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AAC Augmentative and Alternative Communication

Collaborative Teaming to Support Students with Augmentative and Alternative Communication Needs in General Education Classrooms

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This study evaluated the effectiveness of the use of a team collaboration process to increase the academic achievement and social participation of three students with augmentative and alternative communication (AAC) needs who were members of general education classrooms. Three educational teams, comprised of the general education teacher, inclusion support teacher, instructional assistant, speech-language pathologist, and one of the student's parents, developed and collaboratively implemented Unified Plans of Support for the students that consisted of academic adaptations and communication and social supports. The effectiveness of the support plans was evaluated through behavioral observations and team interviews. Evaluation outcomes suggest that consistent implementation of the plans of support by team members was associated with improvements in academic skills, social interactions with peers, engagement in classroom activities, and use by the students of a variety of AAC devices. Implications of the collaborative teaming process in supporting students with AAC needs in general education classrooms are discussed.

KEY WORDS: augmentative and alternative communication (AAC), collaborative teaming, inclusive education, parent participation

In recent years, inclusive education has emerged as a promising educational practice for teaching students with augmentative and alternative communication (AAC) needs (Erickson & Koppenhaver, 1998; Erickson, Koppenhaver, Yoder, & Nance, 1997; Koppenhaver, Spadorcia, & Erickson, 1998; Soto, Müller, Hunt, & Goetz, 2001a; Sturm, 1998). Inclusive education is based on the following beliefs and values: (a) all children can learn; (b) all children have the right to be educated with their peers in age-appropriate, heterogeneous classrooms within their neighborhood schools; and (c) it is the responsibility of the school community to meet the diverse educational needs of all of its students (Thousand & Villa, 1992).

The sharing of an inclusionary philosophy by all key stakeholders seems to be a necessary but not a sufficient condition for ensuring the adoption of this model (Nevin, Thousand, Paolucci-Whitcomb, & Villa, 1990). A considerable body of literature establishes that effective inclusive education for students with significant disabilities requires substantive changes in classroom structure, a different conceptualization of professional roles, and a continuous need for collaborative teaming (e.g., Gee, Graham, Sailor, & Goetz, 1995; Giangreco, 2000; Giangreco, Dennis, Cloninger, Edelman, & Schattman, 1993; Giangreco, Prelock, Reid, Dennis & Edelman, 1999; Hunt, Doering, Hirose-Hatae, Maier, & Goetz, in press; Hunt, Hirose-Hatae, Doering, Karasoff, & Goetz, 2000; Rainforth & York-Barr, 1997; Thousand & Villa, 1992; York-Barr, Schultz, Doyle, Kronberg, & Crossett, 1996).

Collaborative teaming has been defined as a group of individuals with diverse expertise working together to achieve mutually defined goals (Snell & Janney, 2000; Thousand & Villa, 1992). According to experts in the field of collaborative teaming, an effective collaborative teaming process involves regular, positive face-to-face interactions; a structure for addressing issues, performance, and monitoring; and clear individual accountability for agreed-on responsibilities (Nevin et al., 1990; Salisbury, Evans, & Palombaro, 1997; Thousand & Villa, 1992; West & Idol, 1990).

In the case of students who use AAC systems, the educational team must work together to integrate an often complex array of technologies used for learning, mobility, and classroom participation (Erickson & Koppenhaver, 1998; Erickson et al., 1997; Koppenhaver et al., 1998; Soto et al., 2001a; Sturm, 1998). The challenge of coordinating the contribution of all team members is heightened by the fact that, within the

inclusion model, the traditional roles and responsibilities of educational personnel are changing, and a number of team members may have overlapping functions (Giangreco, 2000). For instance, parents, classroom teachers, special educators, speech-language pathologists, assistive technology specialists, and paraprofessionals may all have important roles in teaching and supporting a wide range of communication and language skills. Additionally, inclusive practices require that the general curriculum and regular school activities become the context within which communication and language intervention targets are defined (Ehren, 2000). As such, educational personnel must now engage in collaborative consultation, curriculum-based intervention, and classroom-based services to support content learning.

In a recent study, Soto and her colleagues reported the results from five focus groups of team members who had been supporting students with AAC needs in inclusive classrooms for at least 3 years (Soto et al., 2001a). Participants in the five focus groups offered their perspectives on the skills, processes, and structures that promoted the inclusion of students with AAC needs in the general education classroom and on the outcomes of inclusive education for all of those involved. All focus groups emphasized the importance of collaborative teaming as a prerequisite condition for a successful inclusive effort. When describing what collaborative teaming meant to them, participants emphasized the importance of regular team meetings in which all team members contributed to the development of strategies and ideas for achieving mutually defined goals. Collaborative teaming skills were further defined as an understanding of the roles and responsibilities of all team members, combined with a willingness to be flexible around role boundaries. Accountability, strong leadership, and good interpersonal skills were some of the qualifications of a functional team, along with training in AAC. Participants reported the need for adequate training with regard to both the technical skills required to operate and maintain an AAC system and the strategies necessary to enable students to use an AAC device as a tool for accessing a curriculum and participating in social situations. These findings are consistent with current recommendations on best practices for collaborative teaming in inclusive classrooms (e.g., Giangreco, 2000).

Although there seems to be consensus on the importance of collaborative teaming in inclusive classrooms, little research has been conducted to examine the application of a collaborative teaming process and its effect on the social and academic participation of students with significant disabilities (Giangreco, 2000; Salisbury et al., 1997). The purpose of this study was to investigate the effectiveness of a collaborative teaming process on the social and academic participation of students with significant disabilities and AAC needs. This investigation builds on recommendations for best practices for collaborative teaming in inclusive classrooms outlined in the current literature. It differs from previous research in that the collaborative process described in this article provides a detailed and simplified process, called a Unified Plan of Support (UPS), that was designed to unify and integrate educational, communication, and social supports for students with AAC needs in regular classrooms. The main elements of the UPS process are (1) regularly scheduled team meetings, (2) development of supports to increase focus students' academic and social participation in general education instructional activities, (3) a built-in accountability system, and (4) flexibility to change ineffectual supports (Hunt et al., in press). Elements for effective collaborative teaming were incorporated into this model. Most importantly, team members collaborated to create and implement individualized instruction and supports needed to increase academic successes and social participation of the focus students. Each collaborative team included a general education teacher, inclusion support teacher, instructional assistant, each student's parent(s), and a speech-language pathologist who served as the AAC specialist.

Monthly meetings allowed for ongoing evaluation and revision of the students' UPS that were implemented through the cooperative efforts of all team members. Implementation strategies included general and special education co-teaching (Bauwens, Hourcade, & Friend, 1989), small-group and individual tutoring, and direct support from the special education teacher, AAC specialist, and instructional assistant. The roles and responsibilities of general and special educators included the flexibility required to jointly address the needs of all three of the students involved as the team members shared responsibility for the students' success.

