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A Comparison of Service Delivery Models: Effects on Curricular Vocabulary Skills in the School Setting

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The present study evaluated the effectiveness of three service delivery models in the elementary school setting. Differences were investigated between (a) a collaborative approach, (b) a classroom-based intervention model with the speech-language pathologist (SLP) and classroom teachers working independently, and (c) a traditional pull-out model for children in kindergarten through third grade who qualified for speech or language services. The same curricular vocabulary targets and materials were used in all conditions. This study also examined the vocabulary skills of regular education children who participated in the collaborative approach, the independent classroom-based model, or received instruction from only classroom teachers, without the SLP's involvement. Results indicated the collaborative model was more effective for teaching curricular vocabulary to students who qualified for speech or language services than a classroom-based model (teacher-SLP independent) or a traditional pull-out model. The findings for students who were not enrolled in speech or language services indicated the collaborative and classroom-based models increased vocabulary skills to a significantly greater degree than receiving only regular instruction from the classroom teacher. The results are congruent with the theoretical advantages of the collaborative model reported in the literature and support the use of integrated service delivery models for intervention in the school setting.

Key Words: teacher-speech-language-pathologist collaboration, service delivery models, classroom-based intervention, curriculum-based intervention, vocabulary

The introduction of the Regular Education Initiative (REI) (Will, 1986) challenged special educators in the public schools to deliver more services in the regular classroom. The REI has also had an impact on the provision of speech and language services. The optimal service delivery in the literature has shifted from the traditional pull-out model towards a collaborative classroom-based approach. Suggested advantages of collaboration include increasing speech-language pathologists' (SLPs') knowledge about curriculum, increasing teachers' strategies for children with communication difficulties, improving generalization of skills to classroom curriculum, and serving a larger population including "at risk" children who do not qualify for speech or language services (Block, 1995; Cirrin & Penner, 1995; Ebert & Prelock, 1994;

Miller, 1989; Nelson, 1989). The purpose of this study was to assess the effectiveness of the collaborative model for teaching vocabulary compared to both classroom-based intervention without collaboration and the traditional pullout model. Measures of change included the number of words acquired and the level of response for children in kindergarten through third grades.

Classroom-Based Service Delivery Models

Several current service delivery models involve intervention in the classroom setting (e.g., one teach/one observe, one teach/one drift, station teaching, etc.). Although intervention services are delivered within the classroom in these models, the teacher and SLP work primarily in an independent fashion (Elksnin & Capilouto, 1994) with no true collaboration occurring between them. Surveys have indicated these independent classroom-based service delivery models are the most frequently employed. For example, Elksnin and Capilouto (1994) found that approximately three-fourths of SLPs providing services in the classroom used the one teach/one drift model and/or the one teach/one observe model. Beck and Dennis (1997) also found that the one teach/one drift was the most frequently employed classroom-based service delivery model. A survey by Paramboukas, Calvert, and Throneburg (1998) indicated the most-used models were one teach/one drift and the SLPteach model (the classroom teacher was not present in the classroom during the SLP's language lessons). Paramboukas, Calvert, and Throneburg also found that 76% of SLPs providing services in the classroom did not have a scheduled planning time with the classroom teacher. These findings suggest that although SLPs are beginning to enter the classroom, many are not engaging in a collaborative relationship with the teacher as defined by ASHA (1993).

Efficacy of the Collaborative Model

Research investigations to evaluate the effectiveness of collaboration are sparse. Existing studies comparing pullout treatment with collaborative classroom-based services have investigated the language skills of preschool children (Roberts, Prizant, & McWilliam, 1995; Valdez & Montgomery, 1997; Wilcox, Kouri, & Caswell, 1991). Roberts et al. found that the number of turns or language functions did not differ for preschool children in pull-out versus collaborative classroom settings. However, no data were included concerning language skill improvement; therefore, the study did not address the efficacy of in-class versus pull-out treatment. The effectiveness of collaborative classroom-based versus individual pull-out intervention for early lexical acquisition in 20 language delayed preschool children was investigated by Wilcox et al. (1991).

Language-impaired preschool children received 12 weeks of treatment with individual treatment meetings twice weekly for 45 minutes or collaborative classroom intervention meetings once per week for 3 hours. Results indicated that classroom-based and individual treatment were equally effective when evaluating the number of spontaneously produced target words within their assigned context; however, generalization data demonstrated the classroom group produced significantly more target words in their home environment. Valdez and Montgomery (1997) examined the pull-out and

collaborative models with equal treatment times for 40 preschool subjects. The authors reported “no significant clinical differences” (p. 67) as measured by the Clinical Evaluation of Language Fundamentals–Preschool (Wiig, Secord, & Semel, 1991); however, statistical analyses were not used to evaluate the results.

