



## Evaluation of a rime-based reading program with Shuswap and Heiltsuk First Nations prereaders

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**Abstract.** The utility of teaching reading using rime-based reading strategies with prereaders was examined. Two experiments are presented that studied the effects of a rime-based reading program with First Nations prereaders; one experiment with Shuswap kindergartners and the other with Heiltsuk Grade 1 children. Rhyming, phoneme identity, letter-sound knowledge, phonological working memory, First Nations language speaking ability, and reading were measured. In the Shuswap group, the reading program increased the abilities that were specifically taught, rhyming, initial phoneme identity, letter-sounds, and word reading by rime-analogy, compared to the control group. Children also developed abilities that were not specifically taught, final phoneme identity and reading by letter recoding, and could use the rime-analogy strategy to read words with unfamiliar rime endings. Phonological working memory remained unchanged. The Heiltsuk children gained in reading compared to a Grade 1 comparison group. Pretest letter-sound knowledge and rhyming were related to later reading but phoneme identity and First Nations language ability were not. Progress in phonological awareness and word reading can be enhanced in prereaders by adding experience with rime-based strategies to the reading program.

**Keywords:** Aboriginal, Letter, Phoneme, Reading, Rhyming, Rime-analogy

There is extensive correlational and experimental evidence that phonological awareness is the best single predictor of success in learning to read in English (e.g., Ehri 1995). Phonological awareness is conscious access to the sounds of speech within words and the ability to manipulate these sounds. This finding was corroborated in other languages including French (Demont & Gombert 1996), Norwegian (Bjaalid, Høien & Lundberg 1996), German (Naslund & Schneider 1996), and Swedish (Lundberg, Olofsson, & Wall 1980) and holds even when age, language ability, IQ, social class, and memory are controlled (Bradley & Bryant 1985; Wagner & Torgesen 1987). Furthermore, children who experience great difficulty with beginning reading typically have a deficit in phonological awareness (Stanovich, Siegel

& Gottardo 1997; Vellutino, Scanlon, Sipay, Small, Pratt, Chen & Denckla 1996).

Research on phonological awareness suggests that there are at least four units of sound within words; namely, syllables, onsets and rimes, and phonemes (Treiman 1992; Treiman & Zukowski 1996). For example, the one syllable word /bat/ can be divided into onset and rime (/b/, /at/), and single phonemes (/b/, /a/, /t/). In the former case, the onset (/b/) is represented by a phoneme, and the medial and final phoneme are sounded together to make the rime. Onsets and rimes can be represented by one or more phonemes (e.g., the onset in *black* is /b/). Note that stimulus items in phonological tasks are presented verbally, not as written text.

Rhyming is a form of phonological awareness based on the onset and rime units of sound, and words with common rimes (e.g., *bat*, *fat*) usually rhyme. Rhyming emerged as the best predictor of reading in several longitudinal studies (Bradley & Bryant 1983; Ellis & Large 1987; Lundberg et al. 1980) and as a good predictor in other research (Naslund & Schneider 1996; Vellutino & Scanlon 1987; Walton 1995). Goswami and Bryant (1990, 1992) proposed that the ability to recognize rhyming words may form the basis for noticing that these words often share a common spelling. This reading strategy of making inferences from similarities in spelling to similarities in sound was referred to as making orthographic analogies (Goswami & Bryant 1990). In the above example, the analogy is rime-based as it rests on the common *-at* spelling of the rhyming words.

A logical analysis of the rime-based analogy reading strategy would suggest that the prereading skills of initial phoneme identity (the first sound of a word), rhyming, and letter-sound knowledge would be directly involved. Ability in rhyming would be required because it is potentially at the core of noticing that words ending in common spellings often sound the same. Identifying the first sound of a word (initial phoneme identity) is implicated because in many cases, the only difference in sound between two rhyming words is the initial phoneme. Letter-sound knowledge refers to knowledge of the sound represented by a single letter, and some letter-sound ability is needed to read any word. As well, there must be an orthographic form of a rime stored in memory before a rime-based analogy could be used to read a new word. This last condition would require experience reading words where common letters represented common rimes.

Children could also potentially learn to read new words using a letter recoding strategy where individual letters are sounded out and then blended. However, letter recoding requires phonological skills at the phoneme level, skills which are more difficult than rhyming. So, a possible advantage of teaching beginning reading using the rime-based analogy reading strategy

over providing experience with letter recoding is that most prereaders can rhyme but fewer can manipulate phonemes within rimes (Treiman & Zukowski 1996; Yopp 1988). The rime-based analogy reading strategy, then, is potentially based on phonological skills possessed by most kindergartners (i.e., initial phoneme identity, rhyming) whereas letter recoding requires manipulating phonemes within rimes, a far more difficult task. This rationale has generated the recommendation by several researchers to examine the utility of teaching reading strategies based on onset and rime units of text to beginning readers (Adams 1990; Muter, Snowling & Taylor 1994; Treiman 1992; Walton 1995).

There are at least two reasonable accounts that address the question of how children could begin using rime-based analogies when beginning reading. First, children could learn to read using a rime-analogy strategy following experience with letter recoding at the phoneme level, especially with medial and final phonemes (Ehri 1991, 1995). In this account, when first beginning reading the stored orthographic representation of the rime would not contain sufficient letter detail for the effective use of a rime-based analogy strategy. However, with experience the complete representation of the rime would be stored in memory and reading by a rime-based analogy would become efficient. This explanation is supported by the finding of an independent relation between rhyming and *later* reading (e.g., Bradley & Bryant 1983) but no relation between rhyming and *beginning* reading, after partialling out the effects of phoneme awareness (Bruck & Treiman 1992; Johnson, Anderson & Holligan 1996; Nation & Hulme 1997; Walton 1995). Furthermore, beginners who could read using a rime-based analogy strategy also had the phonemic and letter-sound prereading skills associated with letter recoding (Bruck & Treiman 1992; Ehri & Robbins 1992; Walton 1995). In this account, the effective use of a rime-based analogy reading strategy to read words follows some competence with letter recoding.

A second method that could result in success with the rime-based analogy reading strategy is to directly teach this reading strategy and the implicated prereading skills in the first steps of reading. A common method that has been used to examine if children can use the rime-based analogy strategy is to teach them clue words like *beak* and then test to see if they can then read new words that share a common rime with a clue word like *peak* (Ehri & Robbins 1992; Goswami 1991, 1993; Muter, Snowling & Taylor 1994). In many cases, especially when children were competent in related prereading skills, they were able to read using a rime-based analogy after only brief exposure to clue words. However, these studies examined only whether children were able to use the rime-based analogy strategy immediately following training with this strategy. Still, this method of testing for the use of the rime-based analogy

strategy could, with extended teaching experience, potentially result in the development of this reading strategy without the presentation of clue words. A key rationale for the studies currently presented was to determine if experience with a rime-based reading strategy would enhance specific prereading skills and word reading measured several days later, as opposed to measuring these abilities immediately after the training.

There is some evidence that extended experience with the rime-based analogy strategy develops this strategy. Greaney and Tunmer (1996) found that poor readers who received this type of teaching increased their reading ability compared to poor readers who received instruction in the use of context cues. These children ranged in age from 9 to 12 years, already had considerable experience with reading, and so the question of the initial development of reading based strategies in prereaders could not be examined.

Peterson and Haines (1992) taught kindergartners to use rime-based analogies (seven 15-minute sessions over 1 month) and found increases in the effective use of this strategy, as well as in letter-sound knowledge. Wise, Olson and Treiman (1990) compared the effects on reading of onset-rime segmentation with segmentation after the vowel (e.g., cla-p) with Grade 1 children and found that onset-rime segmentation was more beneficial. However, neither of these studies screened the sample for readers and so the initial development of a reading strategy using rime-based analogies could not be examined, as it was potentially confounded with reading ability.

Two studies compared the effects of instruction at the onset-rime level with letter recoding at the phoneme level with Grade 1 children (Haskell, Foorman & Swank 1992; Sullivan, Okada & Niedermeyer 1971) and both found no significant overall differences in later word reading. In both studies, many children began the study as readers and so, as in previous research, the initial development of the use of rime-based analogies was confounded with reading achievement.

