use, unspecified (d4409)	Coloring a Balloon Cutting a Square	Filling in Shapes* Cutting a Circle*
Reaching (d4452)	None	Dribbling a Ball~
Throwing (d4454)	None	Throwing a Ball at a Target~
Catching (d4455)	None	Dropping and Catching a Ball~ Catching a Tossed Ball~

Note. *Fine Motor Precision subtest; + Fine Motor Integration subtest; - Manual Dexterity subtest; ~ Upper-Limb Coordination subtest.

Motor Integration), and Manual Coordination (which consists of Manual Dexterity and Upper-Limb Coordination). A side-by-side comparison between the components measured on the SHS and the BOT-2 as identified by ICF-CY classification is listed in Table 1. Specific subtests in which the items are included on the BOT-2 are indicated in the notation at the bottom of the table.

It was expected that students' scores on the SHS would correlate with three out of four subtests of the BOT-2 (Fine Motor Precision, Fine Motor Integration, and Manual Dexterity) because these subtests measure skills that have been shown to be important aspects of handwriting and also parallel the activities of the SHS as shown in Table 1. These skills include visual-motor integration as well as students' ability to control specific finger, hand, and arm movements (Daly et al., 2003; Kaiser et al., 2009; Marr et al., 2001; Tseng & Chow, 2000; Volman et al., 2006). It was expected that the SHS would not strongly correlate with the Upper-Limb Coordination subtest as this subtest requires more gross motor movements, which are not included in the SHS as shown in Table 1.

The BOT-2 has shown evidence of reliability and validity. It shows excellent internal consistency ($\alpha \geq .93$) for the Total Motor Composite for all age groups, test-retest reliability ($r \geq .80$ for Total Motor Composite and Short Form and $r = .99$ for ages 4 to 12) and inter-rater reliability ($r > .90$ for all subtests except for Fine Motor Precision, $r = .86$). The BOT-2 has also been shown to have valid test content, internal structure, and can differentiate between clinical groups and non-clinical groups (Bruininks & Bruininks, 2005; Wuang & Chwen-Yng, 2009).

The BOT-2 also displays a moderate relationship with the previous version of the BOT-2, the Bruininks-Oseretsky Test of Motor Proficiency ($r = .60$) for the fine motor composites, moderate to strong correlations with the Peabody Developmental Motor Scales, Second Edition ($r = .51$ to $r = .75$), and a correlation of $r = .74$ to the Test of Visual-Motor Skills-Revised for the Visual-Motor Skills composite (Bruininks & Bruininks, 2005).

Further review of the BOT-2 found that it exhibits construct validity and its norms reflect the demographics of the United States (Deitz, Kartin, & Kopp, 2007). A systematic review of 12 standardized tests concluded that the BOT-2, along with one other assessment, had the best results on psychometric properties and that the fine motor portion of the BOT-2 should be part of an evaluation of writing readiness (Van Hartingsveldt et al., 2011).

Procedure

This study was conducted under procedures approved by the university's Institutional Review Board, including parental consent and random number assignment to protect confidentiality. There were no ethical concerns identified with this study. The test administrators were occupational therapy students who received training in the administration of the SHS and BOT-2 prior to data collection. The Lower SES group data sets were collected in the fall of 2010 by occupational therapy student researchers and were approved for use in

this study. Different occupational therapy student researchers collected the Higher SES group data in the fall of 2012. The SHS and BOT-2 were administered to all student participants in the hallway of their respective schools. All participants completed the SHS and each subtest of the BOT-2 separately, often switching administrators between subtests. Although each item within each SHS and BOT-2 subtest was presented in its appropriate sequence, the subtests themselves were presented in various orders as to minimize any effects the sequence may have on the outcome. The BOT-2 Examiner's Manual advises strict adherence to the scoring procedures and the administration rules, but it does allow flexibility in the subtests used. It does not indicate a required order for subtest administration (Bruininks & Bruininks, 2005). It took approximately 15 minutes for students to complete the SHS and approximately 30 minutes for students to complete the four BOT-2 subtests.

