Explicit Phonemic Awareness of Adolescents: Skills at Baseline and Following Brief Instruction

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KEYWORDS. Phonemic awareness, high school, literacy

BRIEF. The purpose of the study was to investigate the explicit phonemic awareness skills of adolescents at baseline and following a brief instructional seminar.

ABSTRACT. Phonemic awareness, the ability to analyze and manipulate individual speech sounds in words, is necessary for learning to decode printed words. The purpose of this study was to contribute to an understanding of the development of phonemic awareness by assessing the skills of typically-developing teenagers at baseline and following an instructional seminar. Three tasks (phoneme segmentation, phoneme matching and phoneme isolation) were used to evaluate the explicit phonemic awareness skills of high school students at each of the four high school grade levels. A few weeks later, a brief instructional seminar on phoneme segmentation was conducted, followed by the re-administration of the phonemic awareness tasks. The juniors and seniors performed better than the other groups on the pretest but for all students baseline scores were relatively low. After the short instructional seminar, all four groups showed significant score increases on the posttest as compared to baseline. The results from this study contribute to an understanding of the development of phonemic awareness skills over the school-aged years. In addition, findings suggest the potential for teachers of reading in the primary grades, found elsewhere to perform unimpressively on explicit tests of phonemic awareness, to similarly benefit from brief instruction.

INTRODUCTION.

Metalinguistic awareness is the ability to analyze the structure of language. One type of metalinguistic skill is phonemic awareness, or the ability to analyze individual speech sounds (i.e., phonemes) in words [1]. The term "explicit" phonemic awareness is used to describe the conscious and deliberate analysis of phonemes for persons who are proficient readers and writers. When learning to read, young children rely on phonemic awareness to decode new words through segmentation of the word's component phoneme parts [2]. Phonemic awareness creates a connection between the speech sounds in words and how these sounds are orthographically represented with letters. Accordingly, phonemic awareness instruction is an important component of early reading instruction [3, 4]. Over time, children become more fluent readers and rely less on decoding (and phonemic awareness), instead using stored orthographic representations from their mental lexicon to quickly recognize words in print [5, 6]. Evidence for this developmental shift comes from findings that adolescent skilled readers do not necessarily do well on phonemic awareness measures [7]. Beyond the early elementary school years, the influence of orthography on the analysis of speech sounds can make it difficult to think beyond print [8]. For example, one must ignore orthography to appreciate that the letter *X* represents two speech sounds, "k" and "s" as in *fox* (/f/ /a/ /k/ /s/). Despite a reliance on mental orthographic representations to read and spell individual words, there may be occasions beyond the elementary school years when the application of a more purely phonemic analysis of words is important. First, previous studies of the role of phonemic awareness in adolescent learning have found that, when learning a second language, students in the late teenage years will rely on phonemic awareness if they lack orthographic knowledge of the second language [9]. Second, the phonemic awareness of elementary school teachers themselves has been found to influence the success of their literacy instruction as measured by student word reading outcomes. This correlation between teacher phonemic awareness and student learning has been reported for normal readers at the kindergarten level [10] and struggling readers through fifth grade [11]. Teachers who rely on orthography may instruct, for example, that "fox" has three sounds instead of four, causing confusion for those students who are at the early stage of analyzing words at the phonemic level. In light of such findings, there is reason to experimentally pursue a better understanding of the nature and progression of explicit phonemic awareness skill beyond elementary-aged readers.

Prior studies of explicit phonemic awareness in typical adolescents are equivocal with regard to whether this skill peaks around grade 7 and then plateaus throughout high school [7] or then slowly declines throughout high school [12]. A model previously published by our group [13] displays what we believe to be the succession of phonemic awareness for words stored in our lexicon and those which do not exist in our lexicon (see Figure 1). For both types, before the time when the foundation of reading and writing is attained there is a steep incline in phoneme segmentation accuracy. Upon attainment of reading and writing fluency, there is posited to be a slight gradual decline for the words not in our lexicon, whereas for the words in our lexicon, phonemic segmentation accuracy sharply declines before plateauing. Overall, this model captures the hypothesis that phonemic awareness skills may decline the further removed the student is from the early elementary years as such skills are progressively less likely to be actively recruited to accomplish word reading tasks. Over time, much like the fate of other acquired skills like juggling that are not practiced, it could be the case that lack of use results in a decrease in phonemic awareness competence [7]. It is reasonable to predict that the reintroduction of practice, for example, as part of brief "reminder/brush up" training, would result in a return of competence.