It is a commonly held view that the relationship between phonological awareness and reading is interactive and reciprocal (Goswami 1993; Vandervelden & Siegel 1995; Wagner & Torgesen 1987). If these interactive models of reading are accurate, increases in phonological skills such as rhyming and initial phoneme identity might result in the development of the related skills of medial and final phoneme identity. Also, the development of competency with a rime-based reading program may result in the increased use of rhyming and initial phoneme identity when beginning reading. This last possibility was suggested by Seymour and Evans (1994). Furthermore, competence in a rime-based analogy reading strategy could result in the development of the letter recoding reading strategy. Examining these questions has implications not only for the proposed models of reading but also

for enhancing the effectiveness of methods used to teach beginning reading in schools.

Although there has been a long standing concern for the reading achievement of First Nations children in English (Miller 1972; Narang 1974; Rich 1973), even the most recent research in this area has not incorporated the findings on the robust relationship between phonological awareness and beginning reading. Of the existing research on beginning reading with First Nations children, two experimental studies found no differences between the teaching methods examined (Bryant 1986; Miller 1972), four made specific teaching recommendations without clear supporting evidence (Kasten 1992; Narang 1974; Rich 1973; Shields & Matheson 1990), and six studies considered home and school environments that might increase language acquisition and reading success (Featherly 1986; Harris 1985; Hartle-Schutte 1989; Kempter 1984; Mayfield 1985; Soldier 1992). In Canada, the term First Nations is generally preferred to the terms native Indian or aboriginal and so the term First Nations will be used throughout the study.

To the authors' knowledge, this study is the first to examine relationships between phonological awareness and beginning reading with First Nations children. More specifically, findings are presented from two experiments that examined the effects of a rime-based reading program to teach phonological awareness and beginning reading to Shuswap kindergarten and Heiltsuk Grade 1 prereaders.

Teaching First Nations children to read English has implications that go beyond the cognitive processes of acquiring meaning from text, as there are extensive cultural differences between First Nations peoples and the majority population of Canada. Of particular relevance here, the First Nations children in this study received daily teaching in their First Nations language, although all had English as a first language and English was the primary language of instruction in school. In addition, important educational goals recently identified by three First Nations communities in British Columbia were knowledge of the First Nations culture, particularly language, and high levels of competence in academic skills, especially reading in English and mathematics (Kamloops First Nations Education Forum 1994; More 1984; Napoleon 1988). Chief Dan George, a highly respected Chief from British Columbia, articulately expressed these views regarding academic skills when he wrote:

Like the thunderbird of old, I shall rise again out of the sea; I shall grab the instruments of the white man's success, his education, his skills. With these new tools I shall build my race into the proudest segments of your society (1974, p. 92).

Historically there are indications of poor reading achievement in Grade 1 in the two First Nations communities involved in this study (Bella Bella Teacher Inservice 1996; Dufficy, Bell, Elliot & Schmid 1987). There is also considerable evidence that children who experience difficulty learning to read early in their formal schooling tend to have reading problems in later grades (Stanovich 1986; Walberg & Tsai 1983). These reading difficulties can, over time, negatively affect other academic subjects, self-esteem, and motivation. For these reasons, identifying the most effective methods for teaching reading to First Nations children may have the strongest long term results when directed at the beginning steps of reading. As reported earlier, one of the most consistent findings of recent research in reading is the strong link between children's skill in phonological awareness and their progress in beginning reading. The search for effective methods for teaching First Nations children to read, then, should potentially incorporate this research.

Although phonological awareness is the ability most closely linked with reading development, there is substantial evidence that phonological working memory is also an important factor in beginning reading (Gathercole & Adams 1993; Gathercole & Baddeley 1990). Using a nonword repetition task, phonological memory was critically involved in the long-term learning of phonological information. Gathercole and Baddeley (1990) concluded, however, that factors other than phonological working memory may underlie the association between nonword repetition and reading ability. Indeed, correlational studies found that phonological working memory did not contribute to reading ability after controlling for phonological awareness (Leather & Henry 1994; McDougall, Hume, Ellis & Monk 1994). The research studying the relationships among phonological working memory, phonological awareness, and beginning reading is inconclusive. This study extends the research in this area by examining if gains in phonological awareness and beginning reading will be associated with increases in phonological working memory.

It is now becoming common in Canada for First Nations children to receive teaching in their aboriginal language when starting school and the children in the study varied in the ability to speak their First Nations language, Shuswap or Heiltsuk. It is possible that this language experience enhances phonological skills in English and so indirectly increases reading achievement in English. Alternately, the daily time taken by the language teaching could have the opposite effect and result in lower reading achievement in English. The relationship between First Nations language speaking ability and the development of word reading in English was examined to clarify these questions.

In summary, the phonological literature provides a strong rationale for examining the effects of experience with a rime-based analogy reading program on relevant prereading skills and beginning reading. Also, there is evidence of poor beginning reading achievement with children from some First Nations communities, and an expressed interest on the part of their parents and teachers to address this concern. Unfortunately, the existing research on teaching beginning reading with First Nations children does not provide direction about effective reading programs. This study extends the research literature on phonological awareness by examining the effects of a rime-based reading program with First Nations prereaders from two different communities.

Two experiments were conducted to examine the effects of a rime-based reading program with First Nations prereaders. Experiment 1 was conducted with Shuswap kindergarten children and experiment 2 with Heiltsuk Grade 1 children.

In experiment 1, to investigate the possible effects of experience using a rime-based analogy reading strategy with First Nations children, the study: (a) sampled First Nations prereaders; (b) measured rhyming ability, phoneme identity, letter-sound knowledge, phonological working memory, reading, and First Nations language speaking ability; and (c) included a treatment condition where children were taught to read using a rime-based analogy strategy and related prereading skills (initial phonemes, rhyming, letter-sounds) and a control group where stories were read to children. Incorporating the control group allowed for an identification of the specific prereading skills and reading strategies that may develop as a result of the rime-based reading program, beyond the literacy instruction received in the classroom and the extra story reading in the control group.

The three questions examined in experiment 1 were:

- (a) Will experience with a rime-based reading strategy and related prereading skills (initial phoneme identity, rhyming, letter-sounds) enhance these abilities and word reading with prereaders compared to a control group?
- (b) Will experience with a rime-based reading strategy and related prereading skills develop abilities *not* taught such as phoneme identity within rimes, phonological working memory, and reading by letter recoding compared to a control group?
- (c) Will children be able to generalize the use of a rime-based reading strategy to words with unfamiliar rime endings?

## Experiment 1

### *Method*

#### *Participants*

The results are reported here for 21 Shuswap First Nations children. The Shuswap have lived in the interior of British Columbia, Canada, for several thousand years. The children were from the early primary classroom of a Shuswap First Nations school located on a reserve adjacent to a medium-sized city. In all, 23 children were solicited for the study. One child was screened from the study when she read more than one word from Baron's (1977) reading test (bed, pit, bet, sin, hug, man, bag, rag) and one child discontinued when the family moved. The average age of the remaining 21 children (5 girls and 16 boys) was 5 years, 11 months ( $SD = 6.25$ , range = 5 years, 1 month to 6 years, 11 months).

The parental consent rate for the class was 77 percent. Shuswap parents had indicated at a recent meeting that two important educational goals for their children were achievement in reading in English and learning to speak Shuswap (Kamloops First Nations Education Forum 1994).

English was the first language of the children, all of whom received 45 minutes of learning to speak Shuswap almost daily. An immersion model was used where Shuswap was the only language spoken during this period and no attempt was made to translate to or from English. The teaching consisted primarily of learning everyday conversations, action-oriented phrases, numbers, days of the week, the names of common animals, and Shuswap songs. Shuswap has the same five vowels as English and 10 of the same consonants, all of which are represented by the same letters in both languages (a e h i k l m n o p s t w y). Shuswap has 27 phonemes not heard in English and includes whispered phonemes and stops. No attempts were made to teach reading in Shuswap. Estimates of children's Shuswap speaking ability were obtained by having a Shuswap language teacher rate their ability according to a Likert scale developed for the study.