Researchers who were not involved in test administration scored the assessment results of the two groups of students. To assess whether there was sufficient inter-rater reliability among scorers, a current researcher completed three Score Sheets based on the screening completed on three previous SHS screens from the Lower SES group. Inter-rater reliability was very high ($r = .99$) for these three sheets. True inter-rater reliability of the administration of the SHS was unable to be determined since the assessments for the Lower SES group were administered over a year prior to the Higher SES group and no videotaping of the sessions occurred. Different researchers who were not blind to the SES groups administered and scored the assessments, thus presenting a limitation in this study; however, the purpose of this study was not to compare SES groups, but to compare the results of the assessment tools within the SES groups.

In order to organize data from the initial assessments, all data for the BOT-2 were entered into the BOT-2 Assistant Scoring and Reporting System software program produced by Pearson Education, Inc. Data were then exported from the BOT-2 Assistant Scoring and Reporting System to SPSS version 19, and the SHS scores were added to the data, along with the data from the Lower SES group students.

Data Analysis

Data were analyzed to determine if there was a relationship between the SHS and BOT-2 scores within the groups of students. SHS overall percentage scores were compared to the scale score (SC) for each of the four selected subtests of the BOT-2 based on combined (male and female) norms for his or her age. Next, composite scores (SS)—the sum of the two subtest scale scores of the BOT-2—were also compared to the SHS (Bruininks & Bruininks, 2005).

Results

Pearson Product Moment correlation coefficient (Kielhofner, 2006) was used to assess the association between the students' scores on the SHS and the BOT-2 (see Table 2). All correlations

for data in the Lower SES group show a roughly linear pattern with no outliers and were statistically significant except for the correlation between the SHS and Manual Dexterity SC. In the Lower SES group, there were moderate to high correlations (r = .503 to .655; $p \leq .01$) between the SHS and the BOT-2 for two out of four of the BOT-2 subtests and the corresponding composite score (SS). The Higher SES group displayed a moderate correlation between the SHS and BOT-2 (r = .551; $p \leq .05$) for Fine Motor Precision and low to moderate correlations (r = .320 to .440) for Fine Motor Integration, the Fine Manual Control composite, and Manual Dexterity (Kielhofner, 2006). These results display a linear relationship between pre-kindergarten students' scores on the SHS and the Fine Manual Control section of the BOT-2. As predicted, students' scores on the Upper-Limb Coordination subtest did not meet criteria for correlation with scores on the SHS in either group because the scatterplots displayed no linear pattern. Average scores for each subtest in both groups is listed in Table 3.

Table 2

Pearson Correlation Coefficient of SHS and BOT-2 in Lower SES Group and Higher SES Group Students

	SHS	
BOT-2	**Lower SES** (n = 36)	**Higher SES** (n = 14)
FM Precision SC	.627**	.551*
FM Integration SC	.503**	.320
Fine Manual Control SS	.655**	.440
Manual Dexterity SC	.147	.344
UL Coordination SC	.097	-.184
Manual Coordination SS	.114	.180

Note. ** = Correlation is statistically significant at 0.01 level (2-tailed); * = Correlation is statistically significant at 0.05 level (2-tailed).

Table 3

Student Scores on the BOT-2 Subtests and the SHS, Including Minimum Scores, Maximum Scores, Mean, and Standard Deviation

	Lower SES (n = 36)			**Higher SES** (n = 14)		
	Min Score	Max Score	M(SD)	Min Score	Max Score	M(SD)
BOT-2						
FM Precision SC	1	20	9.17(5.11)	8	23	12.36(4.34)
FM Integration SC	2	17	9.31(4.02)	4	22	13.50(5.07)
Fine Manual Control SS	22	56	37.03(9.94)	31	68	45.43(9.80)
Manual Dexterity SC	6	23	12.97(3.72)	7	19	14.21(3.73)
UL Coordination SC	6	35	18.11(7.32)	14	24	17.57(2.68)
Manual Coordination SS	28	60	51.69(12.86)	20	69	53.00(7.01)
SHS	48	60	54.42(3.95)	57	89	72.29(9.73)

Note. FM= Fine Motor; SC = Scaled Score; SS= Standard Score; UL= Upper Limb

Linear regression was used to determine the best linear relationship on the scatterplots, which exhibited at least a roughly linear pattern with no outliers. This was done to determine if students' scores on the SHS could predict scores on the BOT-2. It was expected that both the Lower and Higher SES groups' scores would have similar estimated slopes for those items for which linear regression was appropriate in both groups. However, linear regression did not reveal conclusive results that scores obtained on the SHS could predict scores obtained on the BOT-2 because of how different the estimated slopes were between the Lower SES group and Higher SES group.