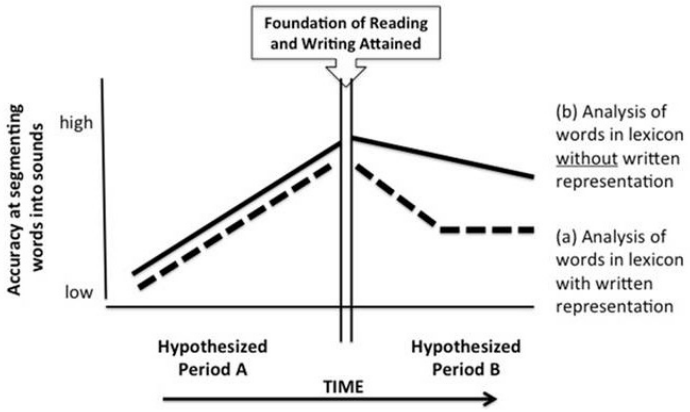


Figure 1. Model of theorized phonemic segmentation accuracy by lexical representation word type over time [13].

The purpose of this study was to examine the explicit phonemic awareness of typical adolescents to better understand how students analyze sounds in words across childhood. Two research questions were asked:

1. Are there baseline developmental differences in explicit phonemic awareness skills between high school classes?

2. Do the explicit phonemic awareness skills of adolescents improve following a brief instructional seminar on phonemic segmentation?

MATERIALS AND METHODS.

Participants.

Participants (N = 87) were recruited from four classes of high school students enrolled in the School for Science and Math at Vanderbilt (SSMV; Freshmen = 17,

Sophomore = 23, Junior = 24, Senior = 23). SSMV students are enrolled in Metro Nashville Public Schools and are admitted to SSMV based on a competitive application (i.e., high grades and test scores in science and mathematics). Based on participant's enrollment in SSMV, we assumed that all study participants were typical adolescents without reading impairment. The participant sample should be considered a convenience sample rather than a random sample.

Measure.

At both baseline and immediately following the brief instructional seminar, participants were group administered a pen and paper test of phonemic awareness adapted from Moats [14] and used by Spencer and colleagues [15, 16]. The test was created to tap the explicit phonemic awareness of literate adults. To be successful on this test, participants must think beyond the letters comprising a word to consider a word's phonological makeup [8]. The test was comprised of three subtests: phoneme segmentation, phoneme identification, and phoneme isolation (see examples in Figure 1 in Supporting Information). Participants received individual subtest scores as well as a total score, which was the sum of the three subtest scores.

In the phoneme segmentation subtest, students were asked to count the number of sounds perceived in words which varied both in number of phonemes and transparency of letter-sound correspondences. For example, in the word *bat* there are 3 letters and 3 phonemes but in *box* there are 3 letters and 4 phonemes. Bat-type words (n = 11) were grouped together as "easy" due to their grapheme-phoneme (letter-sound) transparency. Box-type words (n = 10) were grouped together as "hard" due to their grapheme-phoneme opaqueness (see Table 1 in Supporting Information). For each word participants received 1 point for each correct answer with a maximum of 21 points available

In the phoneme identification subtest, students were asked to note the underlined letter or letter cluster, and then to choose the word or words that included the same sound. For example, participants were given a word such as *weigh*, which would be matched with *raid* because the "a" phoneme is made by the graphemes *ai* and *eigh*. On this subtest there were five target words with four possible matches. Words correctly identified as matching or not matching the target received 1 point for a maximum total score of 20 points.

There were six items in the third subtest, phoneme isolation. Participants were asked: What is the third speech sound in each of the following words? Give a letter that represents the third sound and an example word with the sound circled. The third letter of the word did not always match to the third sound in the word. Each item was scored as correct or incorrect based on the letter and example word provided, and the maximum score was 6 points.

Brief Instructional Seminar.