Studies that have examined service delivery for schoolaged children have only compared classes as a whole who have received collaborative services to control classes who did not receive collaborative services. Ellis, Schlaudecker, and Regimbal (1995) evaluated the effects of collaborative consultation on basic concept instruction with 40 kindergarten children from two classrooms. The results indicated the consultative group scored significantly higher on the Boehm Test of Basic Concepts (Boehm, 1986) than the control class, who received the regular education curriculum. Most recently, Farber and Klein (1999) evaluated the effects of collaborative intervention in 12 kindergarten and first-grade classes. Results indicated that children who participated in the collaborative language enrichment program demonstrated significantly higher abilities in understanding vocabulary and cognitive-linguistic concepts, as well as increased writing skills, when compared to control classes who received regular curricular instruction from the classroom teachers only. These studies offered support for the effectiveness of collaborative services for the classes as a whole, but neither study specifically evaluated the progress of children receiving speech and language services.

In summary, little research has been conducted on the effectiveness of collaboration or other classroom-based approaches (Ellis et al., 1995; Farber & Klein, 1999; Roberts et al., 1995; Wilcox et al., 1991). Although many authors have suggested numerous benefits of the collaborative service delivery model, recent surveys have indicated that SLPs providing services in the classroom often function in a relatively independent manner by employing models such as one teach/one drift, one teach/one observe, or SLP teach (Beck & Dennis, 1997; Elksnin & Capilouto, 1994; Paramboukas et al., 1998).

The present study investigated the growth of curricular vocabulary skills for school-age children attending kindergarten through third grade who participated in three service delivery models. Results were evaluated separately for children who qualified for speech and language services and children who did not. Specifically, curricular vocabulary skill progress was evaluated for children who qualified for speech or language services in kindergarten through third grade and participated in (a) a collaborative approach with the teacher and SLP co-teaching lessons, (b) a classroom-based intervention model in which the SLP presented vocabulary lessons to the classroom without teacher involvement, and (c) a traditional pull-out model in which the SLP targeted curricular vocabulary in smallgroup treatment sessions. This study also examined the growth of vocabulary skills for children who did not qualify for speech or language services in the same four grades who (a) participated in the collaborative approach, (b) participated in the model where the SLP and teachers independently targeted vocabulary in the classroom-based model, or (c) received curricular vocabulary instruction from only classroom teachers, without the SLP’s involvement.

Method

Subjects

Children from 12 classrooms participated in the present study. Subjects included 177 children enrolled in kindergarten through third grade at two different elementary schools located within five miles of each other in the same community with a population of approximately 20,000 in central Illinois. Both schools served primarily Caucasian children from families of lower middle to middle socioeconomic status. The children in the three sets of grades (K–3) were exposed to different speech-language service delivery models (collaborative, classroom-based, and traditional). Mean ages for the three groups were similar. Table 1 presents the number of children with parental permission who participated in the study from each classroom within the collaborative, classroom-based, and traditional settings. It also presents the number of children who received speech services and the number of children who received language services, as well as the number of children in each setting who did not qualify for speech or language services.

The children who qualified for speech-language services had been identified and tested within 6 months of the beginning of the study by the school SLP (the fifth author, who had more than 10 years of experience as an SLP in school settings) and were on her caseload at the time the study began. The criteria the SLP and school district used for a child to qualify for language intervention was a score of one standard deviation or greater below the mean on two different standardized language tests. The criterion for a child to qualify for articulation intervention was a score of one standard deviation or greater below the mean on one standardized test of articulation. A variety of speech-language assessments were used based on the presenting problems of the child.

Children receiving speech-language treatment exhibited mild or moderate speech and/or language impairments according to the Illinois State Board of Education Speech-Language Technical Assistance Manual (1993). Speech impairments consisted of articulation delays. Language impairments consisted of specific expressive and/or receptive language delays in language form, content, and/or use. The children did not exhibit other organic, neurologic, or cognitive disorders.

Intervention

Children in corresponding grades at each school were exposed to the same basic curricular units during the time the study was conducted. Before the spring semester, the single SLP who served all three sets of classes met with the classroom teachers to discuss the curriculum for that semester to ensure that the specific curricular units targeted for the intervention in the collaborative setting during the spring semester were consistent with those taught by the regular education teachers in the classroom-based and traditional settings. Curricular units/vocabulary words targeted for the kindergarten classes included five science units, two math units, three social studies units, one language arts unit, and one health unit. Curricular units/ vocabulary words targeted for first grade included six social studies units, three science units, and three health units. Second-grade curricular

units included four science units, four language arts units, and four social studies units. Third-grade curricular units included eight science and four social studies units.