#### *Procedure*

Children were pretested in January for English reading ability (Baron's 1977 reading test), rhyming, phoneme identity, letter-sound knowledge, and phonological working memory and then posttested (10-week interval) with the same measures. Shuswap speaking ability was estimated at the end of the study. All tests were administered individually by a research assistant. Children were randomly assigned from within the classroom to the Rime Strategy ( $n = 11$ ) condition or to the control group ( $n = 10$ ).



### *Tests*

#### *Rhyming oddity*

A version of the rhyme-oddity task used by Bradley and Bryant (1983) was used to measure rhyming. Following Bryant, Maclean, Bradley and Crossland (1990), pictures were added to remove the memory load. The initial letter was changed in seven of the 48 stimulus items to allow for illustrations. None of the rhyming oddity target words were altered.

The test consisted of two practice trials with corrective feedback and then 15 experimental trials without corrective feedback. In each trial the child was given four words with pictures, where three rhymed and a fourth did not (e.g., /fan/, /cat/, /hat/, /mat/). The child's task was to detect the word that did not rhyme and say it back to the researcher.

#### *Phoneme identity*

The Yopp (1988) Sound Isolation test was used to measure phoneme identity. The test measures the ability to identify phonemes in initial, final, and then medial positions. This test had the highest predictive correlation with a subsequent measure of learning to read novel words ( $r = 0.72$ ) with kindergartners.

The test consisted of one practice trial with corrective feedback and then 15 experimental trials, also with corrective feedback. In each trial the child was given a word and then asked to identify the initial, final, or medial sound, with five words for each position. The scores are summed to produce a total score for phoneme identity (maximum score = 15).

#### *Letter-sound knowledge*

Children were presented with two 21 cm × 28 cm cards which listed the letters of the alphabet in alphabetical order in a 2.5 cm sans serif font in lower-case. One card listed the letters from *a* to *o* and the second card listed the remaining letters. Children were asked to provide the sound of individual letters and those who responded with the name of the letter were asked for the sound of the letter.

#### *Phonological working memory*

Phonological working memory was estimated with the Gathercole and Baddeley (1990) Nonword Repetition test. Children were read a list of 40 nonwords that increased in the number of syllables from one to five, with 10 nonwords at each level. Children were asked to repeat the word immediately following each word reading.

*Shuswap speaking ability*

The classroom teacher also taught Shuswap to the children and she was asked to rate children's Shuswap speaking ability on the following 5-point scale: (1) knows less than 10 words, (2) knows more than 10 words but *cannot* carry on a conversation, (3) knows more than 50 words but *cannot* carry on a conversation, (4) knows more than 50 words and *can* carry on a conversation, and (5) fluent speaker.

*Reading tests*

Children were tested for reading with two versions of the same test with both versions using the same reading test words. This first version did not contain reading clues whereas in the second version, children were taught to read two clue words with shared letters representing common rimes before being presented with the reading test words.

In the first version of the reading test, test words were presented one at a time and children were asked if they could say the word (e.g., *bat*, *red*, *bad*, and *bet* in set 1). Testing for reading without reading clues examined whether children were able to use their memories for known words to read unknown words.

In the second version of the reading test, children were taught to read two clue words (e.g., *bed* and *rat* in set 1) and then asked to read the same test words as version 1. Words were presented singly on cards in a 2.5 cm sans serif font in lower-case (e.g., *bat*, *red*, *bad*, and *bet* in set 1). One of the test words rhymed with a clue word. The two clue words remained visible to the child during the attempt to read the test words in this second version of the test.

Test words were organized within four sets for a total of 16 test words (see Table 1). All test words were presented randomly within sets, one word at a time.

The reading test words were designed to indicate whether children were reading using a rime analogy or a letter recoding reading strategy. The rime analogy test words (e.g., *bat* and *red* in set 1) shared a letter representing an onset with one of the clue words and letters representing the rime with the other clue word. Children able to make a rime analogy (e.g., using the knowledge that the common *-ed* spelling pattern represents a common sound) could use this reading strategy to help read the rime analogy test words.

The letter recoding test words (e.g., *bad* and *bet* in set 1) did not share any ending spelling sequences with the clue words and so could not be read using the rime analogy strategy. There are two possible explanations that could account for the reading of the letter recoding test words. First, the children can read these words by recoding individual letters. Second, some letter recoding

Table 1. Reading test sets with reading clues

	Reading clues			
	set 1	set 2	set 3	set 4
	bed	sat	bed	hid
	rat	fin	tug	ram
Reading test words				
Test word type				
Rime analogy	bat	fat	bug	ham
Rime analogy	red	sin	ted	rid
Letter recoding	bad	fan	beg	had
Letter recoding	bet	sit	bud	rim

test words (e.g., *bet* in set 1) made analogies about spelling patterns that cut across the onset-rime (e.g., the clue word *bed* and the test word *bet* both begin with *be-*).

There were four reading test sets in all and sets 1 to 3 were presented in random order. These sets presented new words but had rime endings that were used in the Rime Strategy treatment condition. Set 4 was always presented last and contained new words with untaught rime endings. The set 4 words allowed for an examination of whether children could generalize the use of a rime-based analogy reading strategy to words with unfamiliar rime endings.

#### *Treatment conditions*

The classroom literacy instruction consisted of a variety of daily activities that included story reading, direct teaching in letter sounds, singing songs that contained rhyme, and learning to print their names. As well, common objects around the classroom were labeled and parents were encouraged to read to their children on a regular basis at home.

#### *Rime strategy condition*

In the Rime Strategy condition, children were taught to read new words using a rime-based analogy reading strategy and the implicated prereading skills of initial phoneme identity, rhyming, and letter-sound knowledge. As experience with the rime-based analogy strategy also likely taught the three prereading skills, the decision was made to teach initial phoneme identity, rhyming, and letter-sound knowledge directly as well. These abilities were taught separately and equal time was spent on each of the three prereading skills and the

Table 2. Letters, initial phonemes, rime endings, and words taught in the Rime Strategy condition

Letters	Rime endings			
	-at	-ed	-in	-ug
b		bed	bin	
f		fed	fin	
h	hat			hug
m	mat			mug
r	rat			rug
s	sat			
t			tin	tug

reading strategy over the course of the study. The teaching of the reading strategy is described first.

Children were presented with written words with shared letters representing identical rimes and then taught to recognize the common spellings at the end of these words. All of the letters and rime endings used in the treatment condition are presented in Table 2. This was accomplished by first presenting the children with the two words *hat* and *mat* printed on individual cards in a 2.5 cm sans serif font. While keeping the spelling of the words intact, the researcher pointed to the *at* letters that represented the rime, noted the similarity, and had the children say the /at/ sound. The words were then segmented and blended at the onset-rime boundary. The words *rat* and *sat* were added once the children could successfully read the first two words. The words ending in *ug*, *ed*, and *in* were included over time as children gained in competence.

Appendix A shows a variation of the “Twister” game common to children’s parties. The onsets and rimes in Appendix A were painted onto cardboard sheets that measured 1 metre by 1.3 metres. In this game, after the researcher was confident that children could read at least two words (typically *hat* and *mat*), the researcher said a word (e.g., /hat/) and the child would place one foot on the *h* and the other on *at*. That child would stay in place as the researcher said a different word (e.g., /mat/). The second child would place one foot on the *m* and another on the *at*. The game would continue until all children were standing on the floor mat. New words were added to the game as children gained competence. Children were encouraged to help each other and most groups did so frequently and with apparent enjoyment.

The children were taught in small groups ( $n = 2$  to 3) twice a week for about 25 minutes per session in a room adjacent to the classroom. The sessions were presented by a researcher who was not of First Nations ancestry. Sessions began with 2 or 3 minutes of teaching directed to the group and to individual children. All teaching sessions, for both the reading strategy and the three prereading skills, were followed by playing a game that provided practice with the skill just taught (see Appendices A to D).

