Deaf and hard-of-hearing (d/hh) students are traditionally educated within self-contained programs at residential or special day schools, within self-contained or resource classrooms in public schools, or within regular education classrooms with support provided by an itinerant teacher. The co-enrollment model offers a promising alternative in which these students are educated within a regular education classroom composed of both d/hh and hearing students and team-taught by a teacher of the deaf and a regular education teacher. This article examines the development of one such program and the social and academic performance of the d/hh students within the program. Data on social interaction between d/hh and hearing classmates suggest that specific instructional strategies that promoted students’ sign language development, identified d/hh students as “sign language specialists” and grouped d/hh and hearing students during academic activities resulted in increased interaction between these two groups of students. Stanford Achievement Test scores in the areas of reading vocabulary, reading comprehension, mathematical problem solving and procedures indicate that although d/hh students scored below the national normative hearing group, reading comprehension levels exceeded the national normative sample of d/hh students during both years two and three of the program. We discuss the challenges of implementing a co-enrollment program.

One model of inclusive education for students with hearing losses is a co-enrollment program in which deaf/hard-of-hearing (d/hh) students and typical hearing students learn together in a classroom that is co-taught by a regular education teacher and a teacher of deaf children. Although documentation of the effectiveness of a co-enrollment program is limited, this model provides d/hh students with opportunities for academic and social integration with hearing peers that may not occur in self-contained or resource classrooms. As members of a co-enrollment classroom, d/hh students study the same academic curriculum as their hearing peers. While exposure to grade level curriculum also occurs for students receiving itinerant services, an advantage of the co-enrollment model is that a teacher of the deaf can explain curricular information and match individual student needs. Additionally, d/hh students can become true social members of the class because they are involved in all classroom activities with a stable group of peers. The teacher of the deaf can encourage student interaction by providing ongoing instruction in sign language and appropriate communication methods for both hearing and d/hh students. Whereas many public school programs for d/hh students enroll only one student with a hearing loss at a specific grade level, co-enrollment classrooms include multiple d/hh students, thus making regular interaction with d/hh peers another integral part of this model.

One of the first co-enrollment programs in the United States, TRIPOD, was founded in 1982. TRIPOD classes are co-taught by a regular education teacher and teacher of d/hh students. All teachers learn to communicate in American Sign Language (ASL) and several deaf teachers facilitate the process of sign language acquisition for students and hearing teachers. Results of the Stanford Achievement Test ad-
ministered to 49 students ages 7 through 15 years in 1994, 10 years after the program was implemented, indicate that the math skills of TRIPOD d/hh students were approximately 1 year level above the scores of the 1990 national normative sample of d/hh students. Reading comprehension scores were comparable to this sample through age 13, after which TRIPOD students began to move ahead of the normative group, with the difference between the two groups growing to one and a half grade levels in favor of the TRIPOD students by age 15 (Kirchner, 1996). Socially, d/hh students and hearing students developed friendships that were maintained outside of the classroom setting and learned to comfortably communicate with one another (Boyle, 1994; Kirchner, 1994, 1996). Kluwin, Gonsber, Silver, and Samuels (1996) reported that implementation of a co-enrollment kindergarten program resulted in regular interaction between d/hh and hearing students and “astonishing” sign skill development among hearing students (p. 14).

In August 1995, a public school in Tucson, Arizona, initiated a co-enrollment program. Fifteen deaf and hard-of-hearing students ranging from kindergarteners to eighth graders, who had received their prior education within self-contained classrooms for d/hh children, became members of classrooms that included hearing students. By the third year of the program, enrollment increased to 25 d/hh students. This article describes the development of this co-enrollment program through informal interviews conducted with the principal, classroom descriptions provided by one of the co-enrollment teaching teams, and data on the d/hh students’ academic performance and social interaction with hearing peers.

**Method**

The information provided in the following section was obtained through informal interviews and conversations with the school principal, the co-enrollment classroom teachers, and the speech-language pathologist serving this classroom. Interviews with the principal were audiotaped and transcribed to yield information related to the formation of the co-enrollment program and issues that emerged during implementation of the program. Conversations with the teachers and speech language pathologist typically occurred within the classroom after school or during lunch breaks with written notes being recorded. In some instances specific questions were presented in a written format with these participants supplying written responses. These conversations served as a primary source of information on classroom procedures and student behavior and elicited reflection on the impact and future of the co-enrollment program.