This model of team collaboration was evaluated through multiple data sources that included behavioral observations and team interviews. Triangulation of data sources (Patton, 1990) provided the opportunity for behavioral data describing students' levels of engagement and social participation to be validated by team members' descriptions of the quality of the students' classroom participation.

METHOD

Setting

This study was conducted at two elementary schools located in two small, diverse school districts in the San Francisco Bay Area. The schools had included students with severe disabilities in general education classrooms for 10 and 11 years, respectively. The three students were supported in their kindergarten and first- and fifth-grade classes on a continuous basis by an instructional assistant. All three general education teachers had previous experience that included supporting children with severe

disabilities, but none of the teachers had worked with students with extensive AAC needs previously. Research activities began the first month of the school year and continued for 7 months.

Participants

Students

Minh was a grade 5 student who experienced severe physical and speech impairments caused by cerebral palsy. He had no use of his hands, arms, or legs. His visual and auditory abilities were in the normal range. Minh used a powered wheelchair accessed with a headswitch for mobility. He used a head light to point to an alphabet board and other low-technology AAC devices. He also used a Headmaster Plus™ (Prentke Romich Co.) and a single switch to access a laptop computer and a head mouse to access his dynamic display communication aid. In addition, Minh communicated through eye gaze and facial expressions. His receptive and expressive language comprehension skills were at the grade 1 and grade 3 levels, respectively, as reported by the team. He read at the first- to second-grade level.

Khamla was a kindergartner who experienced moderate physical and speech impairments caused by cerebral palsy. He walked with a slow, awkward gait and had full use of his arms. Khamla had been diagnosed with corneal clouding but did not use corrective lenses. He had no apparent hearing loss. At the beginning of the study, Khamla used some gestures and sign approximations to express his basic wants and needs. He had had previous exposure to picture symbols but was not using a picture symbol system. He used few intelligible words. Khamla appeared to have moderate cognitive delays, severe expressive language delays, and moderate receptive language delays as reported by the speech-language therapist.

Paolo was a student in grade 1 who experienced severe physical and speech impairments caused by cerebral palsy. His visual and auditory abilities appeared to be within the normal range. He used a manual wheelchair for mobility. Paolo had good gross motor use of his hands. He primarily used gestures, facial expressions, and vocalizations to communicate his wants and needs. He owned a dynamic display communication aid that he did not use functionally. His receptive vocabulary was assessed to be at 3.7 years using the Peabody Picture Vocabulary Test-Revised (Dunn & Dunn, 1981). Paolo was beginning to identify letters and letter sounds and was developing prekindergarten math skills.

Educational Teams

Three educational teams were recruited for the study from two school districts in which students with significant disabilities had been included in general education programs for several years. The districts were canvassed for elementary-level inclusion programs that supported students with AAC needs. All members of the three teams selected for the study supported the inclusion of students with disabilities in general education classes and expressed an interest in participating in the collaborative teaming process.

Five core members of the educational teams for each of the three students participated in the study. Core members are defined as those members who have substantial daily involvement with the student (Giangreco, 2000). The general education teacher, inclusion support teacher, instructional assistant, speech-language pathologist, and one of the student's parents developed, reviewed, and collaboratively implemented plans of support for each of the focus group students. Table 1 presents demographic information describing the educational team members including their ages, gender, ethnicity, and years of experience with AAC.

Intervention: Unified Plans of Support

Unified Plans of Support (Hunt et al., in press) were developed for Minh, Khamla, and Paolo through the collaborative efforts of their educational teams. The teams met once a month for approximately 1 hour and 30 minutes to develop and continue to refine the support plans. Each UPS included a listing of (a) curricular supports for reading, writing, and math (e.g., adapted materials and/or modified instructional content, performance requirements, or teaching methods; Janney & Snell, 2000); (b) communication supports to promote classroom participation (e.g., low-technology boards for commenting to classmates, voice output communication devices to support participation in classroom discussions, attention bells to indicate the desire to ask or answer questions); and (c) social supports to increase interaction with peers (e.g., partner systems, social facilitation by adults, small-group instruction, learning centers). Examples of the curricular, communication, and social supports developed and implemented for each of the three students appear in Table 2.

Curricular adaptations and modifications were designed to support the focus students' full participation in academic activities as they worked according to their individual levels of ability and to enable the students to rely less on individual supports from the instructional assistant. Communication and social supports were established to (a) decrease periods of nonengagement in classroom activities, (b) increase students' attempts to initiate communicative interactions in the context of instructional activities (e.g., asking questions, making comments, answering questions), and (c) increase interactions between the focus students and their classmates.

TABLE 1: **Demographic Information of Study Participants**

			Age (yr)			Ethnicity			AAC Experience (yr)		
Group	*N*	*Gender*	*20–35*	*26–45*	*46–55*	*European-American*	*Asian-American*	*Hispanic-American*	*0–2*	*6–10*	*≥11*
Inclusion support teachers	3	Female	1	2	0	1	2	0	0	2	1
Parents	3	Female	2	1	0	0	2	1	2	1	0
Speech-language pathologists	3	Female	2	1	0	3	0	0	2	0	1
Classroom teachers	3	Female	1	1	1	3	0	0	2	0	1
Instructional assistants	3	Female	1	1	1	2	0	1	3	0	0

Structure and Organization of the UPS Meetings

The structure of the collaborative process allowed members of the team to share their knowledge, experience, and skills. Each support item was developed through a process that included sharing ideas and building on the suggestions of others. The collaborative problem-solving process included four key elements: (a) identifying learning and social profiles for each of the focus students, (b) developing supports to increase the students' academic success and social participation in classroom activities, (c) collaborative implementation of the plans of support, and (d) a built-in accountability system (Giangreco, Cloninger, Dennis, & Edelman, 1994; Merritt & Culatta, 1998; Salisbury et al., 1997; West & Idol, 1990).

At the beginning of each student's first UPS meeting, members of the team reviewed the student's academic development with respect to reading, writing, and math. In addition, they described the extent and quality of each student's participation in classroom activities (e.g., contributing to group discussions, working without support from the instructional assistant, participating in large-group instruction, working collaboratively in small-group activities, seeking needed assistance) and interactions with classmates (e.g., initiating and responding to interactions, participating in conversations, providing and receiving assistance, working collaboratively). The initial support plan was built on that assessment information through a "brainstorming" and consensus process. Each item on the UPS was suggested by one or more members of the team, followed by a discussion of the effectiveness and feasibility of the support strategy. If the team members agreed on the inclusion of the item, it was added to the student's support plan.

The UPS form that guided the discussion (Fig. 1) listed each support item in the curricular areas of reading, writing, and math. Additional areas included general participation in classroom activities and communication and socialization with peers. A grid on the right side of the page was used to identify the team members responsible for implementing each support strategy. The grid also included a rating scale used each month to evaluate the extent to which each support item was being implemented (i.e., not at all, somewhat, moderately well, and fully). The monthly rating procedures prompted team members to implement items rated as somewhat implemented more rigorously and also provided the opportunity for them to discuss items that were not at all implemented. These latter items were often revised or deleted from the plan because they were perceived by team members to be ineffectual or impractical.