All participants participated in a single 45-minute group instructional seminar on phonemic segmentation. The seminar was conducted separately for each of the four high school classes. The content and presentation was the same across all four individual seminar sessions. During the seminar, the first author modeled aloud the segmentation of 15 words with the aid of pictures (see Figures 2-13 in Supporting Information). Following this, participants worked in teams of four or five to respond to practice prompts asking for the number of sounds in individual words projected onto a SmartBoard screen via PowerPoint slides. Each team had time to consider and discuss the prompt before submitting a single group response via a handheld wireless "clicker" device through the use of TurningPoint polling software. For example, the students would be asked "How many sounds are in the word *ice*?" After the polling was closed, the software automatically generated a bar graph that showed the distribution of the responses. The first author provided immediate feedback, clearly identifying and counting out the separate phonemes before highlighting the correct answer. There were 30 practice phoneme segmentation items (see Table 2 in Supporting Information). The words used in the instructional and practice portions, while sharing some of the same general phonological patterns of words from the pre/posttest, were themselves different from those that appeared in the pre and posttest. No data from the practice items were stored or used for further analysis after the seminars. Immediately following the conclusion of the brief seminar, the first author re-administered the phonemic awareness measure used at pretest.

RESULTS.

Pretest.

The first research question was: Are there developmental differences in explicit phonemic awareness skills between high school classes (freshmen, sophomores, juniors, seniors)? An ANOVA indicated a main effect of group on total pretest score, $F(3, 83) = 3.70$, $p = .02$. Post hoc comparisons using the Tukey-Kramer HSD test revealed that the junior class (Mean = 26.54, $SD = 6.18$) scored significantly higher than the freshmen (Mean = 21, $SD = 5.45$) on the total score ($p = .04$). There were also significant group differences for two of the three subtests: phoneme segmentation, $F(3, 83) = 2.98$ ($p = .04$) and phoneme isolation, $F(3, 83) = 6.16$ ($p < .001$). Post hoc comparisons showed that for phoneme segmentation, the junior class (M = 8.91, $SD = 5.06$) scored significantly higher than the freshmen class (M = 4.29, $SD = 4.30$; $p = .04$) and that for phoneme isolation, the senior class (M = 2.83, $SD = 1.11$) scored significantly higher than both the sophomore (M = 1.69, $SD = .87$; $p = .001$) and freshmen (M = 1.82, $SD = .63$; $p = .01$) classes. There were no group differences on phoneme matching.

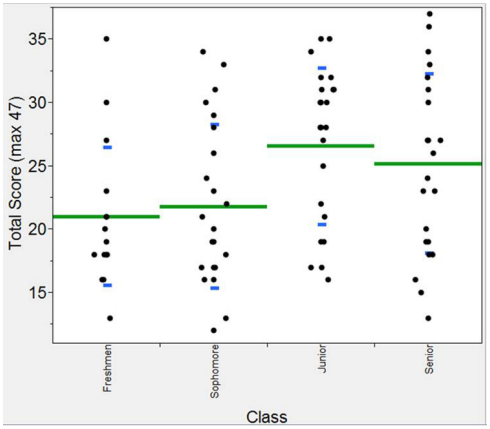


Figure 2. Pretest total score by group (green and blue lines represent group means and standard deviations, respectively).

Posttest.

On average, there were 41 ± 11 days between the pretest and posttest. Recall that the format and specific items on the pretest and posttest were identical. Because of the extent of time between the testing dates, participants were unlikely to recall specific test items. As such, any score increases from pretest to posttest are likely attributable to the instructional seminar. However, due to circumstances such as late receipt of parental consent and absences, nine participants took both tests on the same day. Of these, one was a senior, three were juniors, two were sophomores, and the three were freshmen. These nine participants completed the pretest immediately prior to the instructional seminar, after which they completed the posttest with the rest of the participant group. The change from pre- to posttest scores of the nine participants taking the pretest and posttest on the same day were grouped together and compared against the rest of the participants (n = 78) to determine whether there was a familiarity advantage for those taking the test twice on one day. The change in pretest to posttest scores did not significantly differ between these two groups (total score: $p = .29$; phoneme segmentation: $p = .18$; phoneme matching: $p = .13$; phoneme isolation: $p = .35$).

As shown in the far right column of Table 1, when all participants were grouped together there were significant increases in the scores for each of the subtests as well as the total score. Additionally, the change scores for each of the four separate classes were significant for the total score as well as the phoneme segmentation and phoneme isolation subtests. Only the sophomore class, however,

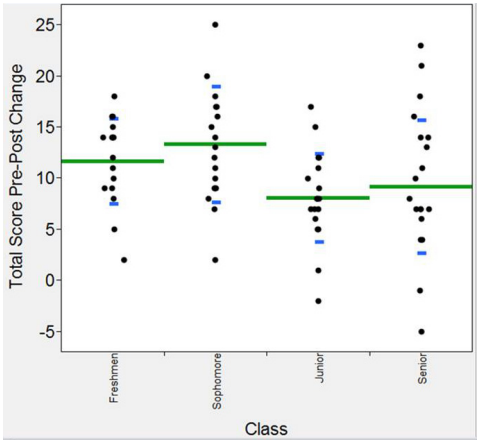
demonstrated significant improvement on the phoneme identification task.