Setting	No Speech- Language Services	Speech Services	Language Services	Total
Collaborative Setting Total	62	7	5	74
Kindergarten	17	0	2	19
1st grade	14	1	1	16
2nd grade	12	4	0	16
3rd grade	19	2	2	23
Classroom-Based Setting Total	49	3	8	60
Kindergarten	11	0	3	14
1st grade	15	0	2	17
2nd grade	10	1	1	12
3rd grade	13	2	2	17
Traditional Setting Total	34	3	6	43
Kindergarten	5	1	5	11
1st grade	11	0	0	11
2nd grade	8	1	0	9
3rd grade	10	1	1	12

TABLE 1. Number of subjects by type of services from three sets of kindergarten through third-grade classrooms.

Collaborative Setting. The SLP, the individual K–3 classroom teachers, and two students in Communication Disorders and Sciences collaborated to plan intervention and activities to target vocabulary words from the curriculum. The individual teachers and SLP met at the beginning of the semester to generally plan the collaborative language lessons for the semester. They also met during regularly scheduled collaboration meetings throughout the semester to plan the activities for targeting curricular vocabulary words, to discuss children’s individualized speechlanguage goals, and to share materials, data, and knowledge.

The collaboration meetings were scheduled for 40 minutes per week for each of the four classroom teachers (a total planning time of 160 minutes for the SLP). An REI grant funded substitute teachers to allow the regular classroom teachers to attend the collaborative meetings during the school day. Administration required all participating professionals to attend the meetings. Because of the REI grant and administrative support, the single set of kindergarten through third-grade classes at one school all participated in the collaborative model.

Collaborative language lessons were conducted in the classroom with the classroom teacher, SLP, and two graduate students present. Instruction was shared by all four individuals through a team teaching approach. Each week, the language activity targeted minimally five vocabulary words from the curriculum, for a total of more than 60 words in each class over the course of the semester. Additional targets of the language activities included the specific speech and language goals of the children with individualized education plans (IEPs), as well as general classroom communication skills such as

listening and verbal expression. The language activities began with an introduction of the vocabulary words to the class. The classroom as a whole then received instruction on the curriculum unit from the teacher, SLP, and graduate students. The subjects then participated in a hands-on activity based on the topic discussed. For selected activities, the children were divided into groups to complete the required work with one adult (teacher, SLP, or graduate student) assisting each group. The classroom teacher continued to emphasize the targeted vocabulary and concepts throughout other lessons during the week. Collaborative language activities took place once per week for 40 minutes during 12 weeks in the spring semester.

Children who received speech-language services minimally received one small-group or individual 15-minute pull-out session per week in the speech room in addition to the collaborative intervention, for a total of at least 55 minutes of services per week. The pull-out portion of services was deemed necessary by the SLP for additional time to target and document progress toward speechlanguage goals. Vocabulary and concepts from the curriculum were also implemented during these sessions to target each child's speech-language goals. There were 6 small groups for the pull-out portion of this intervention. Each group consisted of the 1–4 children from each grade level with speech or language goals. Children with speech goals at each grade level were seen together for small-group pullout treatment and children with language goals at each grade level were seen together for small-group pull-out treatment. For example, the two children from kindergarten in the collaborative group with language goals were treated together during pull-out, the first-grade child with language goals in the collaborative group was seen individually during pull-out, the first-grade child with speech goals in the collaborative group was seen individually during pullout, the four children with speech goals from second grade in the collaborative group were seen together during pullout, and so on.

Classroom-Based (Teacher-SLP Independent). Two sets of kindergarten through third grade classes were located at a second school (within five miles of the first school, in the same medium sized community). One classroom at each grade level was randomly assigned to participate in either the classroom-based or traditional service delivery model. Children who participated in the classroom-based setting (teacher-SLP independent services) received classroombased intervention from the SLP without collaboration with the classroom teacher. The lessons' goals and activities were the same as those presented at the collaborative school; however, the classroom teacher did not participate in the planning and was not present in the classroom during the language lessons. Treatment was administered by the same SLP as in the collaborative school and three students in Communication Disorders and Sciences. Language lessons occurred in the classroom for 40 minutes once per week for 12 weeks during the spring semester. The classroom teachers taught curricular goals for the classes independently.

Children who received speech and language services also minimally received one small-group 15-minute pullout session per week in the speech room in addition to the classroom-based intervention. The pull-out portion of services was deemed necessary by the SLP for additional time to target and document progress toward individualized speech-language goals. Vocabulary and concepts from the curriculum were also targeted

during these sessions. There were six small groups for the pull-out portion of this intervention. Small groups consisted of the 1–3 children at each grade level with speech or language goals. Children with speech goals at each grade level were seen together for small-group pull-out treatment and children with language goals at each grade level were seen together for small-group pull-out treatment. (See example in collaborative section.)