Based on team members' experience in implementing each UPS, individual items were sometimes refined, expanded on as learning occurred, deleted, or added to the plan during subsequent meetings. University members of the research team joined the school teams for monthly UPS meetings but did not participate in the development of the plans of support. They did, however, provide some feedback to members of the team during the days of observation and data collection.

Development of the UPS for Each Student

During the first UPS meetings to develop the initial plans of support, the project directors modeled the process. Following reviews of the students' abilities and needs in each of the areas described previously, members of the educational team were asked by the project directors to "brainstorm" educational and social supports for the students in the areas of reading, writing, math, communication with peers, and general participation in classroom activities. In subsequent meetings, the inclusion support teachers led the discussions to review the UPS, evaluate levels of implementation, add additional items, and refine or delete items that were included previously. Following the initial UPS meetings, members of the university team observed but did not contribute to the discussions.

TABLE 2: **Sample of Items from Each Student's Unified Plan of Support**

	Minh	*Khamla*	*Paolo*
Communication and participation	During whole class discussions, ask Minh to move to the front of the class (T, IA) Encourage Minh to use a bell to indicate that he wants to answer/ask questions (IA, S-LP) Ask open-ended questions and give Minh a chance to respond using a communication board or electronic device (T, IA, S-LP)	Teach Khamla to use a Big Mac, Cheap Talk, or a signed YES or NO to respond during group discussions (T, IT, IA, S-LP) Teach Khamla and his classmates two ASL signs a month during a weekly lesson; encourage them to use the signs throughout the day (All) Move Khamla to the front of the classroom when students are on the rug for a group activity (T, IA)	Pair Paolo with a classmate during "station" activities (T, IA) Teach Paolo to use low-technology communication boards as well as the Dynavox, Cheap Talk, and his voice to communicate with others at school and at home (All) Give Paolo a waist pack that contains pictures or souvenirs to share information about his day or weekend with his classmates, teacher, and/or family (All)
Reading	Create a template for the DynaMyte containing "carrier phrases" so that Minh can respond to questions related to books or short stories (T, IT, S-LP) Pair Minh with a classmate who will help him respond to science questions (T, S-LP)	During Zoo Phonics activities, teach Khamla targeted letter sounds using letter cover-up boards (T, IT, IA, P) Teach Khamla to use a picture story board to answer comprehension questions about simple picture books (T, IT, IA)	Teach Paolo one new letter sound each week during in-class or individual reading sessions and while reading at home (T, IT, IA, P) Teach Paolo to look at his book and speak at appropriate times during reading sessions (T, IA)
Writing	Provide Minh with Writing Blaster and a template on his desktop computer to use during daily journal-writing activities (IT, IA)	Pair Khamla with a classmate to complete his journal entry using Stories About Me; he chooses between two pictures to fill in blank spaces and points to each picture symbol as his partner reads the sentences (IT, IA)	Teach Paolo to find a letter on the computer keyboard in response to hearing the letter and/or letter sound (IT, IA)
Math	Provide Minh with adaptations for math activities or opportunities to work on functional math objectives using a CD-ROM (T, IA)	Pair Khamla with a classmate (i.e., cooperative learning) to create repeating patterns using manipulatives (T, IT, IA)	Teach Paolo to recognize numbers 1 though 5 using manipulatives, workbooks, and computer programs (All)

T = general education classroom teacher; IT = integration support teacher; IA = instructional aide; S-LP = speech-language pathologist; P = parent; All = all team members.

Student Performance Measures and Data Collection Procedures

Design

Student outcome variables were investigated using a combination of data gathering methods: (a) systematic observation of the levels of engagement and interaction patterns of the focus students using a multiple baseline design across students (Kazdin, 1982) and (b) team interviews to elicit team members' perspectives on students' academic growth and social participation. The three team interviews were conducted once during baseline (i.e., 1 week before implementation of the intervention) and twice during the intervention condition (i.e., 1 month after implementation of the intervention and at the end of the study).

Levels of Engagement and Interaction Patterns: Observational Measures

The Interaction and Engagement Scale (IES) (Hunt, Alwell, Farron-Davis, & Goetz, 1996; Hunt, Farron-

Unified Plan of Support (UPS)

Team Members Present:

Focus Student: _____ _____

School: _____ _____

Date: _____ _____

EDUCATIONAL SUPPORT For example: adaptations, curricular modifications, instructional modifications, peer supports.		
SUPPORTS	Person(s) Responsible	Implem. Rating
		❑ fully ❑ mod. well ❑ somewhat ❑ not at all
		❑ fully ❑ mod. well ❑ somewhat ❑ not at all
		❑ fully ❑ mod. well ❑ somewhat ❑ not at all
		❑ fully ❑ mod. well ❑ somewhat ❑ not at all
SOCIAL SUPPORT For example: "buddy systems," "circles of support," interactive media (communication systems, ed. materials, etc.), social facilitation.		
		❑ fully ❑ mod. well ❑ somewhat ❑ not at all
		❑ fully ❑ mod. well ❑ somewhat ❑ not at all
		❑ fully ❑ mod. well ❑ somewhat ❑ not at all
		❑ fully ❑ mod. well ❑ somewhat ❑ not at all

Figure 1. Unified Plan of Support form.

Davis, Wrenn, Hirose-Hatae, & Goetz, 1997) was designed to measure interaction and engagement variables. The IES uses a partial interval recording procedure in which each 10-minute observational period consists of 20 30-second intervals; within each interval are 15 seconds for observation and 15 seconds for recording. A copy of the IES is available from the first author.

All four of the IES observers had previous experience with procedures for in-class data collection, and two of the four had used the IES to collect behavioral data in a previous study (i.e., Hunt et al., in press). Prior to implementation of the data collection process, the four observers reviewed the instrument as a group, after which all possible pairs of the four observers established inter-rater agreement of 90% or higher for each variable while observing students in two general education classrooms.

Data from IES observations can be analyzed in a variety of ways; however, with regard to the outcomes of this study, it was predicted that there would be (a) increases in interactions with peers that were neutral or positive in nature, (b) decreases in the levels of nonengagement in ongoing classroom activities, (c) increases in interactions initiated by the focus students (e.g., making comments, asking questions), and (d) increases in the use of an AAC device over time. Thus, IES data were recorded and analyzed to address these hypotheses. During each interval, the observer noted the first communicative interaction (e.g., speech or touching a symbol on a communication board to make a request or comment) that involved the focus student. The identity of the partner in that interaction (e.g., the teacher, another student, the instructional assistant) was also noted, as well as the individual who initiated the interaction (i.e., the focus student or the partner). The communicative function of the interaction (i.e., a request, protest, comment, or assistance) was identified as well as the quality of the interaction (i.e., positive, neutral, or negative) and the use of an AAC device. Engagement variables included the level of engagement (i.e., active, passive, or not engaged) and the grouping pattern (i.e., student alone or with a group) that occurred the majority of the time during each interval.