**Description of Setting**

The co-enrollment program was initiated within an alternative public school that had been created to explore multiple ways of grouping and instructing students, to evaluate collaborative planning strategies utilized by teachers, and to investigate the impact of school organization on teachers and students. During the 1997–1998 school year, the third year of the co-enrollment program, the school enrolled 282 students in kindergarten through eighth grade. The school population reflects the diverse ethnic, socioeconomic, and educational population of the Tucson community. Approximately 50% of the students are from ethnic minority families and 60% of the enrolled students qualify for reduced price lunches. Seventeen percent of the students receive special education services. Although students were grouped in traditional grades previously, the school presently is composed almost exclusively of multi-age classrooms to promote learning across ages as well as abilities. In most situations, students remain in the same classroom, with the same teacher(s) for a period of three years. Multi-age classrooms provide students with the opportunity to assume the role of “expert” with peers as well as to receive assistance from peers, to develop significant friendships with classmates, and to address academic subjects in a manner commensurate with their own learning level (Dorta, 1995). Multi-age classrooms give teachers an opportunity to develop an intimate knowledge of their students’ learning styles, their progress across academic subjects, the areas in which they excel as well as the areas in which focused instruction is needed, and students’ social development and friendship patterns (McClellan, 1994).

Prior to the implementation of the co-enrollment
model, d/hh students were educated within a self-contained classroom taught by a teacher of the deaf. Several of the students joined hearing peers for recess, lunch, and other nonacademic subjects with the support of an interpreter. Although d/hh students spent an hour a day in regular education classrooms, true inclusion of these students did not occur. The limited time period prohibited d/hh students from learning the classroom routines and expectations or developing friendships with hearing peers. Likewise, hearing students did not develop the sign language skills necessary to communicate with these students. Part-time participation in the regular classroom was viewed by the hearing students and regular education teacher as disruptive and by the d/hh students as frustrating. Academically, these students functioned substantially below grade level in reading, writing, and mathematics. The low academic achievement levels and the social isolation of the d/hh students prompted school personnel to consider alternative educational approaches. An article describing the TRIPOD program initiated interest in the co-enrollment model, and a team of teachers and the school principal traveled to California to observe the program and interview students and classroom teachers. The enthusiasm of the TRIPOD teachers, the observed interaction between d/hh and hearing students, and students’ academic achievement levels prompted serious discussion and subsequent implementation of the co-enrollment model.

Participants

During the first year of the co-enrollment model, a 2/3/4 multigrade class included 9 d/hh students and 19 hearing students. The second year, the grade levels changed to 3/4/5 to accommodate the older d/hh students and enrollment was 8 d/hh students and 17 hearing students. In the third year of co-enrollment, this intermediate 3/4/5 classroom included 7 d/hh students and 23 hearing students. Additional co-enrollment classrooms at the primary and middle school level operated at the school but initially enrolled smaller numbers of students. The greater number of students enrolled in the intermediate classroom prompted the investigation of this classroom. A brief description of each of the d/hh students in the intermediate classroom during the second year of the co-enrollment program is presented in Table 1. Second-year participants are described because collection of academic data began during this year.

Since its inception, the intermediate co-enrollment classroom has been instructed by two teachers with extensive speech/language support provided by a speech language pathologist. The regular education teacher has 29 years of experience with kindergarten through sixth grade students. She is a trained Reading Recovery teacher and has taught in multi-age as well as traditional general education classrooms. The certified teacher of d/hh children has interpreter-level sign

