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Percentile Norms for an Early Reading Assessment in Malay

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ABSTRACT

The study aimed to develop percentile norms on early reading proficiency among young elementary school children. These percentile norms were derived from a suite of early reading assessments in Malay administered to 866 Primary One (Grade 1 equivalent) school children from multilingual and multi-ethnic backgrounds. During testing, the children (462 males and 404 females) were approximately seven years old. The early reading assessment battery included measures such as letter writing, letter name knowledge, letter name fluency, rapid automatised naming, phonological awareness comprising elision, phonological memory, spelling, word reading accuracy, word reading efficiency, oral reading fluency, reading comprehension, vocabulary comprising expressive vocabulary and receptive vocabulary, and listening comprehension. These percentile norms are useful for the early identification and intervention of young children with reading difficulties and reading disabilities from multilingual communities whose languages include Malay, a transparent orthography. The implications of using the norms data for the diagnosis and classification of children with reading difficulties are discussed.

Keywords: percentile norms, transparent orthography, Malay language, young children, reading difficulties, early reading, assessment battery

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1 INTRODUCTION

Educational assessments are essential for making decisions about students' performance (Salvia et al., 2007; Schildkamp, 2019). A critical focus of assessment is to diagnose a student's need for instructional planning, intervention, and special education services (Salvia et al., 2007). Diagnostic assessments provide essential information that will help specify the nature of the student's problems and allow timely decisions about the special assistance to be provided to the student. Diagnostic assessments are conducted to identify the strengths and weaknesses of a student's academic performance so that instructional decisions can be made.

As inclusion has become an increasingly urgent educational agenda, data-based decision making is crucial for supporting inclusive education practices (Wilcox et al., 2021). Thus, examining students' performance using normative data for the identification, characterisation, classification, and decision-making process on the educational plans, such as interventions, accommodations, and modifications concerning a child's exceptionality, is paramount (Conderman et al., 2017; Salvia et al., 2007).

Norm-referenced standards help compare or evaluate individuals in the target population. It is an efficient way to compare an individual's performance to the target population. The norms save the test administrator's time and effort in developing a new norm each time the test is administered (Hasbrouck & Tindal, 2017). Percentile norms procedures have been well described in other studies within education (Hasbrouck & Tindal, 2017), but norms based on valid and reliable assessments in Malaysia are rare. The present study aimed to develop percentile norms for a Malay language reading assessment battery for primary school children, specifically, Primary 1 children (J. A. C. Lee et al., 2020).

The conceptual framework for the reading assessment battery consists of these constructs described below:

a. Alphabet Knowledge

Early alphabet knowledge predicts the acquisition of early literacy skills (National Early Literacy Panel [NELP], 2008). Letter name knowledge and the fluency of letter naming are essential for predicting early literacy skill development in kindergarten and first grade, respectively (Catts et al., 2009; Schatschneider et al., 2004).

b. Rapid Automatized Naming (RAN)

Rapid automatised naming tests tap the naming of objects, colours, letters, and digits and predict reading outcomes, including spelling (e.g., Bowey, 2007; Compton, 2003; Savage et al., 2008). As children become older, the alphanumeric RAN, such as RAN digits, becomes a better predictor of reading outcomes (Bowey, 2007; Compton, 2003; Schatschneider et al., 2004). RAN has been an

important predictor of reading differences (de Jong & van der Leij, 2003; Wimmer & Schurz, 2010). It is also an essential measure in transparent languages such as Malay (L. W. Lee, 2008).

c. Phonological Awareness

Phonological awareness entails understanding and manipulating speech sounds at various levels: word, syllable, and phoneme (Blachman, 2000). It is the foundation for attaining reading skills and a critical factor in differentiating skilled and unskilled readers (e.g., Boscardin et al., 2008; Rayner et al., 2001).

d. Phonological Memory

Tests of phonological memory tap an individual's ability to store phonological information in short-term memory (NELP, 2008). It is an essential cognitive measure for enabling skilled reading outcomes and other literacy skills (NELP, 2008). Researchers in special education and reading disabilities have reported that phonological memory differentiates groups of readers (Al Otaiba & Fuchs, 2002; Swanson et al., 2008).