Each student was observed approximately once per week from September through March during a 2-hour session. Occasional disruptions of this schedule occurred because of holidays, special school events, and student absences. One classmate of each focus student was also observed using the same instrumentation and procedures. Classmate data were used to identify normative patterns for each of the dependent variables. Three participating classmates were selected by the general education teachers, who were asked by project staff to identify three boys in the class who were "average, socially and academically." One of the selected students was observed each session, and the order of observations of each of the three students was rotated across the weeks.

Ten 10-minute observations (five for the focus student and five for the classmate) were spaced across a 2-hour session, with each observation period separated by a 2-minute break. The observations were alternated between the focus student and his classmate, and the order in which students were observed was systematically rotated across sessions. The observational period was scheduled during morning academic activity and did not include recess breaks. Students in each of the three classrooms quickly adjusted to the presence of the data collectors, who were introduced by their teachers as visitors who would be observing in their classroom during the school year.

Additional data probes were inserted into Minh's data collection schedule during the last 3 months of the study. These probes were conducted for 2-hour periods during afternoon academic activities in response to team members' and data collectors' feedback that morning activities in his grade 5 classroom were structured to promote independent seatwork and participation in teacher-led class lessons and therefore did not provide contexts that supported demonstration of the targeted communication and social interaction variables.

Reliability

During baseline and after each UPS was implemented, an independent observer (one of the senior investigators) joined the data collectors for an average of 30% of the sessions (26% for Minh, 31% for Khamla, and 33% for Paolo). The level of agreement between the primary data collector and the independent observer was calculated by dividing the number of agreements on the occurrence of variables during each observational interval by the total number of agreements plus disagreements multiplied by 100. The mean percentage of interobserver agreement on the presence of the interaction and engagement variables targeted by the IES was 98% for communicative partner (range = 94–100%), 98% for initiation of an interaction (range = 91–100%), 97% for acknowledgment of the initiation (range = 91–100%), 96% for communicative function (range = 86–100%), 99% for use of an AAC device (range = 97–100%), 99% for the quality of the interaction (range = 94–100%), 96% for the level of engagement (range = 88–100%), and 100% for student grouping patterns. The overall percentage agreement across all subcategories was 98%.

Levels of Engagement, Interaction Patterns, and Academic Progress: Team Interviews

Team members' perceptions of changes in the social/classroom behaviors and the academic progress of the three focus students were assessed through open-ended interviews that were conducted three times during the course of the study: approximately 1 week before implementation of the UPS, 1 month after implementation of the UPS, and at the end of the study. During the interviews, team members were asked, "How is _____ doing?" with regard to each of the areas addressed by a UPS (i.e., reading, writing, math, classroom participation, and social interaction with peers). The responses were audiotaped and transcribed verbatim for later analysis.

Intervention Fidelity: Implementation of Items on the UPS

The extent to which items on the UPS were implemented (LeLaurin & Wolery, 1992) was evaluated during each monthly UPS meeting that followed development of the original support plan. Team members and university project staff who observed in the classroom were asked to rate the extent to which each item on the support plan was being implemented. As noted previously, rating options included not at all, somewhat, moderately well, and fully. A consensus process was used in which each of the educational team members and the university observers reported their ratings for each item. All members of the team then agreed on a single implementation rating for each UPS item across each of the monthly meetings; had it not been possible to reach consensus, the majority opinion would have been used to rate an item.

Ecological Validity of the UPS Process: Participants' Perspectives

The ecological validity of the UPS process—the extent to which the collaborative teaming process fit into the existing school culture and was useful to the school community (Gaylord-Ross, 1979)—was evaluated through a group interview conducted at the end of the study. Questions were designed to elicit perceptions of the UPS process for the following topics: (a) benefits of the UPS process, (b) limitations of the process, and (c) recommendations for changes in the process. The group interview was moderated by a senior investigator who encouraged speakers to clarify or expand on their responses when necessary. The responses of the team members were audiotaped and transcribed verbatim for later analysis.

Data Analysis

Behavioral Measures

At the end of each observational session, data collectors summarized for each of three students and their classmates the percentage of total intervals of observation (there were 5 sets of 20 intervals for each student) in which the following targeted behaviors occurred: reciprocal interactions with other students, nonengagement, focus student–initiated reciprocal interactions (i.e., requests, protests, comments), and use of an AAC device. The percentage of intervals in which assistance was provided by the instructional assistant was also recorded.

Interviews

Using a group discussion and consensus process, the five members of the university team analyzed the transcripts from each of the interviews conducted during three UPS meetings. Team members read each interview transcript and, using a line-by-line analysis (Strauss & Corbin, 1990), identified themes representing the perceptions of the interviewees within the categories of reading, writing, math, classroom participation, and social interaction with peers. A discussion of agreements and discrepancies in the analyses across team members followed. A summary listing of themes within each category for each of the three interviews (i.e., pre-UPS, 1 month following UPS initiation, and at the end of the study) was developed. Finally, team members reviewed the identified themes to eliminate redundancy and to identify and interpret patterns across categories, interview periods, and stu-

dents (Krueger, 1998; Morgan, 1993). Each member of the three educational teams provided "member checks" of the accuracy of the analysis by reviewing the outcomes and providing feedback (Lincoln & Guba, 1985).

The same procedures were also used to analyze the transcripts of educational team interviews conducted at the end of the study to establish the ecological validity of the intervention. Categories for the initial analysis corresponded to the structure of the interview questions. "Member checks" of the accuracy of the final analysis were provided to all members of the three educational teams.

RESULTS

Student Outcomes: Levels of Engagement and Interaction Patterns

Observational Outcomes

Before implementation of the UPS for Minh, Khamla, and Paolo, the percentage of intervals during which the students interacted with peers fell substantially below the average rates of interactions for their three classmates who were also observed. This is illustrated in Figure 2. Following implementation of the targeted academic and social supports, interaction levels increased from an average of 2%, 5.2%, and 8.7% for Minh, Khamla, and Paolo, respectively, to 26% for Minh (40.8% during the four afternoon probe sessions), 35.7% for Khamla, and 37% for Paolo. One-to-one interactions with classmates also increased from baseline levels that were well below the average rates for their classmates (i.e., 1% for Minh, 3.8% for Khamla, and 6.1% for Paolo) to 7.6% for Minh (29.5% during the afternoon probes), 21.4% for Khamla, and 17.9% for Paolo.