Three games were designed to provide practice with the rime-based analogy reading strategy and for each of the three prereading skills, for a total of 12 games. All of the games were piloted prior to being used in this study. Only those games that children appeared to find interesting and enjoyable were retained for this study. Children's comments on the games were solicited as well to help determine their level of interest.

As a result of pilot, all games that contained a competitive element (e.g., children advanced individual tokens on a game board for a correct answer) were dropped for two reasons. First, children often helped and encouraged one another in the cooperative games but not in the competitive games. In fact, a few children appeared to intentionally lead others to incorrect responses in competitive games. Second, some children with weaker skills became discouraged with the competitive games but not with the cooperative ones. In all, four games were dropped as a result of the pilot and all the games were revised.

All games in the current study were cooperative in nature and the group as a whole benefited from individual success. For example, one token that represented the group was moved around a game board rather than having children compete with personal tokens. Children took turns while playing the games and this allowed for further individual instruction. Responses to the game items were always voluntary and children could pass their turn if they wished, although this rarely occurred. Children were encouraged to help and praise each other and they often did so.

Children were given hand puppets when playing the games and the use of the puppets coupled with the variety of games (12 in total) helped to retain interest in the sessions. Classroom teachers indicated that the students actively looked forward to the sessions and there were frequent requests from other students to attend.

Initial phoneme identity was taught by having children listen for the initial sound in spoken words that had common initial phonemes (e.g., /hat/, /horse/). Children were also shown illustrations of familiar objects (e.g., bed, ball, fish, fan) and asked to group objects that were represented by words with the same initial phonemes. Appendix B shows the illustrations of some of the cards that were used in the grouping game. The initial phoneme sounds were

introduced singly over time in the following order (h, m, r, s, t, b, f). This order matched the initial sounds of the words used in the rime analogy strategy games. Consistent with the teaching of the reading strategy, the brief direct teaching was followed by playing one of the three initial phoneme games for practice and additional individual instruction.

To teach rhyming, children were given experience listening for the common endings of spoken rhyming words and in generating rhyming words. They were also presented with illustrations of common objects (e.g., hat, mat, mug, rug) and asked to group or identify objects that were represented by words that rhymed. As with the other skills, the teaching was followed by playing one of the three games designed to practice and teach rhyming skills (see Appendix C).

The illustration in Appendix C was painted onto a 1 metre by 1.3 metre sheet of cardboard. Children were told the name of the illustrations (i.e., /bug/, /bat/, and /fin/). Then, the researcher demonstrated the game by saying a word that rhymed with an illustration (e.g., /hug/) and jumping on the word that rhymed with /hug/ (i.e., /bug/). The researcher repeated the words /hug/ and /bug/ to draw attention to the rhyming words and children were told that the words rhymed. After several similar examples for each illustration, the researcher said a word that rhymed with the name of the illustration and children took turns jumping on the picture. They were asked to repeat the two rhyming words as they stood on the illustration.

Children were taught seven letter-sounds (h, m, r, s, t, b, f) and the letters were presented in the same order as the initial phoneme identity sounds. The letters *h* and *m* were introduced first and the remaining letters were added over time. Visual cues generated by the child or the researcher were used as memory aids (e.g., *f* looks like a flower). Following a brief period of teaching, children played one of the three letter-sound games designed for the study. In one game, for example, a sheet of cardboard with the seven letters printed in a 7.5 cm sans serif font was placed on the floor (see Appendix D). Children took turns jumping onto the letter that represented the letter-sound spoken by the researcher.

#### *Control condition*

Children in the control group were read stories in small groups ( $n = 2$  to 3) twice a week for about 25 minutes per session and were encouraged to discuss the stories interactively with the research assistant. This was seen as preferable to a no-contact control group as children in the Rime Strategy group were involved in extensive interactive discussions while playing the games. Children took turns selecting story books from the classroom or from those provided by the researcher. As much as possible, the books in the

Table 3. Correlations among pretests in experiment 1 after controlling for age ( $n = 21$ )

Variable	2	3	4
1. Letter-sounds	0.57**	0.71***	0.69***
2. Rhyming	—	0.50*	0.65**
3. Phoneme identity		—	0.52*
4. Working memory			—

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

classroom and those shown to the children by the researcher were by First Nations authors (e.g., 'A Salmon for Simon', Waterton & Blades 1990) and several reflected the Shuswap culture (e.g., 'Coyote as the Sun and Other Shuswap Legends', Secwepemc Cultural Education Society 1993).

## Results

Table 3 shows the correlations among the pretest scores for experiment 1 after controlling for age. Caution should be taken when interpreting these correlations because of the small sample size ( $n = 21$ ). The pretest measures appeared to be normally distributed (skewness  $< 1.00$ ) with the exception of phoneme identity, where 10 children (48%) could not identify phonemes. The strong relationships among all the measures are notable. In particular, letter-sound knowledge was very highly related to rhyming, phoneme identity, and phonological working memory.

Children were taught in sub-groups within treatment conditions ( $n = 2$  or 3) and even though most of the teaching was individual, there is a question of nonindependence among observational units. On this point, Hopkins (1982) concluded:

The common recommendation to use group means where there may be nonindependence among observational units is unnecessary, unduly restrictive, impoverishes the analysis, limits the questions that can be addressed in a study, and does not insure that the relevant independence assumption has been met. (p. 17).

Hopkins recommended addressing the unit of analysis question directly by including both individual scores and sub-group means in the analysis, testing for a significant sub-group by treatment interaction effect, and then using individual scores if this interaction is not significant. This procedure was followed in the analyses for prereading skills and reading and the sub-group

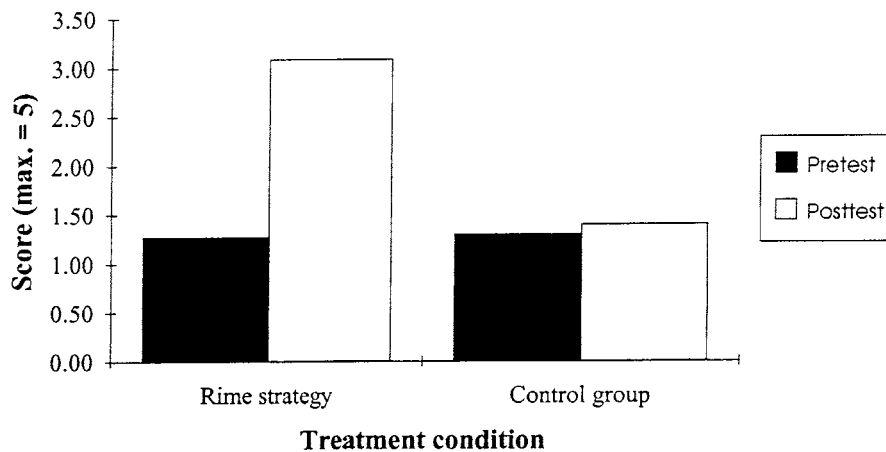


Figure 1. Treatment effects on final phoneme identity in experiment 1.

by treatment condition interaction effect was not significant in all analyses (all  $ps > 0.05$ ). As a result of these analyses, the findings reported here use individual scores as the unit of analysis.

#### *Experiment 1 treatment effects on prereading skills*

Treatment effects on prereading skills and phonological working memory were analyzed using a separate analysis of covariance for each measure, with the pretest score serving as the covariate and treatment condition (Rime Strategy, Control) as the between subject variable. An independent samples  $t$  test found that the groups did not differ on the prereading skills measured at the pretest, all  $ps > 0.05$ . The analysis of covariance results are presented in Table 4.

There were significant increases in initial phoneme identity, rhyming, and letter-sound knowledge for children in the Rime Strategy condition over children in the control group. These findings were not particularly surprising as these skills had been directly taught. However, this was evidence that these prereading skills are amenable to instruction with young children through playing cooperative games that they find enjoyable.

Importantly, children in the Rime Strategy group also made significant gains in *final* phoneme identity over the control group, an ability not taught directly in experiment 1 (see Figure 1). A possible explanation is that final phoneme identity is causally linked to one or more of the prereading skills that increased over the study or to the development of reading. Unfortunately, the sample of the study was not large enough to perform predictive analyses that could clarify this question.