### Table 1  Description of deaf/hard-of-hearing students

<table>
<thead>
<tr>
<th>Student</th>
<th>Age/Grade</th>
<th>Unaided loss (PTA)</th>
<th>Communication method (primary and supportive)</th>
<th>Hearing aid use</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lynda</td>
<td>9 yrs/3rd</td>
<td>59 dB</td>
<td>Speech and sign</td>
<td>Bilaterally aided</td>
<td>Possible learning disability or borderline retardation</td>
</tr>
<tr>
<td>Terrence</td>
<td>9 yrs/3rd</td>
<td>110+ dB</td>
<td>Sign and speech</td>
<td>Cochlear implant (at age four)</td>
<td></td>
</tr>
<tr>
<td>Russell</td>
<td>10 yrs/3rd</td>
<td>87 dB</td>
<td>Sign and speech</td>
<td>Unilaterally aided</td>
<td></td>
</tr>
<tr>
<td>Peter</td>
<td>9 yrs/4th</td>
<td>93 dB</td>
<td>Sign only</td>
<td>Unilaterally aided</td>
<td></td>
</tr>
<tr>
<td>Andrea</td>
<td>10 yrs/4th</td>
<td>45 dB</td>
<td>Primarily oral</td>
<td>Bilaterally aided</td>
<td>Learning disability, Spanish and English spoken in home</td>
</tr>
<tr>
<td>Nathan</td>
<td>10 yrs/4th</td>
<td>101 dB</td>
<td>Sign only</td>
<td>Bilaterally aided</td>
<td></td>
</tr>
<tr>
<td>Brittany</td>
<td>10 yrs/4th</td>
<td>87 dB</td>
<td>Speech and sign</td>
<td>Unilaterally aided</td>
<td>Spanish spoken in home</td>
</tr>
</tbody>
</table>

Fictitious names have been used to preserve confidentiality.

*Second year/spring semester of co-enrollment program.*

*PTA at 500, 1,000, 2,000 Hz in better ear.*
students. Teachers encouraged the students to communicate by pointing, gesturing, and pantomiming in addition to using their developing sign skills. When these strategies were ineffective, students were able to seek assistance from a signing adult.

Interestingly, another activity that promoted acquisition of sign language was soccer. Although teachers did not anticipate that this playground activity would play a significant role in promoting interaction between d/hh and hearing students, several of the members of the classroom, including d/hh students, participated in soccer teams outside of school. These students became leaders during lunch and recess soccer games and this competitive activity motivated students to develop the communication skills necessary to fully participate in the games.

The effectiveness of the classroom sign language activities was demonstrated within the first quarter of the program as d/hh and hearing classmates began to sign with each other. By the end of their first year in the co-enrollment classroom, most of the hearing students comfortably spoke and signed during class discussions and presentations. According to teacher reports, their individual conversations with d/hh peers occurred in sign and without voice 50%-60% of the time.

Teachers noted that female students showed a stronger interest in sign language and developed sign skills more rapidly than male students. Friendships between d/hh students and hearing students therefore first developed between female students. Interactions between d/hh and hearing males were initially based more on physical actions, such as pulling at each other, taking each other’s hats, and poking one another.

At the beginning of each school year, new students joined the co-enrollment classroom. Immersion into a signing environment both promoted and demanded acquisition of sign language. During the second year of the co-enrollment classroom, two hearing students joined the class and both were communicating with sign language by the end of the first month. During the third year approximately half of the students were new to the classroom and many began to sign within two months.

To effectively communicate with d/hh students it is important to utilize attention-getting behaviors that do not depend exclusively on auditory strategies. Through

**Procedures**

One of the major tasks facing members of a co-enrollment classroom is to establish a means of communication that allows direct interaction between hearing and d/hh individuals. Although an educator of d/hh children and an interpreter can facilitate communication between deaf and hearing classmates, it is essential that hearing members of the classroom develop the sign skills and visually based communication methods necessary to converse with d/hh students. At the same time, the presence of hearing peers may motivate d/hh students to increase their use of spoken language during conversation.

**Sign skill development of the hearing students.** To help hearing students learn to sign with their d/hh classmates, specific intervention procedures were initiated during the second week of the school year. Deaf/hard-of-hearing students were designated as “signing specialists” in the classroom and teachers emphasized their expertise in this area to all students. Three primary activities were implemented to facilitate sign language development. Beginning with the second week of school, a daily 10- to 15-minute time period was designated as “Drop Everything and Sign.” During this time period, the d/hh “signing specialists” were paired or grouped with hearing peers and sign or nonvocal communication was the required means of conversation. A second instructional activity focused on teaching signs in a game format. Once a week for approximately 30 minutes the teaching staff directed signing games in which the d/hh children served as mentors for their hearing peers. Finally, the classroom schedule was designed so that much of the daily teacher-directed instructional time occurred within small groups. These groups were purposely composed of hearing and d/hh students to again promote signing interaction between

**Benefits of a Co-enrollment Program**

The speech/language pathologist is ASHA certified with a doctoral degree in child language and has basic skills in ASL.