Discussion

This was a preliminary study examining the Shore Handwriting Screening and Score Sheet's relationship to the BOT-2. The research question asked if there was a relationship between 4- to 5-year-old pre-kindergarten students' scores on the SHS and the fine motor portions of the BOT-2. Findings from the Lower SES group showed moderate to high correlation while the Higher SES group showed a low to moderate correlation between the SHS and the fine motor sections of the subtests of the BOT-2, including Fine Motor Precision, Fine Motor Integration, and the composite Fine Manual Control. Fine Motor Precision displayed a moderate to high correlation in both groups, showing that this subtest may most accurately reflect the items that the SHS measures. These results provide initial evidence that the SHS and Score Sheet relate with the fine motor portion of the BOT-2, but SES may be a confounding variable affecting the outcomes.

When looking at linear regression, it is difficult to draw conclusions because of how different the estimated slopes were between the Lower SES group and the Higher SES group for those scores that met linear regression for both groups. This may have been because of the difference in sample sizes between the two groups and the fact that overall they were small sample sizes. Larger sample sizes may have provided better results.

Implications for Occupational Therapy Practice

There are several reasons why the researchers want to determine content validity of the SHS, which can also provide information for school-based occupational therapy practitioners.

- Early identification of student problems is important (High, 2008); therefore, exploring efficient and effective tools to assist in identification of handwriting deficits for pre-kindergarten students is beneficial. This study was an initial step in this process.
- The 3- to 5-year-old option of the SHS takes approximately 15 minutes to administer, making it a practical assessment for occupational therapists to administer to students who are referred to occupational therapy for handwriting problems if it is

shown to be both valid and reliable.

- The SHS is relatively inexpensive as compared to fine motor and visual-motor assessments that have been linked to handwriting performance.
- The SHS requires only a few supplies, including crayons, pencil, scissors, and the screening form, while the BOT-2 requires several supplies that are enclosed in a bag that must be transported to the assessment site.
- The correlation between the SHS scores and BOT-2 scores suggest that it would be beneficial to continue studies on both the reliability and validity of the SHS and Score Sheet.

Limitations

There were a number of limitations of this study. Since this was preliminary research, reliability of the SHS Score Sheet has not yet been established. This should be a topic for future studies. In addition, the sample size was small and was not consistent between groups, so the results cannot be generalized. Another limitation is that the participants in the study were a convenience sample, not randomly selected. A future study featuring a larger sample from multiple schools and geographical areas would be beneficial.

Another limitation relates to how the assessments were administered. The students from the Lower SES group and the Higher SES group completed the assessments in similar environments—both in the hallways of their respective schools. However, different researchers administered the assessments at each school. This may have impacted students' performance on the assessments.

Lastly, different researchers scored each group because the data was collected as part of two different studies. This difference could have affected scores and could contribute to the difference in scores between the Lower SES group and the Higher SES group on the SHS. The same researcher trained all individuals who administered and scored the assessments in both groups. Future studies should ensure that there is appropriate fidelity.

Future Research

Ultimately, this study provides evidence that 4 and 5 year-old pre-kindergarten student performance on the SHS has similarities to performance on the fine motor portions of the BOT-2, especially in Lower SES populations. Future research should be conducted to strengthen the reliability and validity of both the SHS and the Score Sheet as an appropriate measure of handwriting skills in pre-kindergarten students. Expanding the population to a wider variety and greater number of pre-kindergarten students could strengthen the claim that the SHS is accurately measuring handwriting skills. It is also important to recognize that not all children attend pre-kindergarten. Assessing a group of 4 and 5 year olds who do not attend formal preschool would also

be important. Long-term research endeavors may include assessing students who are in pre-kindergarten, kindergarten, first grade, and second grade, as the SHS and the Score Sheet also have portions of the screening devoted to those age groups.

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