Traditional Setting (SLP Pull-Out, Teacher Classroom). The children in the traditional condition who qualified for speech or language services received curricular-based intervention and were seen in small-group or individual pull-out sessions in the speech room averaging 50 minutes weekly. The treatment targeted speech and/or language goals in addition to curricular vocabulary. The materials used in the pull-out sessions at the traditional school were the same as those used in the classroom and pull-out sessions for the collaborative and classroom-based settings. There were six small groups of one to three children who were seen for pull-out services. The five kindergarten children with language goals were divided into two treatment groups consisting of three children and two children. The kindergarten child with speech goals was seen individually for pull-out services. The second-grade child with speech goals, the third-grade child with speech goals, and the third-grade child with language goals were all seen individually for pull-out treatment.

Children from four classrooms in the traditional school, from grades kindergarten through third grade, served as the control group. The children in this group were not identified as requiring speech or language services. They were exposed to vocabulary from the curriculum in the classroom setting with instruction only from the teacher. The SLP provided no extra vocabulary instruction to the class as a whole.

Test Procedure

Testing was completed for all subjects with signed permission slips at the beginning and end of the spring semester. Vocabulary words from the curriculum were assessed using specially designed tests for each of the four grade levels. Twenty curricular vocabulary words were randomly chosen for each evaluation instrument from the more than 60 words targeted at each grade level. All words in the tests were included in the curriculum of the corresponding classes within the three sets of classrooms during the spring semester. All 20 vocabulary items were administered to each child. The format of the test was intended to be sensitive to different levels of understanding of the vocabulary through a hierarchical earning of points, similar to that employed by Johnson and Anglin (1995). The child was asked to demonstrate knowledge of each word in up to three tasks including (a) defining the word verbally, (b) using the word in a sentence, and (c) recognizing the word's meaning from two choices. The 20 vocabulary test items for kindergarten, first, second, and third grades are included in the Appendix. The multiple choice options for each vocabulary word in the kindergarten test are also included, although all grade-level tests included multiple choice options as well.

For each test item, the child was first asked, "What does the word (test item) mean?" If the child's response indicated sufficient knowledge of the word, the examiner then asked

about the next word on the evaluation tool. If the child's response required clarification, the prompt, "Tell me more about the word (test item)" was used. This prompt was used no more than once for each definition. If the child was still not able to produce an accurate definition, the examiner progressed to the next task for the same word and stated, "Use the word (test item) in a sentence." If the child was able to produce an acceptable sentence using the word, the examiner advanced to the next word on the evaluation tool. If not, the child was given the opportunity to choose the word's meaning from two definitions provided verbally by the examiner. The examiner asked, "Does (test item) mean definition 1 or definition 2?"

In addition to the instructions, an example was given for each task (providing a definition, making up a sentence) when the child was first required to complete that task. The example for each task was given no more than three times throughout the 20-item test for each child.

Scoring. The verbal definitions were scored as correct using similar criteria to those provided in the oral vocabulary subtest of the Test of Language Development—Primary (Newcomer & Hammill, 1982). Three points were awarded for a correct definition (e.g., "frozen water" to define "ice") or two less-descriptive characteristics of the word, such as attributes, function, or location (e.g., "it's very cold and you skate on it" to define "ice"). Guidelines for acceptable and unacceptable responses were developed by two investigators to ensure consistency for administration and scoring. If the child was unable to produce either the precise definition or two less-descriptive characteristics of the word, no points were awarded for the definition, but the child had an opportunity to earn points with the next task.

Four categories of responses for the sentence task were possible: precise sentence, vague sentence, incorrect sentence, or no response. A precise sentence was operationally defined as a complete sentence that offered evidence of the child's knowledge of the word's meaning (e.g., "I need ice to make my drink cold."). A vague sentence was operationally defined as a sentence that was complete and displayed that the child had an understanding of the correct part of speech for the word (noun, verb, etc.), but did not demonstrate the child's knowledge of the word's meaning (e.g., "I have some ice."). An incorrect sentence was one that demonstrated an incorrect meaning of the word or the word was used as the wrong part of speech in the sentence (e.g., "Ice is hot," or "I ice you."). Finally, the last category was no response from the child. If the child did not respond or responded with an incorrect sentence, no points were awarded. The child received two points for the precise or vague sentence. If no points were awarded for the sentence task, the child still had an opportunity to earn a point for the multiple-choice task.

The multiple-choice task required the child to identify the correct meaning from two choices. The child then received one point for the correct answer and no points for an incorrect answer. The total score for the test was calculated for each child.

Examiners. Testing was completed by two university faculty members who were certified

SLPs (the first two authors, who have a combined total of more than 20 years experience as SLPs) and seven students in Communication Disorders and Sciences. All examiners met before testing to train on testing procedures. Guidelines of acceptable and unacceptable responses were distributed to all examiners. The nine examiners recorded a plus/minus tally for correct/ incorrect responses for each task performed by each subject during testing. All testing was audiotaped.