e. Spelling

Individuals with reading difficulties and reading disabilities commonly have spelling problems (Moats, 1995). Spelling requires phoneme-grapheme correspondence skills and is closely related to reading (Rathvon, 2004; Treiman, 2000). It is a more difficult skill to acquire than reading (Ehri, 2000, 2005; Treiman, 2000).

f. Word Reading: Word Reading Accuracy and Word Reading Efficiency

Word reading accuracy involves the knowledge of grapheme-phoneme connections. To read, children may decode, use an analogy, or predict the sounds of the words (Ehri, 2005). On the other hand, word reading efficiency involves the speed of reading the words. Word reading efficiency is one of the markers of reading difficulties/disabilities (Torgesen et al., 1999).

g. Oral Reading Fluency

Children who can overcome slow and laborious reading will enjoy the pursuit of reading for pleasure and reading to learn. Oral reading fluency is a strong predictor of reading proficiency (Fuch et al., 2001). When fluency at the word, sentence, and passage level is reached, attention and memory, which are two critical cognitive resources, are freed up for reading comprehension (Rathvon, 2004).

h. Reading Comprehension

Reading comprehension refers to the ability to understand meaning from the text read. Good reading comprehension is the ultimate goal of reading (National Reading Panel [NRP], 2000). According to Hogan et al. (2014), skilled reading depends on decoding and linguistic comprehension strength. However, due to either decoding or linguistic comprehension weakness, less skilled reading occurs.

i. Vocabulary: Expressive Vocabulary and Receptive Vocabulary

Vocabulary is an essential foundation in literacy attainments, such as word reading and reading comprehension (NRP, 2000; Nation, 2009; Muter et al., 2004). The test of expressive vocabulary taps spoken vocabulary based on pictures presented. The test of receptive vocabulary taps the student's ability to respond by pointing to the pictures based on the single words spoken by the test administrator (Rathvon, 2004).

j. Listening Comprehension

Listening comprehension refers to the ability to understand spoken language. Given that most of the instructions are given orally, listening comprehension is crucial for school success. Cumulative research suggests that deficient listening comprehension results in failure to develop adequate reading comprehension (Hogan et al., 2014).

2 METHOD

2.1 Participants

The percentile norms in this study were derived from the reading outcome data from Lee et al. (2020), which was a larger study on the development and validation of a reading assessment battery for identifying reading difficulties among young children. A total of 866 Primary 1 children from 11 randomly selected government schools located in Kuching, Sarawak, located in East Malaysia, participated in the study. There was a total of 462 male and 404 female children. The participants were between 6.61 and 7.82 years old (M = 7.13, SD = .29). The ethnicities of the children were as follows: Malay (67.1%), Iban (13.9%), Bidayuh (8.3%), Chinese (3.1%), and others (5.9%); missing data was 1.7%. The data were representative of typical government primary school settings in Kuching, Sarawak. Although no official records of reading difficulties/disabilities were available during the time when the larger study was conducted, it was observed during the data collection that several children demonstrated varying symptoms of reading difficulties. Informed consent forms were obtained from the participants prior to the study in accordance with the Declaration of Helsinki. The protocols used were carried out in accordance with the recommendations and approval of the Ministry of Education Malaysia's Division on Planning and Educational Research (Ministry of Education Malaysia, 2019).

2.2 Measures

The reading assessment battery in the Malay language was developed based on the Primary 1 Malaysian curriculum. An in-depth analysis of the well-known tests in English alphabetic orthography, such as the Comprehensive Test of Phonological Processing (Wagner et al., 1999), Test of Word Reading Efficiency (Torgesen et al., 1999), Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Good et al., 2001), and Woodcock Reading Mastery Test (Woodcock, 1998) was conducted and used as a reference during the development of items.

Additionally, a review of the extant literature on transparent orthographies informed the development of the reading assessment battery. The following measures were included in the reading assessment battery: letter name knowledge, letter name fluency, rapid automatised naming, phonological awareness, phonological memory, spelling, word reading accuracy, word reading efficiency, oral reading fluency, expressive vocabulary, receptive vocabulary, reading comprehension, and listening comprehension tests (J. A. C. Lee et al., 2020; Tang et al., 2018). The following assessments were developed and validated to make critical instructional decisions for the early identification of reading difficulties in young children. All the timed tests had alternate forms (i.e., Form A and Form B). Table 1 presents a summary of the measures. Below are the descriptions of each assessment:

The Letter Writing measure comprised two tests - small letters and capital letters. Each of the 26 letters was administered randomly to the children.