In addition to the substantial increases in interactions with classmates during observational sessions, the data presented in Figure 3 indicate that levels of nonengagement in classroom activities decreased dramatically for Khamla and Paolo. For all three students, levels of nonengagement decreased to levels consistent with those of their classmates, that is, from 8.3 to 2.5% for Minh (1.8% during afternoon probes), from 29 to 5.6% for Khamla, and from 17 to 3.9% for Paolo.

In addition to high levels of nonengagement during the baseline condition, there were very low levels of interactions initiated with the teacher or other students by Minh, Khamla, or Paolo (e.g., initiating making a comment during one-to-one interactions or during group discussions) (Fig. 4). After implementation of the UPS, initiation levels for Khamla and Paolo more closely matched those of their classmates. For Minh, initiations matched peer interaction patterns during only two of the morning observations but matched or exceeded peer data during three of the four afternoon

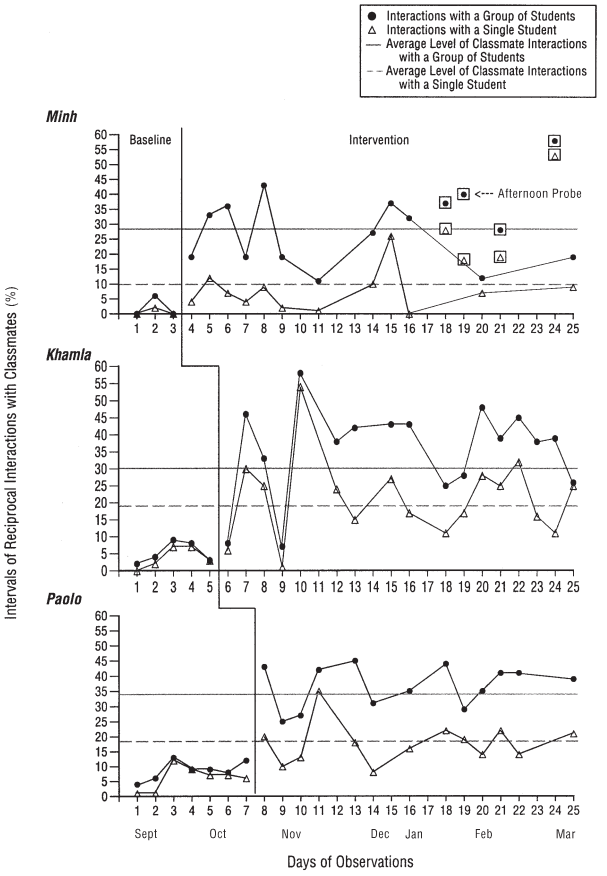

Figure 2. Percentage of intervals of reciprocal interactions with classmates in a group or individually.

probes. Initiated interactions increased from 0% during baseline to 3.5% (14.8% during afternoon probes) during the intervention condition for Minh, from 3.8 to 14.7% for Khamla, and from 5.7 to 12.2% for Paolo.

During the baseline condition, there were no instances of the use of either low- or high-technology AAC devices by Minh, Khamla, or Paolo. After implementation of the UPS, use of an AAC device during the session occurred an average of 9.2% of the time for Minh (22% during afternoon probes), 5.3% for Khamla, and 3.5% for Paolo (Fig. 5).

One explanation for the increases in communicative interactions and the decreases in nonengagement in classroom activities may have been that increased assistance was provided to the students by their special education instructional assistants after development of the UPS. However, analyses of the observational data for each student revealed that the percentage of intervals of assistance from instructional assistants actually decreased after implementation of the UPS, from 32.3% during baseline to 6.8% (3.5% during afternoon probes) during intervention for Minh, from 10.4 to 3.8% for Khamla, and from 13.9 to 5.6% for Paolo.

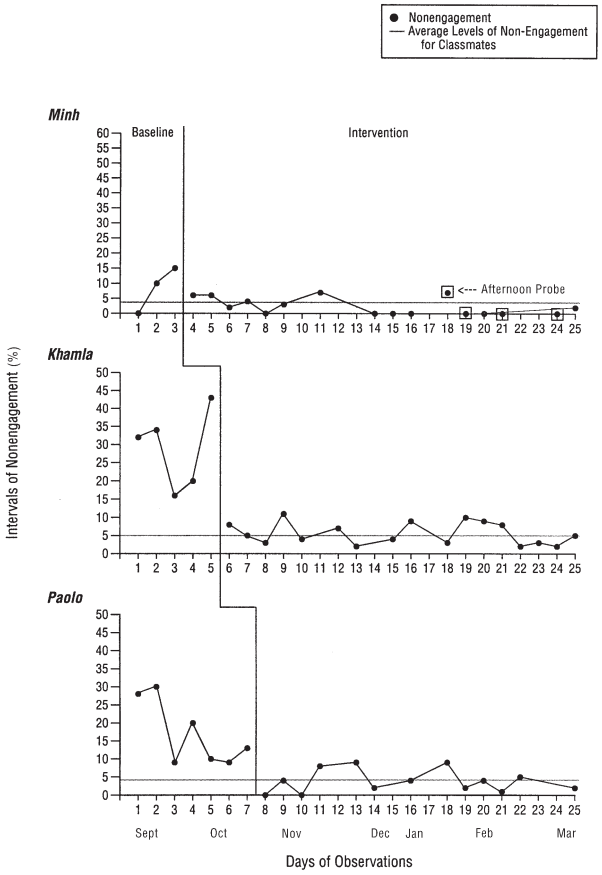

Figure 3. Percentage of intervals of nonengagement in ongoing classroom activities.

Interview Outcomes

During the first interview that was scheduled 1 week before implementation of the UPS, themes that were common to each of the students included low levels of active participation in classroom activities, restricted means of communication, difficulty maintaining interactions with peers, reliance on instructional assistants for support, and inconsistent attention to and interest in classroom activities. These themes are summarized in Table 3.

During the second interview conducted 1 month after implementation of the UPS, team members described more active participation in and attention to classroom activities and increased interactions with peers (see Table 3). During the final interview, substantial changes in student behavior were described, including increased independence, assertiveness, and confidence; more frequent interactions with peers; increased attention to and engagement in classroom activities; more frequent initiation of comments during class discussions; and increased proficiency using a variety of communication modes to interact with peers and participate in classroom activities (see Table 3).

Student Outcomes: Academic Performance

Interview Outcomes

Table 4 presents team member perspectives on Minh's, Khamla's, and Paolo's levels of academic performance. A review of the table reveals increases in academic performance and participation in the general education core curriculum as soon as 1 month after implementation of the UPS. At the end of the study, the three students had made substantial gains in the areas of reading, writing, and math.