Two examiners scored 87% of the vocabulary pretests from the audiotapes. Thirteen percent of the pretests could not be scored from the audiotapes due to poor tape quality or incomplete recordings. In these situations, the judgments of the initial examiner were accepted as correct. All testing following the 12-week treatment period was also audiotaped. The two investigators scored 100% of the posttests either in the live testing environment or from the audiotapes.

Intrajudge reliability was performed by each examiner rescoreing from audiotape 10% of the tests she originally scored. Interjudge reliability was performed by each examiner rescoreing from audiotape 10% of the tests the other examiner originally scored. Pearson's product moment correlations determined the intrajudge reliability of the first investigator was .99, the intrajudge reliability of the second investigator was .99, and the interjudge reliability between the two investigators was .97.

Results

The total number of possible points on the vocabulary tests for all four grade levels was 60. Table 2 presents the mean scores on the pretests, posttests, and the amount of gain made between pre- and posttests for children who qualified for speech or language services in the three service delivery settings. The top rows of Table 2 present the mean total test scores resulting from summing points awarded for all responses on the test instrument. Pretest scores were similar for the speech and language subjects in the collaborative, classroom-based, and pull-out settings. An analysis of variance (ANOVA) determined there was no significant difference, $F(2, 15) = .7449$, $p = .49$, between the three groups (collaborative, classroom-based, pull-out) in the speech and language subjects' pretest scores.

The posttests were administered following 12 weeks of intervention. Although the means for each intervention setting increased to some degree, children with speechlanguage deficits in the collaborative setting made substantially greater gains than in the other two service delivery conditions. The mean test gain for speech-languageimpaired subjects in the collaborative setting was 19 points, whereas speech-language-impaired children in the classroom-based setting improved their total score by an average of 12 points, and speech-language-impaired children in the pull-out setting improved with an average of 13 points. Since some subjects were treated together in the classroom as well as in pull-out conditions, subjects who received all treatments together (six individual or small-group treatment groups per condition—collaborative, classroom-based, pull-out) were analyzed together in the statistical analyses because basing the analysis on individual subjects in such cases would result in the adoption of an inappropriate error term with inflated

degrees of freedom (Levin, 1985). An ANOVA determined there was a significant difference in the test gains between the three service delivery groups, $F(2, 15) = 3.82$, $p = .045$; $h^2 = .34$. The h^2 value suggested the difference between groups accounted for a moderate degree of the total variability in test scores. A Duncan post-hoc analysis revealed the collaborative setting's test gains were significantly higher than both the classroom-based setting (teacher-SLP independent) and pull-out setting. There was no significant difference between the classroom-based setting (teacher-SLP independent) and the pull-out setting.

The speech-language-impaired children's average level of vocabulary knowledge (i.e. ability to provide definitions, sentences, or choose a definition in a multiple-choice task) was calculated. The average response level for words on pretests and posttests was calculated by dividing the total test score by the number of items on the test (20). The resulting response level score corresponded with the three possible responses (three points for providing correct definitions, two points for correct sentences, one point for the correct recognition of definitions given two options, and no points for the incorrect recognition of the definitions given two options). Results of the response level scores for speech-language-impaired subjects are presented in the lower half of Table 2.

Score/Setting	Pretest		Posttest		Test Gain	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Total Test Scores						
Collaboration (<i>N</i> = 6 groups)	28.79	8.14	48.75	7.46	19.96	5.91
Classroom-based* (<i>N</i> = 6 groups)	27.11	3.61	39.30	3.18	12.19	5.78
Pull-out (<i>N</i> = 6 groups)	32.47	10.12	45.72	11.57	13.25	3.90
Response Level Scores						
Collaboration (<i>N</i> = 6 groups)	1.44	0.41	2.44	0.37	1.00	0.30
Classroom-based* (<i>N</i> = 6 groups)	1.36	0.18	1.97	0.16	0.61	0.29
Pull-out (<i>N</i> = 6 groups)	1.62	0.51	2.29	0.58	0.66	0.19

*The classroom-based intervention model involved the SLP providing curricular language lessons 40 minutes weekly without the involvement or presence of the classroom teacher.

TABLE 2. Group means and standard deviations for vocabulary test total scores and response level scores for subjects who qualified for speech or language services.

Initially, the pretest mean response level score indicated that the subjects from all three groups (collaborative, classroom-based, and pullout) were able to recognize the correct definition given the choice of two for approximately half the vocabulary test items and were able to use the word in a sentence for approximately half the vocabulary test items (mean range = 1.36–1.62). Following intervention, speech-language-impaired children from the collaborative group were able to use approximately half of the vocabulary test items in a sentence and give definitions for the other half of the words ($M = 2.44$). Following intervention, speech-language-impaired children from the classroom-based and pull-out conditions were generally able to use most of the vocabulary test items in sentences ($M_s = 1.97$ and 2.29 , respectively). The speech-language-impaired children in

the collaborative group improved their average ability to use each vocabulary word by an entire point (1.44 to 2.44), whereas speech-language-impaired children in the classroom-based and pull-out conditions improved their average ability to use each vocabulary word by approximately one half point ($M_s = .61$ and $.66$). Statistics were not applied to the response level results since they represent a simple derivation of the total test score results.