**Procedures**

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instruction and direct modeling, the students in the co-enrollment classroom learned to tap d/hh classmates on the arm or shoulder to direct their attention to the teacher and to obtain their attention before conversing with them. Both the regular educator and the teacher of the deaf stated that the increased use of visual attention-getting strategies and the emphasis on obtaining attention prior to presenting new information benefitted the hearing students as well as the d/hh students.

**Sign skill development of the regular educator.** In addition to the teacher of d/hh children and the regular classroom teacher, a teaching assistant with sign skills, supported instruction, and initially served as interpreter when the regular educator provided instruction or communicated with d/hh students. As the regular educator knew only a few signs prior to involvement in the co-enrollment classroom, her primary source of instruction was actual participation in the classroom. Direct communication between this teacher and the d/hh students was limited initially to pointing, gesturing, physical manipulation, and modeling of expectations and needs. As her sign skills developed, the regular educator accompanied spoken English with signs first during one-on-one conversations with d/hh students and then during selected instructional lessons. The teacher of the deaf or the teaching assistant provided assistance when she was unable to understand students or they were unable to understand her. By the beginning of the third year of co-enrollment, the regular educator estimated that she signed independently approximately 80% of the time, using primarily ASL conceptual sign accompanied with spoken English. She comprehended d/hh students’ signing approximately 85% of the time within context and 70% of the time out of context.

**Data Collection**

The primary goal of the co-enrollment model is to provide an inclusive educational program for d/hh students. To achieve this goal, d/hh students must comfortably interact with hearing as well as d/hh peers and demonstrate growth in academic subject areas. This section presents data on the social interaction between d/hh students and their hearing classmates and on the reading and mathematics achievement of the d/hh students. Additionally, the academic achievement of the hearing students in the co-enrollment classroom will be compared to that of hearing students in classrooms that did not include d/hh students.

**Social interaction between d/hh students and their hearing peers.** When the co-enrollment classroom began, teachers observed that the d/hh students tended to self-segregate. The students communicated little with each other or with their hearing peers. This lack of social interaction also has been reported in the literature (Antia, 1982; Antia, Kreimeyer, & Eldredge, 1994; Arnold & Tremblay 1979; Levy-Shiff & Hoffman, 1985).

During the first year of the co-enrollment program, a single subject AB research design documented the impact of the co-enrollment model on the social interaction between d/hh students and their hearing classmates by recording the frequency of peer interaction within the classroom and a generalization setting, the school lunchroom. Within this methodology, an A phase, or baseline period, provides data on the occurrence of the dependent variable prior to intervention. Once baseline data demonstrate consistency in occurrence, the intervention or B phase of the study is implemented. The effectiveness of intervention is demonstrated by (1) change in the frequency of occurrence of the dependent variable following implementation of the intervention and (2) minimal overlap in the frequency of occurrence of the dependent variable during the baseline and intervention phases. In this study, the frequency of social interaction between d/hh and hearing peers served as the dependent variable and the co-enrollment intervention as the independent variable.

All students within the intermediate classroom participated in this study with observational data collected on the frequency of peer interaction between d/hh students and their hearing classmates and d/hh students and their d/hh classmates. Peer interaction was defined as any linguistic or nonlinguistic attempt to gain a listener’s attention or to communicate through linguistic or nonlinguistic means. Interaction attempts could be initiated by a hearing student to a d/hh classmate or by a d/hh student to a d/hh or hearing classmate in the absence of adult prompting. Linguistic attempts included communication through spoken or
signed language and nonlinguistic attempts included gesturing, pointing, pantomiming, tapping, and waving. Each d/hh student was observed in the classroom by the speech language pathologist for a 20-minute live and/or videotaped period and each peer interaction involving the student recorded. Identical procedures were used to collect generalization data in the lunchroom. Since d/hh students typically sat at the same table in the cafeteria, it was possible to record data on two to three students during the 20-minute lunchtime period.

