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The Applicability and Limitations of the Pupil Rating Scale Revised-Screening for Learning Disabilities in Chinese Children

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Abstract

As more school learners face difficulties in learning Chinese and request for specific instructions increases, efficient assessment tools for these children are necessary. This study explores the applicability and limitations of the Pupil Rating Scale Revised-Screening for Learning Disabilities (PRS) for identifying children with learning problems. A total of 140 third-grade Chinese children from a primary school in Ningbo were tested for their reading and writing attainment, and teachers rated these children using a modified PRS. Of the participants, 18% were evaluated as having a low performance in reading and/or writing achievement tasks. However, according to the PRS's diagnostic criteria, not one of these children was identified as having a learning disability based on teachers' ratings. It is therefore hard to conclude that the PRS can be recommended for identifying children who are thought to have reading or writing deficits, or in other words, developmental dyslexia.

Keywords: Learning Disabilities, the Pupil Rating Scale Revised (PRS), Applicability, Limitation

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INTRODUCTION

On the basis of the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10, 2016), learning disabilities are characterized by a significant discrepancy between an individual's general intellectual function and their ability to acquire new language and other cognitive skills. Evaluation and testing by a trained professional can help identify specific learning disorders. Developmental dyslexia is considered a relatively common subtype of specific learning disorder. According to the International Dyslexia Association (Lyon, Shaywitz, & Shaywitz, 2003), developmental dyslexia is a specific learning disability that is neurobiological in origin. It is characterized by difficulties recognizing words accurately and/or fluently, and poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities.

Developmental dyslexia is also a common subtype of learning disability in China (Shu & Meng, 2000). Following the definition of developmental dyslexia, we assume that some reading and writing tests as well as cognitive ability tests need to be conducted when diagnosing a child as having developmental dyslexia. However, checklists are widely used as screening instruments for learning disabilities in China. One of these checklists is the Pupil Rating Scale-Revised (PRS) (Myklebust, 1981), which is characterized by its ease of use and interpretation. It consists of five subscales: Auditory Comprehension, Spoken Language, Orientation, Motor Coordination, and Personal-Social Behavior. Scores on the first two subscales are combined to produce a Verbal Score; scores on the remaining three subscales are combined to produce a Nonverbal Score. The Verbal and Nonverbal Scores are added together to produce a Total Score.

In previous studies, children's scores of Combined Raven's Test (CRT) were used to examine the criterion-related validity of PRS by conducting correlation analyses between the scores of CRT with the nonverbal scores, verbal scores and total scores of PRS (Jing, et al., 1998; Wei, 2004). Both these studies found that there were moderate positive correlation between the scores of CRT with the nonverbal scores, verbal scores and total scores of PRS.

The predictive validity of PRS was measured by comparing the correlation coefficient between PRS's verbal scores, nonverbal scores as well as total scores with children's scores on final exams (Jing, et al., 1998; Wei, 2004). These studies found that the verbal scores, nonverbal scores and total scores of PRS were significantly correlated with the scores of final exams. Exploratory Factor Analysis with Varimax Rotation was employed and this revealed the main factors of PRS were verbal, social adaptation, and operation, which was also divided into time and orientation as well as operation in the study by Wang, et al., (2010). In conclusion, these studies concluded PRS had good validity and was suitable for group screening of learning disabilities (Jing, et al., 1998; Wang, et al., 2010; Wei, 2004).

So far, the validity and reliability of a modified PRS as a screening checklist for learning disabilities has been tested by investigating the relationship between a modified PRS and the scores on final exams in many regions of China, as outlined above (Jing, et al., 1998; Wei, 2004). However, it is thought that the results of one final exam cannot reflect children's academic achievements objectively, because the difficulties associated with the final exam may differ between schools.