Intervention Fidelity: Implementation of the UPS

Ratings related to the degree of implementation of the items in each student's support plan were gathered at the first meeting following development of the UPS (i.e., after approximately 1 month). The ratings can be summarized as follows: (a) 4 of the 9 supports for Minh were fully implemented, 2 were implemented

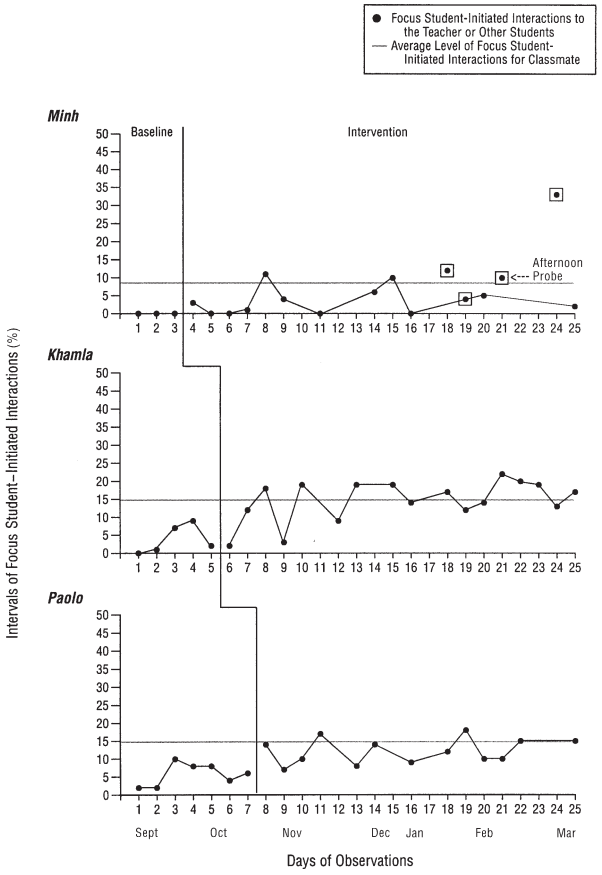

Figure 4. Percentage of intervals of focus student–initiated interactions to the teacher or other students.

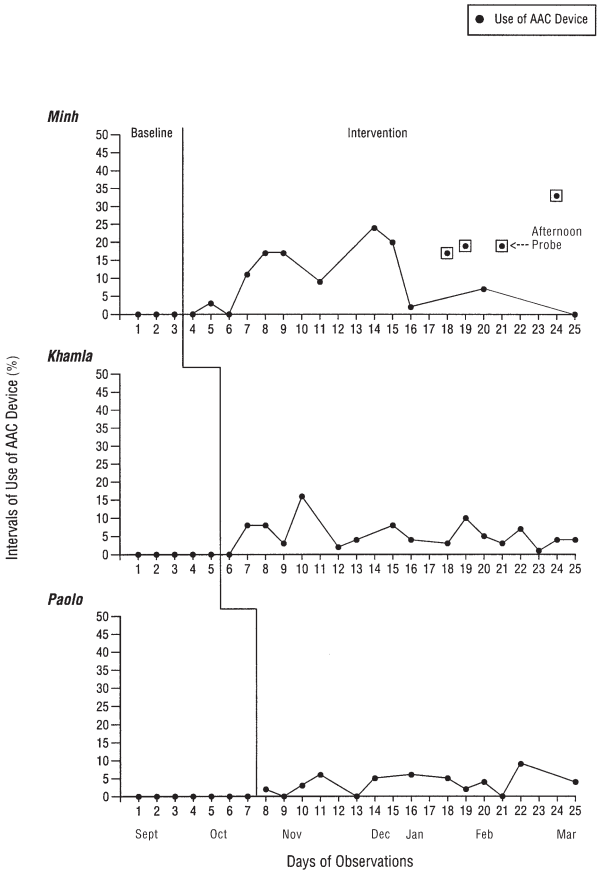

Figure 5. Percentage of intervals of use of an AAC device.

moderately well, and 3 were somewhat implemented; (b) 11 of the 15 supports for Khamla were fully implemented, 2 were implemented moderately well, and 2 were implemented somewhat; and (c) 7 of the 11 supports for Paolo were fully implemented and 4 were implemented moderately well. Ratings of the implementation of items in each UPS at the final meeting were as follows (in some cases, the number of items on each UPS changed from the first meeting to the last because of the addition and revision process): (a) all of Minh's 12 supports were fully implemented, (b) 19 supports for Khamla were fully implemented and 1 was implemented moderately well, and (c) all of Paolo's 12 supports were fully implemented.

Ecological Validity: Participant Perspectives on the UPS Process

Analysis of data from group interviews conducted at the end of the study generated themes that were grouped into two categories: benefits of the UPS process and recommendations for changes in the UPS process.

Benefits of the UPS Process

Seven themes emerged during the data analysis process that were common to at least two of the three team interviews. First, the monthly UPS meetings provided regularly scheduled opportunities to participate in updates on the students' academic and social growth and to focus with other team members on the students' support needs. For example, two team members commented,

> We're just dedicating an hour or so once a month, which is really nothing when you think about it, to really applying our knowledge and our minds and our hearts to Khamla's needs. It's changed for me so much of how I am in the classroom with him. . . It's been just wonderful.

> I think that getting the chance for all of us to discover all of his wonderful strengths and discuss all the areas where we can improve his communication, help him with interactions with more of his classmates, and see what's going on at home [is great]. . . I would never know this information unless we had these meetings.

The UPS meetings and collaborative implementation of the support plans provided opportunities for team members to share perspectives and expertise and model intervention strategies for one another. It also allowed parents to contribute their knowledge and perspectives. One team member commented,

> To have Mom here has been really nice . . . because I am able to pass teachers and other folks in the hallway, but I don't often pass Mom in the hall; so it's been nice to have her to collaborate with, too.

Team members also stated that the collaborative teaming process increased team member accountability. Each month the UPS was reviewed, and team members responsible for implementing each item were "put on the spot" to either confirm that the support was being implemented or lead a discussion of revisions that were needed.

The second theme that emerged during the data analysis process was that the UPS process (i.e., team meetings and collaborative implementation of the support plans) provided a support network for team members and reduced their feelings of isolation. Two teachers made the following comments:

> I think you don't feel as isolated. . . You feel more like, okay, my focus is communication, and somebody else's focus is something else; and it feels much more like, wow, we're all working toward the same kinds of things here. We accomplish a lot more that way.