Beginning on the second day of the school year, daily baseline data were collected on each d/hh student for the first week. During this week-long baseline period, the speech language pathologist remained in the classroom throughout the entire day to catch all appropriate data collection opportunities. Treatment was initiated at the beginning of the second week of school and during this phase of the study, individual student data were collected twice a month from September to December and then once a month from January to May. Data collection sessions were spaced over a 1- to 2-day time period. During classroom observations, students engaged in a variety of academic activities that allowed for interaction. Lunchroom observations occurred in the school cafeteria when 60–80 students were present. Cafeteria personnel distributed food and collected payment for lunches and one nonsigning monitor supervised all students in this setting. Students could eat lunch with any other student in the lunchroom but generally elected to sit with their classmates. All students were required to remain in the cafeteria for at least 20 minutes.

During the week-long baseline period, teachers emphasized the learning of classroom routines and procedures but provided no specific sign language instruction. After this first week the previously described intervention was implemented (i.e., d/hh students assumed roles as signing specialists and teachers structured specific sign language instruction and small-group activities).

Reliability data were recorded for 10% of the observational sessions within each environment by another speech language pathologist at the school and a university graduate student in this field. Both of these individuals were familiar with the students. Interobserver reliability for frequency of interactions was computed using Cohen’s κ (Cohen, 1965) and results indicated a κ of 1.0 or 100% agreement on occurrence of interaction.

Social Interaction Results

Figure 1 presents data on the frequency of interaction in the classroom for d/hh students. Two of the students described in Table 1, Terrence and Russell, did not join the classroom until the second year of the program. Because these data were collected during the first year of the program, these students are not included in Figure 1. After the co-enrollment intervention was initiated, data indicate that interaction increased between the d/hh students and their hearing classmates with concomitant decreases in interaction with d/hh peers for at least some portion of the intervention period.

![Figure 1](https://academic.oup.com/jdsde/article-abstract/5/2/174/525715)
Baseline and intervention data demonstrate minimal overlap in the occurrence of interaction with hearing peers. Although rapid increases in interaction with hearing classmates are evident for four of the five students, one student, Lynda, has a slower rate of increase possibly as a result of her additional disability.

Figure 2 presents generalization data on the frequency of peer interaction in the lunchroom. The brevity of the lunchtime period permitted collection of only two data points during the baseline phase. No data are available for Peter and Nathan during the second baseline session as they left the cafeteria after 18 minutes of data were obtained, thereby preventing the full 20-minute observation. No interaction with hearing peers occurred during this 18 minutes, but is not possible to determine whether interaction might have occurred if the observation had continued for an additional two minutes. Again Lynda demonstrated the slowest rate of change. The two zero intervention points recorded for Peter and Nathan during treatment observation 12 occurred on a day when they elected to sit by themselves and thus interacted only with one another. Although interaction between d/hh students and their hearing peers did not reach levels commensurate with those observed in the classroom, the increase following implementation of the co-enrollment intervention indicates that d/hh and hearing students were interacting with one another outside of the classroom when teachers were not present to prompt or structure such interaction.

Academic Achievement of D/HH Students

In April of the second and third year of the co-enrollment program, all students in the classroom completed the Stanford 9 Achievement Test (Harcourt Brace Educational Measurement, 1996). The Stanford 9 has eight test levels that correspond to curriculum content commonly taught to hearing students in specific grade levels. The d/hh students had their first experience with standardized testing when they took the Stanford 9 during the second year of this program. It is common for d/hh students to take levels of the Stanford that correspond to their reading levels and are therefore often below their grade level. The students in the co-enrollment program completed the test level that corresponded to their grade level (i.e., third-grade students completed Primary 3 level, fourth-grade students completed Intermediate 1 level, and fifth-grade students completed Intermediate 2 level). The test was administered within the classroom to all students simultaneously. Provision of instructions in both oral English and sign language was the only procedural modification.

One of the challenges in comparing the performance of the d/hh students in the co-enrollment program to the hearing and d/hh normative groups is the two different ways in which these normative data are reported. Normative data for hearing students are presented by test level with a specific scaled score corre-
sponding to a specific grade level. For example, a scaled score of 619 on the Primary Level 3 reading comprehension subtest corresponds to the 3.8 grade level (3rd grade, 8th month of school). To compare the performance of the students in the co-enrollment program to the national norms for hearing students, each student’s scaled score was compared to the scaled score for same-grade hearing students. Because the test was administered at the beginning of the eighth month of the school year, a grade equivalent of 3.7 or 3.8 on the Primary 3 level was used for third-grade students, 4.7 or 4.8 on the Intermediate 1 level for fourth-grade students, and 5.7 or 5.8 on the Intermediate 2 level for fifth-grade students. The higher grade level was used unless it was not available in the norm tables, in which case the next lower grade level was used to determine the comparative scaled score equivalent.