The children's alphabet knowledge was assessed in small and capital letters using the Letter Name Knowledge test. Twenty-six letters in school-friendly font type (i.e., Comic Sans MS) were presented randomly. The total scores represented letters that were named correctly.

The students' letter name fluency of the 26 letters of the alphabet in lowercase was assessed. Sixty-six letters were arranged in an array of 6 letters by 11 rows. The students named the letters from the left to the right and then the subsequent rows until all the letters in all the rows had been named. Given that letter name fluency was a timed test, a stopwatch was used to capture the duration of the time taken to name the letters. The total score was the number of letters named correctly in 30 seconds.

The RAN digits' measure comprised randomly arranged digits from 1 to 5 in an array of 5 numbers x 4 rows. The duration of this task was recorded using a stopwatch. Two alternative forms were administered because RAN was a timed test. The final score was digits per second, excluding any errors made by the student.

The Phonological Awareness test was comprised of 16 elision items. The elision items assess the student's ability to delete phoneme/syllables from words presented orally. For example, the students were required to say "jalan" (road) without /ja/. Each correct answer was given 1 point; each incorrect answer was awarded 0 points.

Phonological memory was measured using a digit span test comprising 18 items of digits of increasing length (e.g., first item was 9 4; the last item was 6 9 3 1 5 6 4 7). The student was instructed to repeat the digits read aloud by the test administrator. Digits that were read correctly and in the correct sequence were awarded 1 point for each item.

The Spelling test measures the student's knowledge of encoding skills. The spelling measure was group administered. The Spelling test was administered before the Word Reading Accuracy test by design. There were 10 items in the Spelling test. Each correct answer was given 1 point; each incorrect answer was awarded 0 points.

The WRA test comprised the same items as the Spelling test (10 real words). By design, Spelling was assessed first before the Word Reading Accuracy measure. Each correct answer was given 1 point; the incorrect answer was awarded 0 points.

Given that it was a timed measure, there were two alternate forms. The WRE measure was comprised of 60 real words. The speed and correctness of words read were captured within 30 seconds. The total score was the total number of correct words read within 30 seconds.

The ORF test measures the accuracy and speed of passage reading within 30 seconds. There were two alternate forms. Forms A and B comprised a passage with 85 and 75 words, respectively. The total score was the total number of correct words read within the 30-second limit.

The Reading Comprehension test, which used the same ORF passage, was administered, only after the ORF had been tested. There were five questions, which required short 1-2 word answers. Each correct answer was given 1 point; each incorrect answer was awarded 0 points.

Expressive Vocabulary was measured by getting the students to name the 20 pictures. The Expressive Vocabulary and Receptive Vocabulary measures had the same pictures. Each correct answer was given 1 point; the incorrect answer was awarded 0 points. The Expressive Vocabulary measure was administered by design before the Receptive Vocabulary measure.

Receptive Vocabulary was measured by getting the student to point to the picture named verbally by the test administrator. Each correct answer was given 1 point; the incorrect answer was awarded 0 points.

Listening Comprehension was measured using two recorded dialogues. The dialogues were about school sports and extra classes. Each dialogue was 21 seconds with 31 words and 38 words, respectively. Each dialogue was presented twice, after which students answered three questions on the answer sheet. Each correct answer was given 1 point; the incorrect answer was awarded 0 points.

Table 1. Summary information of the early reading assessment battery in Malay.