> The main thing is I feel less alone. I don't feel overwhelmed. . . I really believe in the whole idea that more

TABLE 3: **Team Interviews: Social/Classroom Behaviors**

Student	*Preintervention*	*Postintervention, 1 Month following UPS*	*Postintervention, at Study End*
Classroom participation			
Minh	Participates minimally in whole-class activities because of the location of his desk and technology system Does not use his AAC device to participate in class Participates minimally in classroom discussions and only with facilitation from the instructional assistant	Participates more often in whole-class activities because of changes in the location of his desk Uses a low-technology board and a laptop computer to participate in classroom activities Initiates participation in class discussions using a bell system	Attends more to class activities and discussion Is more eager to participate in class More often initiates participation in class discussions Increasing use of low-technology devices for participation in classroom activities Is more confident, assertive, and opinionated
Khamla	Follows a few simple classroom routines Enjoys observing but needs assistance to join and participate in group activities Needs prompting to ask peers for materials or assistance Vocalizes minimally and speaks four words or word approximations in English	Uses peer models to follow classroom routines Takes turns with peers throughout classroom activities Spontaneously accesses low-technology boards to communicate personal needs Uses low-technology boards and simple voice output devices to participate in classroom activities	Pays attention and fully participates in group activities Demonstrates increased independence, persistence, and enthusiasm Is very motivated to initiate communication using a board vocabulary of graphic symbols and voice output devices Uses boards to repair communication breakdowns Uses a speech vocabulary of about 25 words and word approximations to create 1- to 2-word sentences
Paolo	Only communicates with gestures and vocalizations Is frustrated in his attempts to express a variety of messages Attends for only short periods of time during class activities Participates only in preferred activities Relies on instructional assistant for assistance	Attends to and takes an active role in academic activities Relies less on his instructional assistant Uses his communication book to participate in academic activities Articulates more clearly	Uses a variety of low- and high-technology AAC devices to communicate Participates in activities with peer support Relies minimally on instructional assistant support Asserts himself, makes choices, and is more confident and independent Works collaboratively with peers to complete tasks

continued

minds are better than one and that collaboration is the way we should go.

The third theme to emerge was that the UPS process expanded team members' visions of the many possibilities for inclusion of focus students in general education curriculum and classroom activities. They also spoke of the ways in which the UPS process facilitated the integration of communication strategies across classroom activities. As one team member commented, "It has definitely helped us to integrate his communication strategies across activities, as opposed to speech and language being a separate activity." Finally, team members felt that the UPS process supported expansion of the role of speech-language pathologists to include facilitation of social interactions in the classroom and to explore, along with other team members, different communication options. As one speech-language pathologist commented, "I think the low-tech [AAC devices] were

TABLE 3: *Continued*

Student	*Preintervention*	*Postintervention, 1 Month following UPS*	*Postintervention, at Study End*
Interactions with peers			
Minh	Does not initiate interactions with peers during classroom activities	More often interacts with other students during classroom activities	Is more confident and assertive in initiating interactions with peers
	Is well liked by his classmates and has one close friend in class	Has a core group of friends	Initiates requests for peer assistance
			Selects vocabulary for his device based on his interactions with peers
Khamla	Seldom initiates interactions with peers and relies on the instructional assistant for support and communication	Interacts more frequently with peers	Has friends
		Requests peer assistance	Engages in cooperative activities
	Rejects most offers of peer assistance	Almost always works with a partner or in a small group	Uses an increased variety of modes of communication to interact with peers
	Uses proximity and objects to initiate interactions with peers	Maintains longer interactions with peers using communication boards and books	
	Engages in parallel play during class activities		
Paolo	Uses gestures and vocalizations to interact with peers	Interacts with peers with increased independence	Participates in extended interactions with peers using a combination of speech and low- and high-technology devices
	Requires assistance to maintain interactions with peers	Selects his "partner for the day"	Selects communication means based on the requirement of the context and partners
	Initiates interactions primarily with the instructional assistant	Uses a communication book to interact with peers	Has developed positive relationships and friendships with other children

really quite successful, and it was really a shift because of these meetings that I would do that, because I was brought in more for high-tech [AAC devices] originally."

A fourth theme that emerged was that monthly UPS meetings allowed for the development of a comprehensive, cohesive plan of academic and social supports. One team member offered the following:

> One of the benefits has been that he has a more well-rounded plan. . . There are seeds of ideas that keep growing as opposed to fragmented ideas, which is what typically happens when we're rushing by each other in the hallway and throwing out ideas here and there. . . I feel like his plan has just gotten more and more rounded and full.

Team members also found that the UPS process was flexible (the fifth emerging theme) and allowed them to refine, add, or delete support items as needed. A teacher commented, "I really like the fact that we set goals at the beginning, but with the idea that, hey, we can change these at any point." Thus, the UPS was seen as a "living" document that was revised regularly to reflect the ongoing needs of the student, the effectiveness of the support items, and the practicality of support item implementation.

The sixth and seventh themes that emerged were that the UPS collaborative process provided a basis for the development of academic and social objectives for focus students' individual education plans (IEPs) (e.g., "I think it's really going to help us when it comes time for his IEP to develop goals around what we've seen") and that the support plan laid the groundwork for continuity across the school years. Finally, one team member commented that the UPS process provided a structure that could be molded by individual teams to make it match a team's collaboration style and individual team members' levels of comfort in the collaborative process. Another team member commented that

> Just the fact that we continued to work with the framework that you . . . presented us with; we kind of found our own way to make it all work, and I think that, to some degree,

TABLE 4: **Team Interviews: Academic Skills**

Student	*Preintervention*	*Postintervention, 1 Month following UPS*	*Postintervention, at Study End*
Reading			
Minh	Reads at a beginning grade 1 level Reads monosyllabic and highly familiar words Reads sentences composed of graphic symbols Loses interest in reading after a brief period of time	Reads simple 5- to 6-word sentences (grade 1 material) Uses a nonverbal strategy to request assistance to read unfamiliar words	Reads at an end of grade 1 level Demonstrates an ability to read words rather than graphic symbols Is motivated to read for longer periods of time
Khamla	Likes to look at books Selects books with prompts Needs assistance to move through the pages Attends inconsistently during group reading	Holds books correctly, turns the pages, and points to pictures Is more engaged during group reading of familiar books	Initiates selecting books and looking at them with others Reads graphic symbols in sentence format Recognizes the first three letters of his name
Paolo	Matches sounds to three letters Reads some simple, familiar words Vocalizes during choral reading Attends to and turns the page during group reading	Matches sounds to nine letters Is increasing his site word vocabulary Sorts uppercase and lowercase letters	Recognizes 13 letters Generates words that begin with some letters Anticipates the story sequence for familiar books
Writing			
Minh	Does not demonstrate phonemic awareness Uses invented spelling to write words Completes sentences by supplying the final word selected from an array of choices Has difficulty generating ideas for creative writing	Is beginning to spell simple words using a low-technology alphabet board Independently responds to questions by spelling out the initial letters in words using a low-technology board	Uses phonemic knowledge to spell new words Generates 2-word sentences using correct spelling and grammar Writes up to 8-word sentences dictated by an adult Attempts to write simple words with his head mouse
Khamla	Likes to scribble using a variety of writing utensils Resists needed assistance to trace letters	Uses rubber stamps with peer assistance to select topic for a journal entry Requests and uses name stamp to sign his work Traces his name with physical support	Enjoys tracing with peer assistance Initiates writing with a variety of utensils Selects appropriate graphic symbols for completing familiar sentences during journal writing
Paolo	Partially writes his name using an adapted keyboard Copies words using an adapted keyboard Attempts to trace using an adapted pencil	Types his first name and mom Makes effort to correct his typing mistakes Writes three letters of the alphabet with an adapted pencil	Types simple sentences with letter-by-letter dictation Types his full name and a few simple words