Table 4. ANOVA results for prereading skills in experiment 1

Variable	Treatment condition		MSE	F	Eta <sup>2</sup>
	Rime Strategy M(SD)	Control M(SD)			
<b>Rhyming</b>					
Pretest	7.00(3.63)	6.50 (3.89)			
Posttest	9.55 (4.32)	6.80 (3.45)			
Adjusted	9.31	7.03	3.32	8.16**	0.31
<b>Initial phoneme</b>					
Pretest	3.18 (2.09)	1.80 (2.04)			
Posttest	4.36 (1.29)	2.20 (2.10)			
Adjusted	3.93	2.63	1.36	5.80*	0.24
<b>Medial phoneme</b>					
Pretest	0.64 (0.92)	0.40 (0.70)			
Posttest	2.45 (1.97)	1.30 (2.16)			
Adjusted	2.23	1.53	1.89	1.35	0.07
<b>Final phoneme</b>					
Pretest	1.27 (1.49)	1.30 (2.16)			
Posttest	3.09 (1.76)	1.40 (2.27)			
Adjusted	3.10	1.38	1.73	8.92**	0.33
<b>Total phoneme</b>					
Pretest	5.00 (3.58)	3.30 (4.60)			
Posttest	9.91 (4.48)	4.80 (6.46)			
Adjusted	8.93	5.78	8.43	5.87*	0.25
<b>Letter-sound</b>					
Pretest	9.27 (7.35)	8.70 (9.38)			
Posttest	15.91 (8.43)	10.70 (9.45)			
Adjusted	15.62	10.99	9.14	12.29**	0.41
<b>Working memory</b>					
Pretest	26.30 (5.44)	27.00 (5.96)			
Posttest	27.60 (4.79)	28.33 (6.21)			
Adjusted	27.91	28.02	4.96	0.01	0.00

Note. Maximum scores for rhyming = 15; initial, medial, and final phoneme = 5; total phoneme = 15; letter-sound = 26; working memory = 40.

\*p < 0.05; \*\*p < 0.01.

Table 5. Treatment effects on reading with and without reading clues in experiment 1

Reading test word type	Treatment condition	
	Rime Strategy <i>M(SD)</i>	Control <i>M(SD)</i>
Rime analogy		
No clues	3.27 (2.97)	1.30 (2.21)
With clues	4.91 (2.39)	1.50 (2.59)
Letter recoding		
No clues	2.36 (2.66)	0.40 (0.70)
With clues	2.00 (2.19)	0.60 (0.97)

Note. Maximum score = 5.

Children in the Rime Strategy condition did *not* make significant gains in either medial phoneme identity or phonological working memory over children in the control group. A possible explanation is that identifying phonemes in medial positions is more difficult than identifying phonemes in either initial or final positions (Vandervelden & Siegel 1995; Walton 1995; Yopp 1988) and children may require more experience than was provided by the study to develop this skill.

The increase in phonological working memory for the Rime Strategy condition was not statistically significant (pretest  $M = 26.30$ , posttest  $M = 27.60$ ). This finding was surprising because of the high relationships between phonological working memory and the other prereading skills measured at the pretest (see Table 3) and the subsequent large increases in several prereading skills and in reading. A possible explanation is that a minimum level of phonological working memory is needed for the development of these important prereading skills but that the relationship is not reciprocal over time. Alternately, the lack of a strong increase in phonological working memory can be interpreted as a lack of transfer between the reading of one-syllable words and the oral memory of multisyllable words (i.e., nonword repetition task).

#### *Experiment 1 treatment effects on reading*

The rime analogy and letter recoding reading scores within treatment conditions are presented in Table 5. Treatment effects on reading were examined using a  $2 \times 2 \times 2 \times 4$  (Treatment Condition  $\times$  Wordtype  $\times$  Reading Clues  $\times$  Set Order) repeated measures ANOVA. Treatment condition (Rime Strategy,

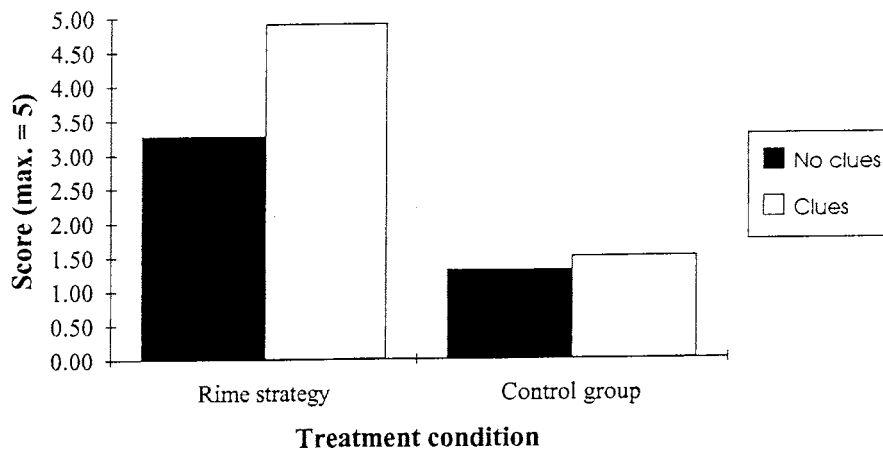


Figure 2. Treatment effects on reading rime analogy test words in experiment 1.

Control) was a between subject variable and reading clues (No, Yes), word type (Rime Analogy, Letter Recoding), and set order (Sets 1–4) were within subject variables.

The reading analyses resulted in a significant main effect for treatment condition,  $F(1, 19) = 6.48, p < 0.02, MS_e = 15.45$ , with children in the Rime Strategy group reading significantly more words ( $M = 12.55, SD = 9.06$ ) than children in the control condition ( $M = 3.80, SD = 6.27$ ). The significant main effect for reading word type,  $F(1, 19) = 17.72, p < 0.0001, MS_e = 2.33$ , was evidence that children read more rime analogy test words ( $M = 5.62, SD = 5.50$ ) overall than letter recoding test words ( $M = 2.76, SD = 3.75$ ).

The important three-way interaction for treatment condition, reading word type, and reading clues was significant,  $F(1, 19) = 6.03, p < 0.03, MS_e = 0.87$ . Post hoc inspection (Newman-Keuls) indicated that the Rime Strategy group read more rime analogy and letter recoding test words than the control group, both with and without clues. Providing reading clues resulted in increased rime analogy test word reading for the Rime Strategy group but not for the control group (see Figure 2). Children in the Rime Strategy group had the most success reading rime analogy test words with reading clues ( $M = 4.91, \text{max.} = 5$ ) compared to without reading clues ( $M = 3.27$ ), and less success reading letter recoding test words.

Of particular theoretical interest is that even though children in the Rime Strategy group were *not* taught to read by recoding individual letters, 7 of the 11 children read letter recoding test words both with reading clues ( $M = 2.00, SD = 2.19$ ) and without them ( $M = 2.36, SD = 2.66$ ). The reading of letter recoding test words by the control group did not differ significantly from zero (see Figure 3). These findings were evidence that the ability to read by

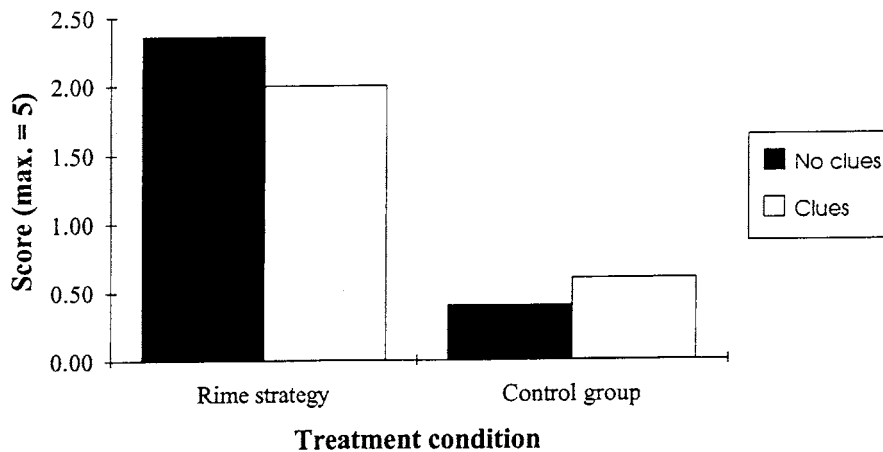


Figure 3. Treatment effects on reading letter recoding test words in experiment 1.

letter recoding can develop as a result of experience with a reading program based on the use of rime-based analogies.