Assessment	Total items	Presentation format	Response format	Timed format	Range
Letter Writing					
Small letters[e, f, g]	26	Letters	Written	No	0–52
Capitals letters[e, f, g]	26	Letters	Written	No	0–52
Letter Name Knowledge[e]					
Small letters[a, e]	26	Letters	Spoken	No	0–26
Capitals letters[a, e]	26	Letters	Spoken	No	0–26
Letter Name Fluency					
Form A[c, e]	66	Letters	Spoken	Yes	0–66
Form B[c, e]	66	Letters	Spoken	Yes	0–66
Rapid Automatized Naming					
Form A[d, e]	20	Digits	Spoken	Yes	0.16–3.03
Form B[d, e]	20	Digits	Spoken	Yes	0.16–2.94
Phonological Awareness					
Elision[a]	16	Text	Spoken	No	0–16
Phonological Memory[a]	18	Text	Spoken	No	0–16
Spelling[a, f]	10	Text	Written	No	0–10
Word Reading Accuracy[a]	10	Text	Spoken	No	0–10
Word Reading Efficiency					
Form A[b]	60	Text	Spoken	Yes	0–57
Form B[b]	60	Text	Spoken	Yes	0–60
Oral Reading Fluency					
Form A[b]	85	Text	Spoken	Yes	0–85
Form B[b]	75	Text	Spoken	Yes	0–75
Reading Comprehension[a]	5	Text	Written	No	0–5
Vocabulary					
Expressive Vocabulary[a]	20	Graphics	Spoken	No	1–20
Receptive Vocabulary[a]	20	Graphics	Pointing	No	10–20
Listening Comprehension[a]	6	Audio recording	Written	No	0–6

Note. [a] Correct = 1 point each; Incorrect = 0 points; [b] = Correct number of words in 30 seconds and 1 point per correct word read; [c] = Correct number of letters in 30 seconds and 1 point per correct letter; [d] = Correct digits per second; [e] = Randomly arranged; [f] = verbally read by the test administrator; g Range of points per letter = 0 – 2.

2.3 Procedures

The participants were administered the reading assessment battery after the second half of the school year. All the tests were administered individually except for the Spelling test and the Listening Comprehension test. Spelling words were read verbally by the test administrators, who were trained by the first author. The Listening Comprehension test dialogue, which was pre-recorded into a CD format, was played on a CD player by the test administrators during the Listening Comprehension test.

2.4 Data Analytic Procedure

Percentile norms were developed for the entire group. SPSS (Statistical Package for Social Science) version 22 was used to develop the percentile norms in increments of 5 up to 100. Twenty different percentile rankings are presented: 100th, 95th, 90th, 85th, 80th, 75th, 70th, 65th, 60th, 55th, 50th, 45th, 40th, 35th, 30th, 25th, 20th, 15th, 10th, and 5th percentile.[1]

3 RESULTS AND DISCUSSION

The percentile norms of the data are presented in Table 2 and Table 3. The raw data are presented in the online supplementary file (see J. A. C. Lee, 2022).

Table 2. Percentile norms for letter writing, letter name knowledge, and letter name fluency in Malay.

Percentile	LW[s]	LW[c]	LNK[s]	LNKc	LNF[a]	LNF[b]
100	52.00	52.00	26.00	26.00	66.00	66.00
95	50.00	48.00	26.00	26.00	54.00	54.00
90	48.00	46.00	26.00	26.00	49.00	52.00
85	46.40	44.00	26.00	26.00	48.00	48.00
80	45.00	42.00	26.00	26.00	45.00	46.00
75	43.00	39.00	26.00	26.00	42.00	43.00
70	41.00	37.00	26.00	26.00	41.00	42.00
65	39.00	35.00	26.00	26.00	39.00	41.00
60	37.40	33.00	26.00	26.00	37.00	39.00
55	35.00	31.00	26.00	26.00	36.00	36.30
50	33.00	29.00	26.00	26.00	35.00	36.00
45	31.00	27.00	26.00	26.00	33.00	34.00

[1] Gender differences based on the percentile norms was not the focus of this study.

40	29.00	26.00	26.00	26.00	31.00	32.00
35	27.00	25.00	26.00	26.00	30.00	30.00
30	25.00	23.00	26.00	26.00	28.00	29.00
25	24.00	22.00	26.00	26.00	25.00	26.00
20	22.00	20.00	25.00	25.00	23.00	23.00
15	19.00	18.00	25.00	25.00	21.00	21.00
10	16.00	15.00	24.00	23.00	16.00	17.00
5	10.00	11.20	17.30	17.00	9.00	10.00

Note. LW = letter writing; LNK = letter name knowledge; LNF = letter name fluency; [s]Small letters; [c]Capital letters; [a] Form A; [b] Form B.