continued

TABLE 4: *Continued*

Student	*Preintervention*	*Postintervention, 1 Month following UPS*	*Postintervention, at Study End*
Math			
Minh	Recognizes double-digit numbers Adds and subtracts numbers to 10 Adds, multiplies, and divides with a calculator Does not understand the concepts underlying multiplication and division	Completes an addition worksheet using a number line Developing initial concepts of time and money using computer software Continues to use his calculator for simple computation	Continues to develop concepts of time and money using computer software
Khamla	Is unable to count Does not use manipulatives purposively	Verbally imitates numbers 1–5 Links cube manipulatives by matching the corresponding sides	Matches numbers 1–5 Counts from 1–5 Writes numbers with assistance from peers
Paolo	Matches and sorts math manipulatives by shape, color, and size Rote counts to 7	Is developing one-to-one correspondence Matches written numbers to 3	Recognizes simple shapes Creates a repeating pattern Sequences numbers 1 to 5

we'll continue to meet . . . because we've been forced to work through it in spite of initial resistance.

Recommendations for Change in the UPS Process

Members of two of the three teams recommended that team members be encouraged to reject suggestions for the UPS that they viewed as impractical or difficult for them to implement. One general education teacher said, "I want to feel free to say 'I can't do this,' and we want to make sure that the process allows us to do that." In addition, one team member suggested that the UPS process be expanded to include students in the general education classroom who were "at risk" academically or behaviorally. Team members commented that a collaborative structure that includes general and special educators, parents, and an individualized plan of support is likely to be relevant and effective for students with learning challenges who are not identified for special education services. Team members agreed that monthly meetings could readily be expanded to include such students.

DISCUSSION

The results of this study provide information about the effects of a collaborative teaming process on the level of engagement and social and academic participation of students with AAC needs in general education classrooms. Collaborative teaming supported by the UPS process resulted in increased levels of student-initiated interactions, decreased levels of assistance provided by instructional assistants, and increased engagement in classroom activities, all to levels that were commensurate with the behavior of focus students' peers. In addition, all three teams reported substantial gains in the focus students' academic performance (reading, writing, and math).

It is important to note that low levels of student-initiated interactions in Minh's case may have been attributable to the fact that his teacher used strategies in the morning that required Minh and his classmates to work by themselves. Minh's level of social interaction was higher during the afternoon observational period, when his teacher used cooperative learning strategies for natural and social sciences. These outcomes suggest that the classroom structure and teaching strategies used by general education teachers have an important impact on the number of opportunities available for social and academic participation in general education classrooms.

All team members expressed satisfaction with the collaborative process because it allowed them to support one another and to contribute to the development of educational and social supports for the focus students. Indeed, the UPS process empowered team members to contribute their knowledge and ideas to the development of a support plan while at the same time providing an ongoing opportunity to revise the plans as necessary. A particular strength of the UPS

was its integration of supports around classroom activities. The general education curriculum became the context for intervention, and academic and social participation became the ultimate goals.

When parents, general educators, and special education personnel are working together as a team, they share responsibility for student success. Too frequently, however, student performance is viewed as the responsibility of the professional most identified with the specialty area in question (Ehren, 2000). For instance, AAC is often considered to be the responsibility of the speech-language pathologist, whereas academic performance and curricular modifications are usually seen as the responsibility of the classroom teacher and/or inclusion support teacher, respectively. The UPS process allowed the speech-language pathologists, classroom teachers, parents, and inclusion support personnel to integrate efforts and share responsibility for student outcomes. All team members assisted the classroom teachers by suggesting curricular, assessment, and instructional modifications to facilitate focus student social and academic participation. Likewise, the classroom teachers functioned as educational partners by reinforcing therapeutic targets, providing new objectives, and assessing students' performance on an ongoing basis. A characteristic that seems to typify a collaborative team is that all members are valued by one another and are able to join together to create a whole that is stronger and more effective than any single team member alone (Giangreco, 2000).

Despite the general benefits of collaborative teaming on student outcomes, some considerations need to be addressed. The first is that providing effective team support to students with AAC needs in inclusive classrooms involves many competencies (Soto Müller, Hunt, & Goetz, 2001b), some of which are targeted in personnel preparation programs and others that are currently developed on the job, for the most part (Giangreco, 2000). As inclusion becomes an educational option for increasing the number of students with AAC needs, educational personnel from all disciplines require explicit instruction and exposure to collaborative teaming practices at the preservice level. Second, collaborative teaming requires adequate planning time and financial resources. Although the results of the current study indicate that the UPS process provided a practical structure to support collaborative practices, it was funded by a university research project. Building an inclusive school community depends on having sufficient resources to allow educational team members to engage in collaborative planning on a regular basis. West and Idol (1990) outlined a number of strategies for increasing collaborative planning time, including (a) having the school's principal or other support staff teach one period per day to allow teachers to attend planning meetings, (b) hiring a "floating" substitute teacher (perhaps funded by the business community) to fill in during planning days, and (c) altering the length of the school day once each week to provide staff collaboration time without students.

A third limitation of the study was its small sample size. This investigation restricted its focus to three educational teams and three students, and although it provides insight into the collaborative process, the ability to generalize beyond the small sample is limited.

In closing, the implementation of inclusive education of students with AAC needs requires a collaborative effort by members of educational teams who share a vision of full social and academic participation of students with disabilities within their school communities. However, successful collaborative teaming depends on regularly scheduled opportunities for members of educational teams—including parents—to share their expertise, identify common goals, build plans of support, and determine responsibilities for implementation. Identifying and implementing structures for regularly scheduled planning time requires both administrative support and staff who are motivated to work as members of collaborative teams (West & Idol, 1990). Further research is needed to document for policy makers the links between effective implementation of models of collaborative teaming and positive outcomes for students. There is also a need to increase the number of university-based personnel preparation programs that have moved beyond an "expert model" to a collaborative, shared decision-making model whereby all members of an educational team have the knowledge, experience, and responsibility for designing and implementing educational and social supports for students with disabilities who are members of general education classrooms.

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Ryalls & Baum

Ryalls, J., & Baum, S. (1990). Review of three software systems for speech analysis: CSpeech, BLISS, and CSRE. *Journal of Speech-Language Pathology and Audiology, 14*, 49.

Three software packages for digital signal analysis of speech were evaluated and compared. Factors such as user-friendliness and ease of execution relevant to operations likely to be of interest to Speech-language pathology were considered and discussed. Each of these three relatively low-cost University-developed systems runs on the IBM-compatible AT type machine, using the Data Translation DT-2801-A analog/digital conversion card. All three provide 12-bit resolution at the 10 or 20 kHz sampling rates, standard to most speech research.

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