Normative data for d/hh students are presented by age with a specific scaled score corresponding to a percentile rank. To compare the performance of the students in the co-enrollment program to the national norms for d/hh students, each student’s scaled score was compared to the scaled score obtained by same age d/hh students (9-year-old, 10-year-old, or 11-year-old norms) at the 51st percentile or at the 50th percentile if no scores were provided for the 51st percentile. When a range of scores was given, the lower end of the range was selected as the normative scaled score at the 51st percentile or the upper range at the 50th percentile. For example, for nine-year-old students, the range of scaled scores in mathematics problem solving is 547–550 at the 51st percentile. In this example, 547 was selected as the normative scaled score. Normative comparisons were made for reading vocabulary, reading comprehension, mathematical problem solving and mathematical procedures.

**Academic Results**

We conducted paired sample t tests to determine whether significant differences existed between the mean scaled scores obtained by the students in the co-enrollment program and the d/hh and hearing normative populations. Results of these tests are presented in Table 2 for years 2 and 3 of the program. The degrees of freedom vary because two students moved at the end of year 2, and during both years, several students failed to obtain a basal level on some subtests.

### Table 2  T-tests for paired samples for Stanford 9 achievement subtests of students in the co-enrollment program compared to normative samples

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Paired comparisons</th>
<th>Yr</th>
<th>M (SD)</th>
<th>df</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reading vocabulary</strong></td>
<td>D/HH norms to co-enrollment students</td>
<td>2</td>
<td>−51.0 (44.3)</td>
<td>3</td>
<td>−2.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>−36.5 (26.1)</td>
<td>1</td>
<td>−2.0</td>
</tr>
<tr>
<td></td>
<td>Hearing norms to co-enrollment students</td>
<td>2</td>
<td>50.3 (40.4)</td>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>76.0 (12.7)</td>
<td>1</td>
<td>8.4</td>
</tr>
<tr>
<td><strong>Reading comprehension</strong></td>
<td>D/HH norms to co-enrollment students</td>
<td>2</td>
<td>−35.6 (21.4)</td>
<td>6</td>
<td>−4.4***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>−37.0 (18.6)</td>
<td>3</td>
<td>−4.0**</td>
</tr>
<tr>
<td></td>
<td>Hearing norms to co-enrollment students</td>
<td>2</td>
<td>49.9 (16.9)</td>
<td>6</td>
<td>7.8**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>49.5 (11.9)</td>
<td>3</td>
<td>8.3**</td>
</tr>
<tr>
<td><strong>Mathematics: problem solving</strong></td>
<td>D/HH norms to co-enrollment students</td>
<td>2</td>
<td>−12.7 (19.9)</td>
<td>6</td>
<td>.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>−36.0 (31.1)</td>
<td>2</td>
<td>−2.0</td>
</tr>
<tr>
<td></td>
<td>Hearing norms to co-enrollment students</td>
<td>2</td>
<td>49.3 (18.6)</td>
<td>6</td>
<td>7.0**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>31.7 (21.0)</td>
<td>2</td>
<td>2.6</td>
</tr>
<tr>
<td><strong>Mathematics: procedures</strong></td>
<td>D/HH norms to co-enrollment students</td>
<td>2</td>
<td>−2.7 (19.2)</td>
<td>6</td>
<td>−.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>−53.7 (45.9)</td>
<td>2</td>
<td>−2.0</td>
</tr>
<tr>
<td></td>
<td>Hearing norms to co-enrollment students</td>
<td>2</td>
<td>68.3 (23.4)</td>
<td>6</td>
<td>7.7**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>37.0 (30.6)</td>
<td>2</td>
<td>2.1</td>
</tr>
</tbody>
</table>

*Co-enrollment mean above comparative group.

**Co-enrollment mean below comparative group.

*p < .05.