Results were also obtained for children who did not qualify for speech or language services from the SLP in each of the teaching conditions (collaborative, classroombased, traditional). The top rows of Table 3 present the mean total test scores resulting from summing points awarded for all responses on the test instrument.

Comparison of group means on the vocabulary pretest for subjects who did not qualify for speech or language services revealed similar total test scores among the three settings (range = 38–39). An analysis of variance (ANOVA) was performed and determined there was no statistically significant difference in the pretest scores between the subjects who did not qualify for speech or language services in the three settings, $F(2, 9) = .079$, $p = .92$.

The children who did not qualify for speech or language services in the traditional setting were exposed to vocabulary from the curriculum in the classroom setting with instruction only from the teacher. The SLP provided no extra instruction of vocabulary to these students. Improvements in the total vocabulary test score for children in the traditional group were the smallest of the three groups ($M = 4.38$). The collaborative and classroom-based (teacher-SLP independent) groups evidenced similar gains ($M_s = 11.52$ and 10.39 , respectively). Since the subjects were treated together in each classroom, the classroom means were used in the statistical analyses because basing the analysis on individual subjects in such cases would result in the adoption of an inappropriate error term with inflated degrees of freedom (Levin, 1985). An ANOVA determined there was a significant difference in the test gains between the three service delivery groups, $F(2, 9) = 21.95$, $p < .001$; $h_2 = .83$. The h_2 value suggested the difference between groups accounted for a high degree of the total variability in test scores. A Duncan post-hoc analysis revealed the collaborative and classroom-based (teacher-SLP independent) setting's test gains were significantly higher than the traditional setting. There was not a significant difference between the collaborative and classroom-based settings.

The average response level score for items on pretests and posttests was also calculated by dividing the total test score by the number of items on the test (20) for subjects who did not qualify for speech or language services. Results of the response level scores for subjects who did not qualify for speech or language services are presented in the lower half of Table 3. The scoring system consisted of three points for a correct definition, two points for a correct sentence, one point for the correct recognition of the definition given two options, and no points for the incorrect recognition of the definition given two options.

Score/Setting	Pretest		Posttest		Test Gain	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Total Test Scores						
Collaborative (<i>N</i> = 4 classrooms)	39.55	4.50	51.07	4.36	11.52	2.34
Classroom-based ^a (<i>N</i> = 4 classrooms)	38.08	5.31	48.46	4.01	10.39	1.57
Traditional ^b (<i>N</i> = 4 classrooms)	39.15	6.28	43.53	6.39	4.38	0.35
Response Level Scores						
Collaborative (<i>N</i> = 4 classrooms)	1.98	0.23	2.55	0.22	0.58	0.12
Classroom-based ^a (<i>N</i> = 4 classrooms)	1.90	0.27	2.42	0.20	0.52	0.08
Traditional ^b (<i>N</i> = 4 classrooms)	1.96	0.31	2.18	0.32	0.22	0.02

^aThe classroom-based intervention model involved the SLP providing curricular language lessons 40 minutes weekly without the involvement or presence of the classroom teacher. ^bChildren without speech-language goals in the traditional intervention model were exposed to vocabulary from the curriculum in the classroom setting with instruction only from the teacher. The SLP provided no extra instruction of vocabulary to the class as a whole.

TABLE 3. Group means and standard deviations for vocabulary test total scores and response level scores for subjects who did not qualify for speech or language services.

Students who did not qualify for speech or language services were generally able to use the vocabulary words in a sentence at the time of the pretest (mean range for response level scores = 1.90–1.98). Following intervention, children who participated in the collaborative and classroombased groups were able to use approximately half of the vocabulary test items in a sentence and give definitions for the other half of the words (*M*s = 2.55 and 2.42, respectively). The majority of responses for children in the traditional setting remained at the sentence level. Statistics were not applied to the response level scores since these scores represent a simple derivation of the total test scores.

Discussion

This research yielded two main findings concerning service delivery models in the educational setting. First, the collaborative model was more effective for teaching curricular vocabulary to students who qualified for speech or language services than a classroom-based model (teacher-SLP independent) and a traditional pull-out model even though materials, targets, and treatment time of the SLP were similar in all settings. Second, SLPs can have an impact on the vocabulary growth of all students in classrooms (including those who do not qualify for speechlanguage services) when using a collaborative or classroombased service delivery model.