Regarding the use of reading clues, children in the Rime Strategy group read equal numbers of letter recoding test words with or without clues. This suggested that children could not or simply did not use the clues for the letter recoding test words. However, children were more successful reading rime analogy test words when reading clues were present. An explanation consistent with Ehri (1995) is that the presence of the reading clues may have supplemented incomplete memories of spellings for rime endings. Unfortunately, the sample of children who read letter recoding test words (10 of 21 children) was insufficient to perform analyses that could identify the best prereading skill predictors of letter recoding ability.

An alternative explanation for the increased reading of rime analogy words over letter recoding test words is that a letter recoding strategy was used to read all test words and children were more successful with the rime analogy words because they contained the same rime endings used in the Rime Strategy condition. Thus, although the test words were unfamiliar, the practice of letter recoding the same rime endings used in the teaching could explain the increased reading of the rime analogy test words over letter recoding test words. This question can be tested empirically using the set 4 reading test words. The reading test words in set 4, unlike sets 1 to 3, had rime endings not taught in the Rime Strategy treatment condition. If the above alternative explanation is correct, children would be more successful reading the rime analogy test words in sets 1 to 3 than the set 4 words, as these last words contained unfamiliar rime endings. The  $2 \times 2 \times 2 \times 4$  (Treatment Condition  $\times$  Wordtype  $\times$  Reading Clues  $\times$  Set Order) repeated measures

ANOVA indicated that set order and the interactions with set order were not significant, all  $ps > 0.05$ , so that children read equal numbers of rime analogy test words across sets. This finding, coupled with the previous result that children read more rime analogy than letter recoding test words, was evidence against the view that children used the letter recoding strategy to read all test words.

#### *Generalizing reading strategies*

The reading test words in set 4 had rime endings not taught in the treatment conditions whereas the rime endings in sets 1–3 were taught. This allowed for an examination of whether children could generalize the use of the rime-based reading strategy to words with unfamiliar rime endings. If children were able to generalize this reading strategy, the number of rime analogy test words read in set 4 would equal the number of these words read in sets 1–3. The  $2 \times 2 \times 2 \times 4$  (Treatment Condition  $\times$  Wordtype  $\times$  Reading Clues  $\times$  Set Order) ANOVA indicated that set order and the interactions with set order were not significant, all  $ps > 0.05$ , and so children read equal numbers of reading test words across sets within word types. This finding supports the view that children in the Rime Strategy condition could generalize the rime-based analogy reading strategy to words with unfamiliar rime endings.

#### *Experiment 1 summary and conclusions*

Children in the Rime Strategy group made significant increases in the prereading skills of rhyming, initial and final phoneme identity, and letter-sound knowledge compared to those in the control group. These findings support the effectiveness of the rime-based reading program for teaching these important prereading skills. However, children did not make gains in medial phoneme identity or phonological working memory.

There were two particularly interesting findings regarding prereading skills. First, the ability to identify final phonemes was enhanced for children who received the rime-based analogy reading program even though this skill was not taught. This was evidence for a link between the prereading skills or reading that developed in the study and identifying final phonemes.

Second, although children in the experimental group made significant increases in many prereading skills and reading, these gains were not accompanied by increases in phonological working memory. This result is consistent with correlation studies that found phonological working memory did not predict reading after controlling for phonological variables (Leather & Henry 1994; McDougall, Hulme, Ellis & Monk 1994), but not with the model of phonological processing described by Gathercole and Baddeley (1990).

Children in the experimental group made significant increases in word reading over the control group and this was evident for reading both the rime analogy and letter recoding test words. Reading was enhanced by providing reading clues for the rime analogy test words but not for reading letter recoding test words. It is important to note that 7 of 11 children in the experimental group also read by letter recoding, a reading strategy specifically not taught in the reading program. Furthermore, all children who read letter recoding test words also read rime analogy test words, but the converse was not always true.

The analysis on set order showed that children read equal numbers of reading tests words across sets, including set 4 that contained words with unfamiliar rime endings. This finding, considered with the analyses on reading, supported two conclusions. First, children used a rime-based analogy strategy to read the rime analogy test words. Second, children were able to generalize the use of the rime-based analogy strategy to read words with unfamiliar rime endings.

## **Experiment 2**

The rime-based reading program was designed for children in the first steps of reading and experiment 1 did not examine its effects when incorporated as part of a complete Grade 1 reading curriculum. The third author recently accepted a Grade 1 teaching position in Bella Bella, a First Nations community located on an island off the west coast of British Columbia, Canada. The people of Bella Bella are primarily Heiltsuk First Nations and have lived in this region for thousands of years. The teacher was experienced with the rime-based reading program from experiment 1 and intended to use it at the start of the year with his Grade 1 students. This provided an opportunity to study the effects of the rime-based reading program when used early in a Grade 1 reading curriculum, and with a group of prereaders who were members of a different First Nations community than experiment 1.

In this case, the rime-based reading program was used daily at the start of the school year as a part of the reading curriculum. The program was phased out over time as children gained competence in reading.

The three research questions examined in experiment 2 were:

- (a) Will a reading curriculum beginning with experience with a rime-based reading strategy and related prereading skills (rhyming, initial phoneme identity, and letter-sound knowledge) enhance reading more than Grade 1 curriculums without this experience?
- (b) Which pretest prereading skills will make independent predictions of later reading achievement?

- (c) Will First Nations language speaking ability be related to the development of reading in English?

### *Method*

#### *Participants*

The results are reported for 18 Grade 1 Heiltsuk First Nations children from Bella Bella and 42 Grade 1 children from a small city in the interior of British Columbia. The Heiltsuk First Nations children were from the Grade 1 classroom and all 19 children in the class participated in the study. One child was not First Nations and his results are not reported here. The average age of the remaining 18 children (7 girls and 11 boys) was 6 years, 8 months ( $SD = 3.93$ , range = 6 years, 2 months to 7 years, 2 months). None had known language or cognitive impairments.

The 42 children from the interior city were solicited from four Grade 1 classrooms in four different schools and served as a comparison group. Two schools were located in low socioeconomic areas of the city and two schools were in high socioeconomic areas, a selection procedure intended to increase the representativeness of the comparison group. The average age of these 42 children (23 girls and 19 boys) was 6 years, 9 months ( $SD = 3.94$ , range = 6 years, 1 months to 7 years, 6 months). These children all spoke English as a first language and none had known language or cognitive impairments. Reading ability was tested concurrently in January and late February with the Heiltsuk children using the same test.

English was the first language of the Heiltsuk children, all of whom received 30 minutes instruction daily in speaking but not in reading Heiltsuk. The teaching consisted primarily of descriptions of types of weather, the calendar, numbers to 100, action-oriented phrases, and labeling words for family, clothing, and body parts. Heiltsuk uses only three of the vowels used in English (a, u, and i) and 17 consonants, all of which are represented by the same letters as in English. The Heiltsuk alphabet has four letters not in the English alphabet and includes plain, aspirated, and glottalized sounds in both high and low tones.

#### *Procedure*

The 18 Heiltsuk Grade 1 children were screened in September for reading ability using Baron's 1977 reading test (all children tested were prereaders) and pretested for rhyming ability, phoneme identity, and letter-sound knowledge using the same tests as in experiment 1. They were posttested in late January and early February (18-week interval) for reading with the 16 reading test words from experiment 1 presented without reading clues (see Table 1).

Time constraints did not allow for collecting posttest data in January on prereading skills.

The 42 children from the interior were tested for reading ability and prereading skills in late January and early February. The lack of prereading skills data for the Heiltsuk children in January precluded analyses comparing these skills for the interior and Heiltsuk groups.