**p < .01.
Statistical results indicate no significant difference between the mean scaled score obtained by the students in the co-enrollment program on the reading vocabulary subtest and the scores of the d/hh and hearing normative sample. On the reading comprehension subtest, significant differences exist between the students in the co-enrollment program and the d/hh normative sample and between these students and the hearing normative sample. Students in the co-enrollment program scored above the d/hh normative sample but below the hearing normative sample. No significant differences were evident when student scores on the mathematical problem-solving subtest were compared to those for the d/hh normative sample, but significant differences did exist during year 2 between the students in the co-enrollment program and the hearing normative sample, with the students in the co-enrollment program again scoring below their hearing counterparts. This pattern was repeated on the mathematical procedures subtest.

Academic Achievement of Hearing Students

One concern raised by some parents, administrators, and teachers is the impact of special needs students on the academic development of typical students. To address concerns expressed to the school principal that the presence of multiple d/hh students might impede delivery of curriculum and thus academic achievement of typical students, we conducted t-tests for equality of means to compare the Stanford achievement scores of the hearing students in the co-enrollment classroom with those of same grade peers in classrooms that did not include d/hh students. Data from both the second and third years of the co-enrollment program yielded no significant differences between these groups on any of the Stanford subtests.

Discussion

The primary goal of a co-enrollment program is to promote full inclusion of deaf and hard-of-hearing students within a regular education classroom that includes both d/hh and hearing classmates. Within the co-enrollment classrooms at this school, instruction is provided by a teacher of the deaf and a regular classroom teacher, who implement specific instructional strategies focused on teaching sign language to hearing students, creating learning groups composed of both d/hh and hearing students, and encouraging d/hh students to assume the role of classroom “signing specialists.” Teachers reported that hearing students began to sign with their d/hh students within a short time, and personal observations of this classroom during the second and third year of the program support this report as some students’ use of sign without voice made it impossible to distinguish between students who were deaf and those who were hearing. Luckner (1999) conducted a year-long study of several co-enrollment classrooms in Colorado and he too noted that visitors to the classrooms found it difficult to distinguish between deaf and hearing students working together on classroom projects.

Data obtained on the frequency of social interaction indicated that the co-enrollment program resulted in increased interaction between d/hh and hearing students within the classroom setting. Although the AB design used to document change in social interaction was not the optimal research design, limitations within the school setting precluded alternate designs. An ABAB design would have been more powerful, but it was not possible or ethical to remove the impact of the co-enrollment treatment once it was implemented and return to a baseline phase. We considered a multiple baseline design across subjects or settings but rejected this possibility because it was not possible to gradually introduce the co-enrollment treatment to selected groups of students within the intermediate classroom and maintain the integrity of the setting. Although two other classrooms enrolled d/hh students, the limited number of d/hh students in these classrooms precluded their inclusion as additional intervention settings. The impact of the co-enrollment intervention on the social interaction of d/hh and hearing students was supported by the replication of results across five students who utilized varying means of communication. The limited number of baseline points collected in the school lunchroom fails to provide a strong baseline for the generalization setting, but the increase in interaction suggests that over the course of the first year, d/hh students began to interact with their hearing peers within a setting in which no adults encouraged such interaction.
Academic data obtained on the Stanford Achievement Test indicate that the reading comprehension scores of the d/hh students were above those of the d/hh normative sample during both the second and third years of the program. Obtaining significant results within an area that is traditionally weak for d/hh students, and with scores based on grade-level tests when most of the students within the normative sample completed below grade level tests, speaks highly of the co-enrollment model. Although it is encouraging to see these results, the students in the co-enrollment program did not perform significantly above the d/hh normative group in other academic areas. Because the available normative data for d/hh students is skewed by below grade-level test data, it would be useful to generate grade-level normative data on d/hh students who complete the Stanford Achievement Test so that a more accurate comparison could be made between a normative group and students in programs such as this one.

The students in the co-enrollment program performed significantly below the hearing normative sample in three of the four Stanford subtests during the second year of the study. Significant differences were obtained in only one of four subtests during the third year of the program. Although it would be tempting to consider the lack of significant differences during the third year as noteworthy, these results likely reflect the limited number of students for whom data were available rather than comparative academic performance. It will be important to continue monitoring academic achievement through both formal and informal means to determine the manner of instruction that will allow the d/hh students to draw increasingly closer to the academic performance of their hearing peers in all academic areas.