The children who qualified for speech or language services made positive gains when comparing pre- and posttest scores in each of the three service delivery models. The subjects in the collaborative setting made the greatest gains after 12 weeks of intervention provided primarily in the classroom. Interestingly, in the two settings where the classroom teacher and SLP worked independently (classroom-based and pull-out), similar curricular vocabulary gains were achieved; however, both were lower than the

collaborative setting.

Relation of Findings to Past Research and Theory

The results of the present study support recent findings with the school-age population by Farber and Klein (1999) and Ellis et al. (1995). Each investigation indicated that collaborative (or consultative) service delivery improved language skills of the classes as a whole more than the traditional curriculum presented by classroom teachers. Investigations that have evaluated the progress of speechlanguage-impaired subjects in pull-out versus collaborative classroom-based services have included only preschool-age subjects. Valdez and Montgomery (1997) and Wilcox et al. (1991) indicated that collaborative classroom-based services and pull-out treatment were equally effective with preschoolaged subjects who qualified for speech-language services. In contrast, the present study with school-age subjects found that a collaborative classroom-based approach to intervention was actually more effective in increasing curricular vocabulary knowledge than pull-out services alone.

Despite minimal scientific validation, the theoretical literature has stated that collaboration may be beneficial not only to speech- or language-impaired students, but to all students who participate in the experience (Simon, 1987). In the present investigation, students who did not qualify for speech or language services evidenced vocabulary gains in the collaborative and classroom-based (teacher-SLP independent) settings.

Factors Influencing Collaborative Success

The larger gains made by the subjects in the collaborative school on the vocabulary test may be attributed to several factors. The “sharing” between the SLP and teachers allowed for an exchange of ideas and release from their traditional roles. The teachers provided input about curricular vocabulary and goals, assuring academic relevance. The SLP provided information concerning the student’s communication needs and strategies to increase the student’s classroom success. The teachers at the collaborative school incorporated many carryover activities throughout the week. The support of the principal and planning time during the school day also contributed to the success of the collaborative model.

Previous surveys concerning various service delivery models found that scheduling planning time was a major obstacle to collaboration (Beck & Dennis, 1997; Elksnin & Capilouto, 1994). For the present study, an REI grant funded substitute teachers to allow the regular classroom teachers to attend the collaborative meetings during the school day. Administration required all participating professionals to attend the meetings. Without this funding and administrative support, collaboration meetings would have had to occur after regular school hours, which may have been difficult for many professionals. In this study, the collaborative lessons were provided for 40 minutes weekly, and meetings were also conducted for 40 minutes weekly for each class. Some teachers and SLPs may suggest this amount of time is not readily available.

The time factor must be considered when discussing the results of the present study. The children with speech or language goals received similar contact time with the SLP in all three settings. In the collaborative and classroombased settings, they were served by the SLP 40 minutes weekly in the large group classroom setting and additionally for approximately 15 minutes weekly during smallgroup or individual pull-out treatment, for a total of approximately 55 minutes of weekly contact. In the pull-out setting, children with speech-language goals were served by the SLP 50 minutes weekly in small groups or individually.

It is interesting to note that although the children in the three groups received similar amounts of contact with the SLP, the time the SLP spent serving the groups was substantially different. For the collaborative group, the SLP spent 160 minutes weekly in planning time with the four classroom teachers (40 minutes with each teacher individually), 160 minutes weekly providing the collaborative lessons (40 minutes ´ four classes), and approximately 90 minutes weekly in individual or small-group pull-out treatment (six individual or small groups ´ 15 minutes) for a total of 410 minutes weekly (approximately 7 hours). For the classroom-based group, the SLP spent 160 minutes weekly providing curricular language/vocabulary lessons in the classroom (40 minutes ´ four classes), and approximately 90 minutes weekly in individual or small-group pull-out treatment (six individual or small groups ´ 15 minutes), for a total of 250 minutes weekly (approximately 4 hours). For the pull-out condition, the SLP spent 300 minutes (approximately 5 hours) weekly providing individual or small-group pull-out treatment (six individual or small groups ´ 50 minutes).

Therefore, although the collaborative model was the most effective in the present study, it was also the most costly in terms of the SLP's time commitment as well as the teachers' and student assistants' time. The time for the classroom-based and pull-out models, however, may be slightly underestimated. For example, occasional informal meetings between the SLP and classroom teachers to discuss IEP goals and progress for students were not documented. Additionally, it was not necessary in the present study for the SLP to spend any time talking/ meeting with teachers in the classroom-based and pull-out conditions to gain knowledge about curricular vocabulary because that knowledge was gained through meetings with the collaborative teachers. If no collaborative condition existed, the SLP would have had to devote some time periodically to becoming informed of curricular goals and to obtaining curricular materials to use in classroom-based or pull-out intervention.