In addition, it is not clear whether PRS can detect each specific subtype of learning disability in Chinese children, because no previous study has investigated the relationship between PRS and data on basic academic skills (e.g. reading skills, writing skills, and calculation skills). Since developmental dyslexia is a nucleus subtype of specific learning disability, the effectiveness of a modified PRS should be tested in terms of the detection of developmental dyslexia to demonstrate the ongoing validity of PRS as a screening checklist. Moreover, the PRS could now be seen as dated, having been designed in 1981 and based on a specific interpretation of dyslexic difficulties extant at that time, when it is usually recommended that tests are revised every 10 years or so. The question arises, is the definition of dyslexia underlying the PRS still valid, is the PRS still valid in 2018 for Chinese children and how well does it compare with the scores derived from a range of tests of academic ability.

The aim of this study was to assess the validity of PRS as a screening checklist for developmental dyslexia. In this study, we investigated how effectively the PRS can detect children who show low performance on objective reading and writing tests, that is, children thought to have developmental dyslexia.

METHODS

Participants

The participants in this study were 140 third grade pupils (75 boys and 65 girls) from a primary school in Ningbo Zhejiang, China. The following tests were administered to them when they enrolled in the third and fourth grades. Teachers in charge of these pupils were asked to rate their students when the participants enrolled in the fourth grade.

Material

Word-reading task

To evaluate the reading accuracy of Chinese words, we conducted a word-reading task. The stimuli consisted of 20 one-character words and 20 two-character compound words (see APPENDIX A). All words were selected from textbooks that had already been studied by the participants. Equal numbers of stimuli in each character-length condition were classified into typical words or atypical words, in terms of the consistency of orthography-to-phonology mappings as follows.

Fang, Horng and Tzeng (1986) defined the consistency of correspondences between orthography and phonology in Chinese words. Following their definition, a character was classified as *consistent* if all characters with the same phonetic radical shared the same pronunciation; otherwise, it was classified as *inconsistent*. In addition, Fang, et al., introduced the concept of graded consistency. An *inconsistent* character was classified as *inconsistent-typical* if the pronunciation of the character was the most common pronunciation used in characters containing the same phonetic radical. An *inconsistent* character was classified as *inconsistent-atypica*l, if the pronunciation of the character was not the most common in characters containing the same phonetic radical.

The degree of consistency in orthography-to-phonology correspondence (consistency value) is given by dividing the number of characters with the same phonetic radical and the same pronunciation of that character (i.e. number of friends) by the number of words with the same phonetic radical (i.e. number of neighbours). For example, seven characters were learned by the participants that shared the same phonetic radical, '令' (冷leng, 领ling, 铃ling, 岭ling, 拎lin, 玲ling, and 龄ling). Of these characters, five characters—领, 铃, 岭, 玲, and 龄—are pronounced as *ling* (ignoring tonal differences).

The consistency value of these five characters is 0.71 (i.e. 5/7). In this study, we classified readings of inconsistent-atypical characters as *atypical* reading when their consistency values were below 0.4, and readings of inconsistent-typical characters as *typical* reading when their consistency values were higher than 0.6. As for single-character words, they were referred to as typical words, if the pronunciation was a *consistent* or *typical* reading; a word was referred to as an *atypical* word if the pronunciation was an atypical reading. As for two-character compound words, a word was referred to as a typical word if both constituent characters were read *as consistent* or *typical* reading; a word was referred to as an atypical word if at least one constituent character was read as an *atypical* reading.

Rapid word-reading task

To evaluate word-reading fluency, a rapid word-reading task was conducted. The stimuli consisted of 10 one-character words and 8 two-characters words that participants had already learned (see APPENDIX B). They were asked to read words as quickly and accurately as they could. Time was measured using stopwatches beginning when the children began to read, until they finished reading all the stimuli.

Rapid passage-reading task

To evaluate reading fluency, a rapid passage-reading task was conducted. This task consisted of one paragraph with 336 words (see APPENDIX C). The original first author for this study created the story. Participants were asked to read the passage as quickly and accurately as they could. Time was measured with stopwatches, beginning when children began to read, until they finished reading the passage.

Word-writing task
To evaluate word-writing accuracy, a word-writing task was conducted. The stimuli used were 12 two-character compound words that do not have homophones (see APPENDIX D). These words were printed out in Pinyin (a phonemic coding system used in mainland China), and the participants were asked to write down corresponding words.