Estimates of Heiltsuk speaking ability were obtained at the posttest by having a Heiltsuk language teacher rate their speaking ability according to the same scale used with the Shuswap children in experiment 1. None of the Heiltsuk children were fluent or could carry on a conversation in Heiltsuk. All but one child knew more than 10 words and five children knew over 50 Heiltsuk words.

#### *Reading curriculum for Heiltsuk children*

The reading curriculum for the Heiltsuk children from September to January included experience with the games for experiment 1 (initial phoneme identity, rhyming, letter-sound knowledge, and rime analogy reading strategy) as well as story reading and learning sight words. Children received approximately 45 minutes of daily teaching with the experiment 1 materials. The first 20 minutes typically included the teacher saying and writing a rime (e.g., *-at*) and then having the students verbally repeat and then write the rime on small chalkboards given to each of the children. The same method was then repeated adding the initial letter-sounds. When the directed teaching was over, the children were asked to generate rhyming words using the letter-sounds and rime endings they were just taught. Peer interaction at this time was encouraged.

These activities were followed by having the students play the group games described in experiment 1. Initially, the children were taught the nine letter sounds f, h, l, m, n, p, r, s, t and the rime *-at*. The rimes *-ug* and *-in* were added after children had mastered making words with the nine letters and the *-at* rime. New letter-sounds were added later but only after children had mastered making words with the *-at*, *-ug*, and *-in* rime units.

The children were read stories approximately three to four times a week for 10 to 15 minute intervals. Children took turns choosing the books for story reading from the class library and were encouraged to choose books containing rhymes (e.g., 'Green Eggs and Ham' by Dr. Seuss). During the reading of these books, the teacher directed the students to notice the common spellings that represented common rime endings and the similarities in sound. Children were also taught sight words for one or two minutes daily. Sight words were presented to the class and they were asked as a class to say the words back to the teacher.



Table 6. Effects of First Nations language speaking ability on reading after controlling for age and treatment group membership (n = 39)

Variable	$R^2$ added
Age	0.389***
Treatment group membership	0.192***
First Nations language ability	0.032 ns

Note.  $R^2$  total = 0.613.

\*\*\* $p < 0.001$ .

#### *Reading curriculum for interior children*

The 42 children from the interior city were drawn from four different Grade 1 classrooms from four separate schools. The reading programs varied but all four programs contained elements of whole language and phonics programs such as extensive story reading, the use of context clues, and direct teaching in letter-sounds and sight words. The interior Grade 1 children were tested for reading with the same 16 reading test words, without reading clues, used to test the Heiltsuk children.

#### *Treatment effects on reading in experiment 2*

Treatment effects on reading were examined with an independent samples  $t$  test using the reading test words presented without reading clues as the outcome variable. The average reading score was 12.83 ( $SD = 4.91$ , maximum = 16) for the Heiltsuk children and 5.88 ( $SD = 6.26$ ) for the interior children, a significant difference,  $t(58) = 4.17$ ,  $p < 0.001$ . This was evidence that a Grade 1 reading curriculum that included experience with a rime-based reading strategy and related prereading skills (rhyming, initial phoneme identity, letter-sound knowledge) was more effective than one without this teaching.

#### *First Nations language speaking ability*

To examine relationships between First Nations speaking ability and the development of reading in English, a regression analysis was performed. The Heiltsuk sample was too small on its own to justify this analysis and so the Shuswap children from experiment 1 were included as well.

A fixed-order multiple regression analysis was performed with treatment group membership (coded as two dummy variables) and age entered first, and First Nations language speaking ability entered last. Reading without reading clues was the outcome variable. This procedure could determine if First

*Table 7.* Testing the independent contribution of prereading skills to reading after controlling for age and treatment group membership ( $n = 39$ )

Pretest variable	Beta
Age	0.029
Dummy 1 <sup>a</sup>	0.540***
Dummy 2	0.326*
Letter-sounds	0.231*
Phoneme identity	0.079
Rhyming	0.318*

*Note.* All Betas are standardized weights.

<sup>a</sup>Dummy variables represent treatment group membership.

\* $p < 0.05$ ; \*\*\* $p < 0.001$ .

Nations language speaking ability contributed to reading after controlling for the effects of age and treatment group membership. The results are presented in Table 6.

Table 6 shows that First Nations speaking ability did not make a significant contribution to reading after controlling for age and treatment group membership.

#### *Prereading skill predictions of reading*

The prereading skills of rhyming, phoneme identity (initial, medial, final), and letter-sound knowledge were measured prior to children being given the rime-based reading program in both experiments 1 and 2. This allowed for an examination of predictive correlations between prereading skills and later reading. The scores from both experiments were combined to provide for more stable estimates ( $n = 39$ ). Word reading without clues was the only reading test given to the Heiltsuk children and this measure served as the outcome variable. Age, treatment group membership (coded as two dummy variables), rhyming, letter-sound knowledge, and total phoneme identity were entered concurrently into a regression equation to predict reading. This stringent analysis can determine if any single variable makes an independent contribution to later reading while controlling for the effects of all other variables entered in the regression equation. The results are presented in Table 7.

The prereading skills of rhyming and letter-sound knowledge each made independent contributions to later reading, a finding consistent with previous longitudinal research (e.g., Bradley & Bryant 1983) that measured these skills

with prereaders. As rhyming is primarily associated with the analogy reading strategy, this result also supports the view that children may have used a rime-based analogy to read test words.

The finding that phoneme identity was *not* related to reading after controlling for the other variables was surprising indeed. This result runs counter to the majority of similar research where phonemic measures typically are the *best* predictors of beginning reading (e.g., Johnston et al. 1996; Nation & Hulme 1997; Vandervelden & Siegel 1995; Walton 1995). Two possible explanations for this finding are considered here. First, pretest scores were used as predictors and 15 children (39%) could not identify phonemes at that time. *Posttest* phoneme identity scores could very well have proven to be excellent predictors of reading but unfortunately, time constraints precluded posttesting for prereading skills with the Heiltsuk children. Still, after controlling for the effects of treatment group membership and age ( $R^2 = 0.58$ ), the three pretest prereading skills accounted for a large additional proportion of the variation in reading ( $R^2 = 0.20$ ). A second possible explanation of the lack of a significant relationship between phoneme identity and later reading is that children were taught to read using a rime-based analogy strategy that favoured rhyming. If the type of literacy instruction received influences the use of particular prereading skills, this result is predicted.

#### *Experiment 2 summary and conclusions*

The Heiltsuk children made significant reading gains compared to the interior children and the major difference in the reading curriculums was that the Heiltsuk children began with the rime-based reading program from experiment 1. However, a caution is in order. It was not possible to randomly assign children to the Heiltsuk or interior groups and in quasi-experimental designs such as this, there may have been initial differences between the groups that could serve as an alternative explanation to the treatment effects. Still, given the expressed concern from the Bella Bella teachers about historically poor reading achievement with their previous Grade 1 children, it seems unlikely that the Heiltsuk children began the study with significantly higher initial prereading abilities than the interior children.

Letter-sound knowledge and rhyming measured at the start of the study accounted for 20% of the variation in later reading achievement after controlling for the effects of age, treatment group membership and phoneme identity. Surprisingly, phoneme identity was not significantly related to reading and a reasonable explanation is that 15 children (39%) could not identify phonemes on the pretest. Alternately, the rime-based reading program may have favoured the use of rhyming skills over phonemic skills.

First Nations speaking ability did not make a significant contribution to reading after controlling for age and treatment group membership.

## Discussion

### *Treatment effects on prereading skills*

Rhyming ability, initial and final phoneme identity, and letter-sound knowledge increased significantly for children in experiment 1 who received the rime-based phonological reading program compared to the children in the control group. This was evidence that young First Nations prereaders can learn important prereading skills effectively through brief direct teaching followed by playing cooperative games that provide experience with these abilities.