Table 3. Percentile norms for the early reading-related assessment battery in Malay.

Percentile	RAN[a]	RAN[b]	PA-EL	PM	SP	WRA	WRE[a]	WRE[b]	ORF[a]	ORF[b]	RC	EV	RV	LC
100	3.03	2.94	16.00	16.00	10.00	10.00	57.00	60.00	85.00	75.00	5.00	20.00	20.00	6.00
95	2.22	2.17	16.00	13.00	10.00	10.00	43.00	46.00	62.40	57.00	5.00	20.00	20.00	6.00
90	2.00	2.00	16.00	12.00	9.00	10.00	39.00	40.00	52.00	51.00	4.50	20.00	20.00	6.00
85	1.87	1.86	16.00	12.00	9.00	10.00	35.00	34.00	45.00	45.00	4.00	20.00	20.00	6.00
80	1.79	1.75	15.00	11.00	8.00	10.00	30.00	28.80	40.00	42.00	4.00	20.00	20.00	5.00
75	1.68	1.67	14.00	11.00	8.00	10.00	27.00	24.00	37.00	38.00	4.00	20.00	20.00	5.00
70	1.62	1.59	13.00	10.00	7.00	10.00	24.00	20.00	33.00	34.00	3.50	20.00	20.00	4.00
65	1.56	1.52	12.00	10.00	7.00	10.00	21.00	19.00	29.00	31.00	3.00	20.00	20.00	4.00
60	1.47	1.43	11.00	10.00	6.00	10.00	19.00	17.00	27.00	28.00	2.50	20.00	20.00	4.00
55	1.41	1.39	10.00	9.00	6.00	10.00	16.00	14.00	24.00	25.00	2.00	19.00	20.00	3.00
50	1.33	1.33	10.00	9.00	5.00	10.00	14.00	12.00	18.00	21.00	1.50	19.00	20.00	3.00
45	1.27	1.25	9.00	9.00	4.00	9.00	11.70	9.00	12.00	18.00	1.00	19.00	20.00	3.00
40	1.21	1.20	8.00	9.00	3.00	9.00	9.00	6.00	7.00	12.00	1.00	19.00	20.00	2.00
35	1.15	1.15	8.00	9.00	3.00	8.00	7.00	5.00	5.00	8.10	0.50	18.00	20.00	2.00
30	1.10	1.08	6.00	8.00	2.00	6.00	5.00	4.00	3.00	6.00	0.00	18.00	20.00	2.00
25	1.04	1.02	5.00	8.00	2.00	4.00	4.00	2.00	2.00	4.00	0.00	18.00	20.00	2.00
20	0.97	0.97	4.00	8.00	1.00	3.00	2.00	1.00	1.00	0.20	0.00	17.00	19.00	1.00
15	0.91	0.89	3.00	7.00	1.00	2.00	0.00	0.00	0.00	0.00	0.00	17.00	19.00	1.00
10	0.83	0.80	2.00	7.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	16.00	19.00	1.00

5	0.71	0.69	0.00	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.00	19.00	0.00

Note. RAN = rapid automatized naming; PA = phonological awareness; EL = elision; PM = phonological memory; SP = spelling total; WRA = word reading accuracy; WRE = word reading efficiency; ORF = oral reading fluency; RC = reading comprehension; EV= expressive vocabulary; RV = receptive vocabulary; LC = listening comprehension; [a] Form A; [b] Form B.

The percentile norms data suggest that most of the participants had mastered the Letter Name Knowledge of small and capital letters. However, using the 25th percentile[2] as an indicator of possible reading difficulty (Catts et al., 2003; J. A. C. Lee et al., 2020), approximately 25% of the participants were unable to obtain the full score of 26 correct letters, suggesting that these students needed intervention. In terms of Letter Name Fluency, the percentile norms indicated that at least 50% of the participants were able to fluently name half of the total number of letters that were presented to them within 30 seconds. Given that the test had been administered after the second half of the year, the data suggest that teachers can use this percentile norms data for decision-making purposes.