Raven's Coloured Progressive Matrices (RCPM)
RCPM was administered as an easy way to assess participants' intellectual maturity, and to exclude the effects of intellectual factors on reading/writing performance.

The Pupil Rating Scale Revised
We used a Chinese version of the revised PRS modified by Jing, et al., (1998). It consisted of five subscales, namely Auditory Comprehension, Spoken Language, Orientation, Motor Coordination, and Personal-Social Behaviour. The teachers in charge of the participants rated each child in terms of the five subscales.

PROCEDURES

At the time of the first data collection, a word-reading task, a rapid word-reading task, and a rapid passage-reading task were administered to participants. For the word-reading task, rapid word-reading task, and rapid passage-reading task, each child was tested individually, and the examiners recorded errors. Each child's responses were also audiotaped for later verification. The word-writing task and the RCPM were administered in the classrooms. In the second data collection, the word-writing task and the RCPM were administered to all the participants in this study who were also evaluated by their classroom teachers using the PRS Revised. Teachers in charge of the classes were asked to review the PRS evaluation methods before they rated their respective pupils. All of the checklists were collected on the same day.

RESULTS

The children whose RCPM scores were below -1.5 SD were excluded (n = 7) from further study, to ensure the group were in the normal range for non-verbal IQ. The children whose reading or writing test scores (tests 1 to 4) were below -1.5 SD (in more than one test) were classified as part of a RWD group (having a reading/writing disability), that is, they were thought to have 'Reading deficits' or 'Writing deficits'. The main findings can be summarized as follows: 12% of the children (n = 16) were assessed as having a problem reading Chinese Words accurately, 9% of the children (n = 12) were assessed as having a problem in reading fluency, and 8% of the children (n = 11) were assessed as having a problem writing Chinese Words accurately. Among the RWD group, 54% of the children (n = 13) showed a single deficit in reading accuracy, reading fluency or writing accuracy. 29% of the RWD group children (n=7) showed double deficits in these reading/writing abilities, and about 17% of the children (n=4) showed triple deficits. Table 1 presents the deficit patterns of the RWD group.

Table 1. The deficit's patterns of the RWD group

		Reading accuracy	Reading fluency	Writing accuracy
Single deficit (Total 54%, n=13)	25% (n=6)	×	○	○
	16.6% (n=4)	○	×	○
	12.5% (n=3)	○	○	×
Double deficits (Total 29%, n=7)	12.5% (n=3)	×	×	○
	12.5% (n=3)	×	○	×
	4% (n=1)	○	×	×
Triple deficits	17% (n=4)	×	×	×

○ = Normal × = Deficit

According to the diagnostic criteria of the PRS, when total scores are below 65, and verbal scores are below 20, the child will be considered as having Verbal Learning Disabilities. On the other hand, when total scores are below 65, and nonverbal scores are below 40, the child will be considered as having Nonverbal Learning Disabilities. There was no participant who met these criteria. Thus, using PRS, no participants in this study were assessed as having Learning Disabilities. Table 2 presents the grade's mean score and standard deviation of the PRS.

Table 2. The Grade's PRS scores (n=133)

PRS Score	Max	Min	Mdn	M	SD
Verbal	45	23	41	39.06	6.34
Nonverbal	75	42	66	65.23	9.95
Total	120	68	105	104.29	16.04

Pearson product-moment correlation coefficients between the total PRS scores and performance on literacy tests were calculated. There was a significant correlation between the total PRS scores of whole grade and the performance on all literacy tests, with the exception of the rapid word-reading task.

Table 3. Correlation Coefficients between Total PRS Scores and the Grade's Scores on Reading and Writing Tests (n = 133)

	Total PRS Score
Word-reading task	.284 **
Rapid-word-reading task	-.156
Rapid-passage-reading task	-.334 **
Word-writing task	.476 **

*: p < .05 **: p < .01

Correlation coefficients between PRS subscales' scores and the scores of Reading and Writing Tests were also calculated per group. In the Normal group, the scores of Auditory Comprehension and Spoken Language are significantly correlated to the scores of rapid passage-reading and word-writing tasks. Moreover, there was a significant correlation between the scores of Orientation and performance on all literacy tests.