The implementation of a co-enrollment model presents challenges that extend beyond the specific educational strategies used within the classroom. When the co-enrollment teachers and principal were asked to identify the primary challenges faced during the implementation of this model, their comments focused primarily on the creation and development of a teaching team. They said that finding two teachers with compatible teaching philosophies and personalities who share a vision of educating d/hh and regular education students together is an immediate challenge. Both the principal and teachers felt that one strategy that facilitated this process was allowing teachers, rather than administrators, to create their own teams. After his year-long study of two co-enrollment classrooms, Luckner (1999) reached a similar conclusion and recommended that “coteaching relationships generally work best when they are voluntary rather than mandated” (p. 33).

The co-enrollment teachers felt that both team members must be willing to learn new skills and accept the reality that it will take some time to develop these skills. The teacher of the deaf commented that while it is obvious that regular education teachers need to learn sign language, how to utilize amplification devices, and how to expand use of visual instructional strategies, teachers of the deaf often need to expand knowledge of teaching strategies in multiple curricular areas if they are to effectively address the broad age and functioning range of regular education students. These teachers also need to develop behavior management strategies for classes composed of 25–30 students. Although the teacher of the deaf found her professional preparation helpful, she noted that to teach effectively within the regular education classroom, she found it essential to release assumptions that deaf students should be taught in small groups, that they needed simplified texts, that they could not keep up with their hearing peers academically, and that hearing students would be bored with the pace of simultaneously signed and spoken instruction. The academic growth of the deaf students as well as the benefits of increased wait time and decreased teacher talk rate for hearing students convinced both teachers that high academic expectations combined with sound educational strategies benefitted all students.

Educating d/hh students within a regular education program has multiple benefits, but one of the disadvantages of this setting is the lack of Deaf adult role models. Although this Tucson school initiated a co-enrollment program without the benefit of any deaf teachers or staff, several Deaf individuals had joined the school staff by the fourth year of the program. A Deaf instructor conducted sign language classes for students, a hard-of-hearing individual operated the school computer laboratory, and a Deaf volunteer
regularly participated in the primary classroom. The number of teachers and support staff who sign also increased over the years. Although pleased with these changes, teachers continue to explore how to best help deaf students develop competence in ASL and gain knowledge and appreciation of Deaf culture. A primary goal of this co-enrollment program is to increase involvement of Deaf individuals in the school. School personnel continue to recruit Deaf individuals for instructional and support positions and encourage volunteers to visit the school and spend time within classrooms so that all students can interact with native ASL users.

Not all classrooms at this school include d/hh students, and some teachers have felt that teachers in the co-enrollment classes have a reduced workload since two teachers and an instructional assistant work with the same number of students that they teach alone. The co-enrollment teachers remarked that this perception can result in “distance” between those teachers involved in co-enrollment classrooms and those who are not. This “separation” can be exacerbated by the extensive planning time required of the co-enrollment team as these teachers may spend every minute without students planning with one another. Although shared planning was viewed as essential to the success of the co-enrollment, the teachers noted that when team members are absent frequently from the teachers’ lounge or other social/discussion situations during the school day, they miss opportunities to interact with other teachers and may be viewed as elitist. To create “whole school” support of inclusion, the co-enrollment team felt that teachers must carefully balance team planning time with time spent interacting with colleagues to promote sharing of ideas and concerns. Educating colleagues about the co-enrollment process and inviting them to participate directly through classroom teaching exchanges, as well sign language classes for which they receive continuing education credit, were proposed as ways to build connections to the program.

Conclusion

Although still in the process of development, data from the first three years of this co-enrollment program in Tucson, Arizona, suggest that this model offers a promising alternative educational program for students with hearing losses. Deaf and hard-of-hearing students are addressing grade-level curriculum, hearing students are learning sign language thereby expanding their peer circle and providing d/hh students with conversational partners, the regular education teacher is steadily improving her sign language competency, and the teacher of the deaf has expanded her instructional strategies and raised her expectations concerning the academic potential of her students.

Conversations with participants in the co-enrollment program indicate that multiple challenges must be addressed when implementing this model—challenges not overcome quickly or through highly directive administrative decisions. The co-enrollment program requires a strong commitment to inclusive education and a high degree of collaboration between administrators, teachers, support personnel, parents, and students. Future investigations at this school should focus on the evolution of the co-enrollment model and the long-term impact on those individuals directly involved in this program and on those in the larger educational community who provide educational programs for deaf and hard-of-hearing students.

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