Limitations

The availability of the REI grant to allow for planning time at one school influenced the research design of the present study. The classes included in the collaborative treatment group were from the single set of K–3 classes at one school. A second school housed two sets of K–3 classes. Classes at each grade level were randomly assigned to either the classroom-based or traditional model at the second school. The two elementary schools were located within 5 miles of each other in the same middlesized community

with a population of approximately 20,000 in central Illinois. Both schools served primarily Caucasian children from families of lower middle to middle socioeconomic classes and pretest scores on the vocabulary measures were very similar between the two schools. The authors believe the results of the present study are valid due to the similarity of the two schools and pretest scores; however, the lack of totally random assignment to groups needs to be acknowledged as a weakness of the study.

It appears that the intervention conducted in the present study improved the quality of knowledge of curricular vocabulary but did not necessarily add many new words to the children's vocabulary (this is especially true for the children without speech-language deficits). The value of the instruction may have been limited given the number of words learned. The children who did not qualify for speech or language services were initially able to at least recognize the correct definition given the choice of two in the multiple choice task for 81%–95% of the items on the vocabulary pretest (the chance level of approximately 50% accuracy would have been expected if the children had no initial knowledge of the vocabulary words). The children with speech-language deficits were able to at least recognize the correct definition for 77%–83% of the test items. Some new words may have been added to the speechlanguage-impaired children's vocabularies, as evidenced by the fact that they were able to at least recognize the correct definition for the multiple choice task for 92%–96% of the vocabulary items in the posttest.

Although the format of the vocabulary test was intended to be sensitive to different levels of understanding of the vocabulary through a hierarchical earning of points (similar to that employed by Johnson & Anglin, 1995), further differentiation of levels of understanding should be considered in future studies. In the present study, children were asked to demonstrate knowledge of each word in up to three tasks including (a) defining the word verbally, (b) using the word in a sentence, and (c) recognizing the word's meaning from two choices. Examples of further differentiation might include receiving more points for precise sentences that indicate some level of understanding of the word's meaning (e.g., "I need ice to make my drink cold") versus a vague sentence that is complete and displays that the child has an understanding of the correct part of speech for the word (noun, verb, etc.) but does not demonstrate the child's knowledge of the word's meaning (e.g., "I have some ice," "I have a penny," "I have a zebra"). In future studies, the child could also receive more points for a correct adult-like definition (e.g., "frozen water" to define "ice") and fewer points for two lessdescriptive characteristics of the word, such as attributes, function, or location (e.g., "it's very cold and you skate on it" to define "ice"). Increased differentiation of levels of understanding would allow researchers/teachers further insight into the nature of vocabulary learning that occurred.

The classroom-based and collaborative settings in the present study involved equal numbers of professionals; however, the classroom teachers at the traditional school received no additional assistance. Children are typically more successful with increased one-on-one adult contact time. Children with speech-language goals from the traditional setting who received pull-out services also experienced small adult-to-student ratios for treatment; however, children without speech-language goals in the traditional setting were taught curricular vocabulary from a single classroom teacher only. The variable of

adult to student ratio should be controlled in future research to determine if a classroom with the same number of aides to assist would experience similar mean gains as classrooms with collaborative professionals.

Future Research

Collaboration was found to be the most effective service delivery model for curricular vocabulary instruction with children in kindergarten through third grade. The results from the present study, however, must be replicated and expanded on in future research. The collaborative and classroom conditions in the present study both contained a small portion of pull-out treatment in addition to the intervention in the classroom for the children with speechlanguage deficits. Future researchers may wish to examine the effectiveness of collaborative or classroom-based interventions without the small pull-out component.

Children learn vocabulary primarily through experiences and verbal interactions during the preschool and early school years (Kamhi & Catts, 1991). However, by third-grade reading becomes the primary method of vocabulary acquisition (Nagy & Anderson, 1984). Future investigation of the SLP's role in facilitating vocabulary learning, reading comprehension, and curricular success is necessary after third grade.

No attempt was made to measure progress on individual educational goals by subjects who received speech or language services. Additionally, the vocabulary scores of the speech-language-impaired children were reported only for the group as a whole. Evaluation of the effectiveness of service delivery models for various types and severities of speech-language disorders is needed in future studies.

It is also vital to determine if collaboration can be as effective in teaching additional skills needed for classroom success by using other measures of functional outcomes and generalization of skills. The focus in the public school system is shifting in the direction of functional outcomes. It is imperative that SLPs document intervention that facilitates positive functional change in their students' lives. Additionally, the 1997 amendments to the Individuals with Disabilities Education Act contain revised provisions that focus on functional IEP goals to support the student's progress in the general curriculum (IDEA Amendments, 1997). Future research should evaluate the relationship between various service delivery models and functional classroom performance. Additional research of classroom-based intervention is necessary to determine the best model for serving children in the school setting.

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