Table 4. Correlation Coefficients between PRS Scores and the Scores on Reading and Writing Tests for Normal group (n = 99)

	Auditory Compre-hension	Spoken Language	Orientation	Motor Coordination	Personal-Social Behavior
Word-reading task	.199*	.167	.215*	.095	.162
Rapid-word-reading task	-.103	-.118	-.218*	-.110	-.024
Rapid-passage-reading task	-.319**	-.274**	-.305**	-.303**	-.212*
Word-writing task	.392**	.355**	.300**	.285**	.317**

*: p < .05 **: p < .01

Table 5. Correlation Coefficients between PRS Scores and the Scores on Reading and Writing Tests for RWD group (n=24)

	Auditory Compre-hension	Spoken Language	Orientation	Motor Coordination	Personal-Social Behavior
Word-reading task	-.019	-.044	.059	.068	.060
Rapid-word-reading task	.155	.274	.214	.133	.190
Rapid-passage-reading task	-.084	-.020	-.116	.035	-.148
Word-writing task	.425*	.363	.470*	.339	.412*

*: $p < .05$ **: $p < .01$

Table 6. PRS Scores for the RWD and Normal Groups

	RWD (n=24)	Normal (n=99)		
PRS Score	M (SD)	M (SD)	U	p
Auditory Comprehension	15.58(2.73)	17.88(2.67)	652	.000
Spoken Language	19.58(3.73)	22.16(3.52)	737	.002
Orientation	15.63(2.60)	17.90(2.67)	650	.000
Motor Coordination	12.33(2.10)	13.37(2.05)	825	.014
Personal-Social Behavior	31.79(5.51)	35.23(5.47)	753.5	.004
Verbal	34.96 (6.24)	40.04 (6.03)	660.5	.000
Nonverbal	59.54 (9.47)	66.49 (9.65)	735	.003
Total	94.5 (15.42)	106.54 (15.39)	712.5	.002

In the RWD group, on the other hand, only the score of word-writing task show the significant correlation with the scores of Auditory Comprehension and Orientation.

A Mann-Whitney U test was conducted to compare the PRS Scores for the RWD group and the Normal group. All PRS subscales' scores and the total score for the RWD group were significantly lower than those for the Normal group ($p < .01$).

DISCUSSION

No participants were identified as having learning disabilities by teachers' ratings in this study, even though 18% ($n = 24$) of the students showed low performance on objective reading and/or writing tests. Although the RWD group's PRS scores were significantly lower than those of the Normal group, none of the children in the RWD group met the PRS diagnostic criteria. The question is whether the differences in PRS scores between the RWD group and the Normal group are meaningful for identifying the children who have learning problems. Therefore, it is hard to say that the PRS is useful for identifying children with learning disabilities.

Although the PRS's subscales do not include any questions related to reading or writing abilities, some reading and writing tests in this study were significantly correlated with the total PRS scores. This suggests that the PRS might be showing the relationship between reading and writing abilities in Chinese. Previous research found some relationships between subscales and reading ability. For example, Colligan (1979) found that Auditory Comprehension correlates highly with reading capability in English. Why might we expect there to be a relationship between Auditory comprehension and reading? The answer seems to be that this subscale includes measures such as following instructions and retaining information, both associated with working memory which has been implicated as a contributory factor in dyslexia. The subscale of Spoken language is also directly linked to reading, and has also been found to be associated with success in reading in English-speaking children (Colligan, 1979).

The present study also showed that some reading and/or writing tests' scores were significantly correlated with the scores of Auditory Comprehension but these correlations were found in the Normal group only, if we separate the children by level of achievement. However, no such relationship pertained for the RWD group, who showed only a correlation between word writing and Auditory Comprehension. In addition, the Normal group's score of reading and writing were significantly correlated with the scores of Spoken Language, while the RWD's scores of reading and writing were not. Furthermore, the Orientation scores for the Normal group significantly correlated with performance on reading and writing tests. Being oriented means that one has an accurate awareness of time, place, direction, and relationships. The PRS includes these four aspects of orientation, some of which have been associated with dyslexia (Myklebust, 1981), aspects which tend to be overlooked in more recent tests. Thus, these

results suggest that performance on reading and/or writing in Chinese were correlated with the abilities of Auditory Comprehension, Spoken language, and Orientation overall, which is consistent with the results of previous research in English. However, the comparison between the Normal and RWD groups, in which the RWD group's scores on all of the subscales were significantly lower than that of the Normal group, suggests a different pattern for Chinese dyslexics than the English-speaking dyslexic.