Table 1. Performance on the posttest measure of phonemic awareness skill and the change between pretest and posttest scores.

Subtest	Freshmen (n = 17)		Sophomore (n = 23)		Junior (n =24)		Senior (n = 23)		All Participants (N = 87)	
	Post-test Mean (SD)	Change Mean (SD)	Post-test Mean (SD)	Change Mean (SD)	Post-test Mean (SD)	Change Mean (SD)	Post-test Mean (SD)	Change Mean (SD)	Post-test Mean (SD)	Change Mean (SD)
Phoneme Segmentation (max 21)	13.41 (3.06)	+9.12** (4.75)	15.87 (2.94)	10.13** (5.82)	15.04 (2.74)	+6.21** (4.59)	14.69 (2.55)	+7.22** (5.01)	14.87 (2.88)	+8.08** (5.23)
Phoneme Identification (max 20)	15.70 (2.26)	+0.82 (1.67)	15.22 (1.93)	+0.87* (1.63)	15.29 (2.27)	+0.08 (2.04)	15.26 (2.18)	+0.391 (2.39)	15.34 (2.12)	+0.51* (1.96)
Phoneme Isolation (max 6)	3.53 (1.46)	+1.70* (1.76)	4.00 (1.38)	+2.30** (1.33)	4.21 (1.44)	+1.79** (1.28)	4.39 (1.23)	+1.56* (1.67)	4.06 (1.38)	+1.85** (1.50)
Total (max 47)	32.65 (4.94)	+11.6** (4.18)	35.09 (4.65)	+13.3** (5.67)	34.62 (5.02)	+8.0** (4.31)	34.35 (4.99)	+9.1** (6.51)	34.28 (4.88)	+10.4** (5.63)

In contrast to the main effect of group found in the pre-test, the four classes did not significantly differ from each other on any of the subtests or the total score at the time of the post-test. The groups differed, though, when considering the magnitude of change from pre- to post-test. An ANOVA indicated a significant interaction between group and total score change from pretest and posttest, $F(3, 83) = 4.5$, $p = .005$ (see Figure 3). Follow up comparisons showed that the increase in total score from pretest to posttest was significantly greater for the sophomore class when compared to the junior ($p = .006$) and senior ($p = .04$) classes. There was also an interaction between group and the degree of change from pretest to posttest on the phoneme segmentation subtest, $F(3, 83) = 2.79$ ($p = .04$). Follow up comparisons indicated that average increase for the sophomore class was significantly greater than that of the junior class ($p = .04$). There were no group differences in the change score on phoneme identification or phoneme isolation subtests.

Figure 3. Pretest to posttest total score change by group (green and blue lines represent group means and standard deviations, respectively).



In addition to the research questions, we were interested in the extent to which improvement was realized on easy words and hard words on the phoneme segmentation subtest. The post-test mean indicated an average improvement of 8 additional correct responses. Significant improvement was observed on both types of words, easy ($p < .001$) and hard ($p < .001$) across all participants and for each word type within each class group. Taken together, these findings suggest that, at the group level, the instructional seminar bolstered skills in phonemic analysis at both the transparent and opaque levels.

DISCUSSION.

Baseline Pretest Performance.

Previous research shows that adolescents who are otherwise skilled readers demonstrate phonemic awareness skills well below ceiling levels [7]. A purpose of this study was to establish if there are noticeable age-related differences in the baseline explicit phonemic awareness skills of high school students. Schuele [13] hypothesized that phonemic awareness skills may steadily decline when students move beyond elementary school. As such, it was predicted that the present study might show an age-related effect favoring performance among the younger high school classes. Results show that age indeed appears to be related, although not in the predicted direction. The juniors and seniors did significantly better than the sophomores and freshmen on the phoneme segmentation and phoneme identification subtests as well as the overall score. The superior performance of the upper classmen runs counter to prior work indicating either a decrease [12] or a plateau [7] in phonemic awareness skill through adolescence. Importantly, the participants in this study were all high school age. Perhaps a developmental advantage in phonemic awareness favoring younger students – that is, those in closer chronological proximity to the early elementary years when phonological analysis of words is more common – could be detectable in a younger group of participants (e.g., middle school students). The superior baseline performance of the upperclassmen could be indicative of advanced explicit phonemic awareness skills when compared to those of the underclassman. Alternatively, it might also reflect the greater experience with test taking or the general relative maturity of the upperclassman.