Tests of Phonological Awareness and Phonological Memory indicate that children may encounter cognitive challenges in helping them to decode words read. In this sample, the information regarding the lowest quartile (25th percentile) provides a cut-point score for those children who scored five and below for Phonological Awareness (Elision task), eight and below for Phonological Memory, two and below for Spelling, and four and below for Word Reading Accuracy should be provided with immediate remedial assistance in sound awareness, sound deletion, decoding, and spelling.

Interestingly, although the words used for the Spelling test and Word Reading Accuracy were precisely the same, reading was much easier for the students than spelling. Consistently at the 75th, 50th, and 25th percentiles, the students performed better in word reading than spelling. This finding has been demonstrated elsewhere that spelling in Malay is more complex than reading (J. A. C. Lee et al., 2020; Tang et al., 2018). Therefore, general and special education teachers may use the percentile norms to identify students who encounter difficulties in reading and students who can read reasonably well but struggle in spelling.

For Word Reading Efficiency and Oral Reading Fluency, using the 25th percentile as a cut-point, the norms data from this study suggest that students scoring between 2 and 4 for the timed tests of single words and short passages, respectively, call for immediate attention by the teachers in schools to provide the necessary intervention on decoding and reading words by sight. The inability to read words on a list and in a passage suggests that the children will have comprehension difficulties. As shown in the percentile norms, students need to be minimally at the 75th percentile in terms of word reading efficiency and oral reading fluency to show reasonable ability to comprehend a passage.

For specific tests, such as letter name knowledge, receptive vocabulary, and expressive vocabulary, very few children (i.e., a low percentage of 5% of the sample) had difficulties, resulting in better performance among many students. For example, only 5% of the students scored

[2] The 25th percentile was used a cut-point in this study because it is the lowest quartile of reading performance. Furthermore, it is a widely supported cut-point for decision making on intervention services. The lower a student scores below the 25th percentile, the more difficulties in reading the student will present; the higher the student scores above the 50th percentile, the better the student's performance (Martins & Capellini, 2021).

14 points and below for Expressive Vocabulary. In contrast, 5% of the students scored 19 points and below for Receptive Vocabulary. The results suggest that the students are better in Receptive Vocabulary, which taps their ability to understand when instructed to point to objects presented to them, than in Expressive Vocabulary, which taps their ability to verbalise the names of the objects. Given that communication requires the ability to verbalise thoughts and ideas, teachers should be sensitive to the remediation needs of students who may understand the information presented verbally but cannot express themselves well. Regarding listening comprehension, 5% of students scored 0 on the Listening Comprehension test, suggesting the need for these students to be identified for remediation. Teachers commonly provide long instructions to the students in class and during school assembly, so children with listening comprehension problems may be at a disadvantage and would require remediation in listening comprehension skills.

4 CONCLUSION

The percentile norms on children's early reading skills in Malay are based on a large dataset that is representative of young children in Kuching, Sarawak. The norms data in this article provide opportunities for other researchers to extend the studies about reading difficulties among children in transparent orthographies such as the Malay language. It is helpful for further investigations on similar strands of research in other parts of Sarawak and Malaysia.

4.1 Study Limitations and Future Research

There are several limitations to this study. First, letter-sound fluency and nonword tests, which are important predictors of reading disabilities, were omitted from the reading battery, given the floor effects during the pilot study. Future studies could include these two tests to capture growth over time. Second, including more urban, suburban, and rural locations in Sarawak and throughout Malaysia would enhance the value of the percentile norms through a data science approach. Thus, norms data should be captured systematically in a longitudinal manner. Additionally, reading outcomes of children with reading disabilities should be tracked and monitored longitudinally to provide educators, teachers, and educational interventionists with sufficient information on a child's ability compared to the normative data.

4.2 Implications for Policy and Practice

The percentile norms for the reading assessment battery have been developed to provide trained school professionals with a set of reliable percentile norms, which can be used to identify children with symptoms of reading difficulties and neurobiological specific learning disabilities such as dyslexia. In turn, early identification enables appropriate early interventions to be provided. The norms data present new opportunities for researchers to leverage artificial intelligence in education to identify reading difficulties and disabilities in multilingual communities. Specifically, digitalisation of the diagnosis and classification of young children with reading difficulties using advanced technologies such as artificial intelligence and machine learning capabilities can speed up the diagnosis rate for children at risk of reading difficulties (Khan et al., 2018).

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