In contrast, Jing, et al., (1998), who translated and revised the PRS into Chinese, examined pupils from primary schools in Guangzhou, and found that the prevalence of pupils with learning disabilities in Guangzhou was 8.3%. In addition, Wang, et al., (2010) conducted investigations in four primary urban schools in Zhanjiang, and found that 10.3% of the participants were identified as having learning disabilities. These previous studies succeeded in screening children with learning disabilities in Chinese. The difference between these studies and the current study would be that in this study objective measures of literacy were administered, so that we were able to compare the ratings on the PRS with actual achievement. By contrast, the previous studies relied on the findings of the PRS to identify children with difficulties, and this study suggests that those findings might well be inaccurate.

Sun and colleagues (2013) conducted investigations on over 6000 students from primary schools to investigate the prevalence of dyslexia and its potential risk factors. In the study by Sun, et al., (2013), children with dyslexia were identified not only based on the scores of PRS, but also with reference to the scores of the Dyslexia Checklist for Chinese Children (DCCC), a Chinese language test and the Combined Raven's Test. This suggested that when using the PRS as a screening test for developmental dyslexia, some other supplementary tests are necessary. According to the study by Sun, et al., (2013), gender, mother's education level, and learning habits ($p<.01$) were associated with dyslexia. Since PRS was used to evaluate children's behavioral characteristics at school by their teacher, a further study might be needed to investigate the family environment and children's behaviour at home when screening for learning difficulties. Moreover, the study by Sun, et al., investigated students only from grade 3 to grade 6. Children from grade 1 to grade 2 as well as kindergarten should also be included in the investigation so that we can clarify the prevalence rate of dyslexia in young children and start to intervene as early as possible.

In addition, the PRS has also been used for screening bilingual or multilingual students with study problems, as well as in learning English. For example, Johnson (1997) conducted investigations in an international school in Belgium to compare the learning achievements of pupils with the teachers' evaluations of these children using the PRS. The results of Johnson's study suggest that the PRS may indeed aid in the early identification of youngsters in the process of acquiring English who may also have learning problems.

Previous studies have considered the PRS as an effective tool for identifying learning disabilities. However, we are concerned that pupils who use a different language in school and in daily life might have problems listening or speaking. Many children with learning disabilities have difficulty processing auditory information (Johnson, 1997). It is thought that teachers have tended to give lower scores for bilingual pupils with some learning problems, since the PRS subscales emphasize the pupils' abilities on auditory comprehension and spoken language.

On the other hand, there are many kinds of dialects in most regions of China, whereas usually Mandarin is used in schools. Children who speak dialects at home use Mandarin at school. The PRS has been conducted in many regions of China, including Zhejiang, Jiangsu, and Guangzhou. In previous studies, teachers were asked to follow the manual of the PRS and rate the children objectively. As a result, the verbal and total scores of pupils in Guangzhou where children may speak Cantonese at home, were relatively lower than those in other regions (Wei, 2004). The influence of Cantonese, which retains many characteristics of ancient Chinese, has been found to lead to lower evaluations of pupils in Guangzhou. Children who speak a dialect seem to show low auditory comprehension and low spoken-language skills relative to children who speak Mandarin. Consequently, teachers are more likely to identify them as having learning disabilities.

According to the international definition of learning disabilities (ICD-10, 2016; DSM-5, 2013), not only Speaking and Listening difficulties, but also Reading, Spelling, and Calculating are included. A learning disability is represented as a category of disabilities in several domains (Fletcher, Lyon, & Shaywitz, 2002). In contrast, the subscales of PRS are focused on Auditory Comprehension and Spoken Language. It can be considered that children who have problems reading or writing may be overlooked when we base our assessments solely on PRS scores. Indeed, our results indicate that none of the children at risk on reading or writing would be correctly identified using the PRS. Moreover, it is not clear that the PRS was designed to consider differences in IQ level between those children who might be diagnosed as dyslexic, and those who have a more generalized learning difficulty based on low IQ.