The finding that reading stories to the control group children was less effective in teaching the prereading skills is not surprising because this experience did not teach these skills directly whereas the Rime Strategy program did. Still, there are many excellent reasons for reading stories to children, among them increased cultural knowledge and vocabulary growth (e.g., Arnold, Lonigan, Whitehurst & Epstein 1994). An argument could be made that these factors, especially increased cultural knowledge, are more important than the development of prereading skills and beginning reading achievement. Based on the research of Arnold et al. (1994), increased vocabulary growth would be anticipated in the control children over the Rime Strategy group, although time constraints precluded this examination. There is no need, however, to choose between reading stories to First Nations children *or* to provide them with experiences that will effectively develop prereading skills and reading. Why not provide children with both experiences?

With the exception of the increased ability with final phoneme identity, the development of the other prereading skills in experiment 1 was not particularly surprising as these were taught directly to children in the Rime Strategy group. However, final phoneme identity was not taught and its development is theoretically interesting because it suggests that there is a relationship between a rime-based analogy reading strategy and the later development of an important phonemic skill. The finding that final phoneme identity developed as a result of the rime-based phonological program is consistent with interactive views of the relationship between phonological awareness and beginning reading (e.g., Goswami 1993).

The model of reading proposed by Gathercole and Baddeley (1990) assigns a key role to phonological working memory for the processing

of phonological information. The finding that increases in phonological skills and reading can take place without increases in phonological working memory can be taken into account if (a) a minimum capability of phonological working memory is viewed as being sufficient and that phonological working memory does not develop reciprocally with reading achievement or, (b) if learning to read one-syllable words does not increase the oral memory of multisyllable words.

#### *Treatment effects on reading*

Experiment 1 demonstrated that Shuswap children learn to begin reading words quite easily if they are taught using a rime-based phonological reading program. Ten of the 11 children in the Rime Strategy group read some reading test words ( $M = 12.55$ ) whereas only four of 10 children in the control group read any test words ( $M = 3.80$ ). An interesting teaching implication is that the reading program consisted primarily of playing interactive cooperative games preceded by brief direct teaching, enjoyable experiences that are easily applied to many primary classrooms.

The relative efficacy of the rime-based phonological reading program was demonstrated further in the comparison of the Grade 1 reading curriculums of the Heiltsuk children from Bella Bella and those from the interior city. The Heiltsuk children read more words on average ( $M = 12.83$ ) than children from classrooms in the interior ( $M = 5.88$ ). Eleven of the 18 Heiltsuk children (61%) scored the maximum of 16 on the reading test compared to 7 of the 42 interior children (17%). The ceiling effect for reading in the Heiltsuk group may have concealed an even greater difference in reading between the Heiltsuk and the interior city groups.

Children demonstrated repeatedly that new words were easier to read if a rime-based analogy could be used ( $M = 5.62$ ) than if letter recoding was required ( $M = 2.76$ ). This finding was evidence that most prereaders can easily learn to use a rime-based analogy reading strategy in the first steps of reading.

Reading by recoding individual letter sequences was intentionally not taught in experiment 1 and, surprisingly, 7 of the 11 children in the Rime Strategy group also read test words that required letter recoding. All 7 letter recoders also read rime analogy test words. These important findings supported the view that experience with a rime-based analogy reading strategy also results in the ability to read by recoding individual letters.

As many readers in both experiments could use both the letter recoding and rime-based analogy reading strategies, it is possible that they used these strategies in conjunction. For example, when reading rime analogy test words, children may have used letter recoding to sound out the rime and then used

this information to make a rime-based analogy. The word *mat* could be segmented first as *m-a-t*, and then partially blended as *m-(at)*, so that letter recoding could facilitate the use of the rime-based analogy strategy. The present study cannot determine if children used the rime-based analogy and letter recoding reading strategies in combination.

The reading test words in set 4 contained words with *unfamiliar* rime endings. The finding of the equal reading of rime analogy test words across sets supports the conclusion that children could generalize the use of the rime-based analogy reading strategy to words with unfamiliar rime endings.

Children were more successful reading rime analogy test words when reading clues were present. This finding is consistent with the model of beginning reading developed by Ehri (1995), where the presence of reading clues could supplement incomplete memories of spellings for rime endings. However, children read equal numbers of letter recoding test words with or without reading clues, and so they could not or did not use the clues for these reading test words. Perhaps the information provided by the reading clues was more salient for using the rime analogy strategy than for reading by letter recoding.

#### *Pretest prereading skills and predictions of later reading*

Rhyming and letter-sound knowledge were the only prereading skills to make independent contributions to later reading. The result that phoneme identity did *not* make an independent contribution to reading was particularly surprising, especially given the robust findings in other research that phonemic abilities are typically the best predictors of reading. A possible explanation for this unusual result is that many children were unable to identify phonemes at the pretest and that these abilities likely developed prior to the reading test. Also, the rime-based reading program likely favoured the development and use of rhyming and initial phoneme identity, but not other phonemic skills.

#### **Conclusion**

Consistently, phonological awareness has proven to be an excellent predictor of progress in learning to read and the primary purpose of the study was to examine the effects of a rime-based phonological reading program with two different groups of First Nations prereaders. To the authors' knowledge, this is the first study to examine the effects of teaching reading to prereaders using rime-based strategies and to study phonological awareness as it relates to beginning reading with First Nations children. The general conclusion is

that progress in phonological awareness and word reading can be enhanced in prereaders by adding experience with rime-based strategies to the reading program.

### Acknowledgments

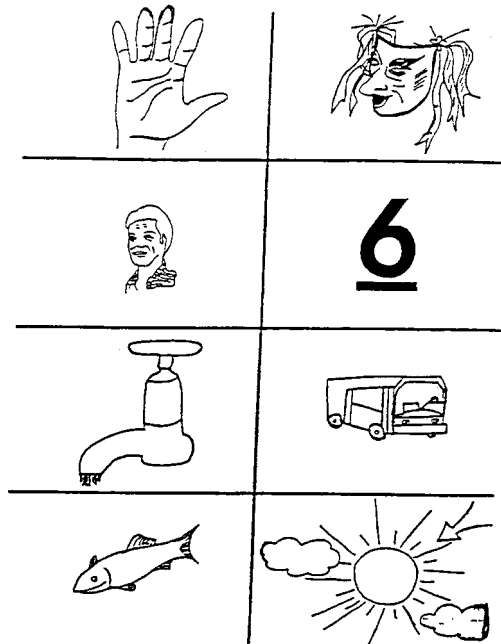
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### Appendix A

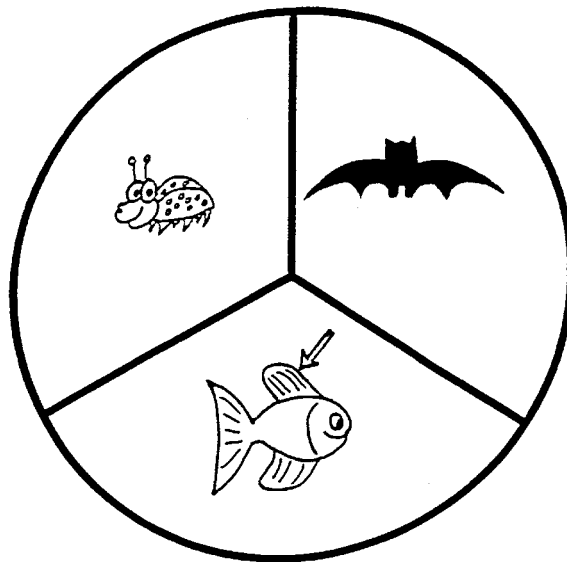
#### Rime-based analogy strategy game

	Word Twister	h	Word Twister
<b>b</b>	<b>ed</b>	<b>m</b>	<b>at</b>
<b>f</b>	<b>in</b>	<b>r</b>	<b>ug</b>
		<b>s</b>	<b>t</b>

**Appendix B**  
**Initial phoneme identity game**



**Appendix C**  
**Rhyming game**





## Appendix D

### Letter-sound game

Letter Sound Jump	<b>b</b>
<b>f</b>	<b>h</b>
<b>m</b>	<b>r</b>
<b>s</b>	<b>t</b>

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