Pretest to Posttest Change.

Previous research has documented a significant increase in the explicit phonemic awareness abilities of elementary education teachers following participation in a 10-day workshop [11]. The malleability in this population is crucial given the importance of phonemic awareness in children's early literacy acquisition and concerning evidence that teachers themselves tend to have poor baseline knowledge and skill in this area [15,17,18]. The baseline phonemic awareness skills of teachers of primary grades is notably lacking for those words lacking clear sound to letter correspondences. For example, Spencer *et al.* [15] noted that early elementary educators accurately counted the number of phonemes in only 22% of nontransparent "hard" words .

It has been suggested that the development of phonemic awareness in teachers requires extended time and training [19] and will "probably not result from a brief, 1-hour workshop" [15, p. 518]. A purpose of this study was to determine whether explicit phonemic awareness skills might, in fact, improve following a brief 45-minute instructional seminar on phonemic segmentation. Using high school students as a participant pool, it was found that scores on an assessment of phonemic awareness did increase following the brief instructional seminar. Significant growth from pre- to posttest was documented not only on the phonemic awareness task that was practiced during the brief seminar (segmentation), but also on those tasks (e.g., phoneme isolation) that were not directly practiced during the seminar.

To determine whether the explicit phonemic awareness skill change evidenced by the current study participants might inform instructional considerations for teachers, the mean posttest scores of the adolescents were compared to the baseline scores of the educators who participated in the study conducted by Spencer *et al.* [15]. The educators in this study were administered the test of phonemic awareness prior to an instructional workshop, in other words, a "baseline" performance. When the mean total posttest scores of the present study participants were compared to the baseline educator scores from Spencer *et al.*, moderate to large effect sizes favoring the performance of the high school students ($ds = .62 – 1.0$) were calculated. The range of effect sizes reflects separate comparisons to each of the four educator groups reported by Spencer and colleagues: kindergarten teachers, first grade teachers, reading teachers, special education teachers. Effect sizes between the post-test scores of the high school students and the baseline scores of the educators from Spencer *et al.* [15] were even larger when considering only the segmentation subtest ($ds = 1.00 – 1.32$). Notably, the mean overall percent accuracy in segmenting "hard" words on the post-test for the high school students was 55% (as compared to 16% accuracy at pretest). Compare this to the aforementioned 22% educator accuracy in segmenting the same hard words reported by Spencer *et al.* [15]. It is plausible, therefore, to expect a similar increase in explicit phonemic awareness skill

among teachers following a brief instructional seminar comparable to the one utilized in the present study.

LIMITATIONS AND FUTURE DIRECTIONS.

In addition to grade level, there may have been other potential explanatory factors underlying the superior baseline performance of the upperclassman found in the present study. Such factors (e.g., language skill, reading skill, IQ, etc.) were not examined in the present study due to time constraints. Future research studies in this area should therefore be designed to empirically evaluate additional influences on phonemic awareness performance within the adolescent population. In light of findings from prior studies of adolescent phonemic awareness [7,12], we were somewhat surprised to see a general increase in baseline performance at the higher grade levels. It may be the case that a methodological difference between the studies offers some explanation. Whereas the studies cited above employed designs in which the phonemic awareness measures were verbally administered to individual participants, the present study used relied on group administration of paper and pencil measures of phonemic awareness. Limited access to and availability of the participant population dictated such administration in the present study. The influence of phonemic awareness measure modality (e.g., spoken vs. written) may account for some of the differences between the results of this study when compared to the extant literature. Specifically, it may be the case that the upperclassmen's greater academic experience with written tests provided them with an advantage over their younger peers in this modality. Accordingly, future research should directly compare phonemic awareness performance on both spoken and written test modalities within the same group of participants

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SUPPORTING INFORMATION.

Figure S1. Examples items from phonemic awareness subtests
Table S1. Easy and Hard word classifications for phoneme segmentation task
Figure S2-S13. Phonemic awareness instructional seminar slides
Table S2. Practice phoneme counting words during instructional seminar

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