Furthermore, many studies simply define groups of children as 'learning disabled' despite evidence that the meaning of learning disabled varies in different academic domains and even in different countries (Fletcher, et al., 2002). Although the PRS is divided into verbal and nonverbal subscales, it is difficult to specify what problems the children have, by relying simply on the results of the PRS. When a child has (or is at risk for) a form of developmental dyslexia, which is considered a common subtype of learning disability, objective reading and writing tests are necessary to identify what kind of academic difficulties she/he has. More importantly, specific identification can then directly link to intervention.

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APPENDIX A: THE STIMULI OF WORD-READING TASK

CHARACTER TYPE (CONSISTENCY VALUE)		
	TYPICAL	**ATYPICAL**
ONE-CHARACTER	跑 (0.66) 棋 (0.8) 飘 (0.75) 颗 (0.75) 极 (0.75) 望 (0.66) 递 (0.66) 诚 (0.66) 抵 (1) 练 (0.66)	贫 (0.13) 姐 (0.14) 枯 (0.4) 浇 (0.25) 灭 (0.2) 挂 (0.12) 盼 (0.13) 柴 (0.33) 输 (0.33) 攻 (0.25)
TWO-CHARACTER	傍晚 (1,0.66) 欺骗 (0.8,0.66) 骄傲 (0.66,1) 叮嘱 (0.71,1) 结构 (1,1) 议论 (1,1) 富裕 (0.75,0.75) 呼唤 (1,1) 旗帜 (0.8,0.75) 肌肤 (1,1)	眼睛 (0.11,0.25) 姑娘 (0.66,0.2) 感恩 (0.33,0.33) 价钱 (0.33,0.4) 推理 (0.14,0.66) 佳话 (0.12,0.25) 附近 (1,0.33) 等待 (0.16,0.16) 欣赏 (0.33,0.28) 路途 (0.2,0.33)

APPENDIX B: THE STIMULI OF RAPID WORD-READING TASK

CHARACTER TYPE	
ONE-CHARACTER	**TWO-CHARACTER**
架 笑 笔 睡 捧 桌 话 盏 短 蝉	辽阔 海洋 勇敢 粮草 检阅 呵护 菠萝 视线

APPENDIX C: THE STIMULI OF RAPID PASSAGE-READING TASK

爷爷坐在院子里扎(zā)灯笼的时候，我就坐在旁边的椅子上画画。我喜欢把爷爷认真工作的样子画下来。夏天的时候，院子里虽然很凉快，爷爷还是不停地用一条水蓝色的毛巾擦(cā)汗。

有一天我放学回到家，看见爷爷扎的灯笼已经堆成了小山。我就坐在旁边把小山一样的灯笼和爷爷画了下来。涂颜色的时候，我发现水蓝色的铅笔用完了，只好用绿色来画爷爷的毛巾。画完之后我拿给爷爷看，爷爷停下手上的活儿，用毛巾擦了把汗。他看着绿色的毛巾问我："为什么把爷爷的毛巾画成绿色呢？"我说："水蓝色的铅笔用完了。"爷爷听了，把画还给我，又继续埋头工作。

第二天我放学回到家，发现屋檐(yán)下的灯笼全部不见了。我吃了一惊，赶紧跑进屋里找爷爷。我才踏进屋里，就看到桌子上放着一盒崭(zhǎn)新的画笔。哦，一定是爷爷把灯笼卖了，给我买了画笔当礼物。

APPENDIX D: THE STIMULI OF WORD-WRITING TASK

PINYIN	ANSWER
zhù fú	祝福
xiōng pú	胸脯
yuán fèn	缘分
huāng liáng	荒凉
xùn sù	迅速
qiān xū	谦虚
ān wèi	安慰
wēi xiǎn	危险
tǐ tiē	体贴
huó pō	活泼
fēn fāng	芬芳
yī kào	依靠