Language intervention: computer training for young children with special needs

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Abstract

Three studies that explore the usefulness and effectiveness of computers for training language skills of young children with communication disabilities are reviewed. A study of eight toddlers with Down syndrome compared traditional individual language intervention with computer-based instruction for developing comprehension of vocabulary and early grammatical patterns over a period of three months. Both approaches showed a similar, highly significant effect, indicating that computer-based intervention was as successful as traditional one-to-one language therapy.

A second study used 52 children (ages 4–10) who were enrolled in special education classes for children with severe language, learning and behavioral disabilities. The effectiveness of adding twice a week, 30-minute interactive computer language training sessions to the regular classroom language curriculum was examined. Children showed significantly more progress in vocabulary, general language ability and social communication during the 10 week period they were receiving the computer training.

Lastly, the effectiveness of using a parent volunteer to work with toddlers on computer-based language tasks was compared with language progress when these children worked with a professional speech language pathologist. Four out of five of the children showed more progress when working with the parent volunteer.

The article concludes with a discussion of educational considerations for planning computer-based language intervention and includes a sample language lesson for the computer as well as software evaluation guidelines.
The microcomputer, a device that has existed in widespread use for little more than a decade, is reshaping the clinical and educational realms of speech-language pathology and special education (Lewis, 1993). A recent review of research studies conducted over this period indicates that the use of computer technologies for young learners with language impairments can be helpful and effective (Schery and O’Connor, 1995). There is also some evidence that a trained non-professional can effectively facilitate learning during computer-based intervention activities (Schery and Spaw, 1993), making the intervention process less “labor intensive”. As the accessibility of educational microcomputers increases, the opportunity for effective instruction and interactive practice in developing communication skills for young children with special needs expands.

There are several reasons why a computer-based approach is attractive for work with such children. Computers are nonjudgmental and patient. They provide undivided attention to the child using them and allow instruction to proceed at the child’s pace, no matter how long it takes for the child to process information or to respond. Computer programs typically provide immediate reinforcement to children, allowing them to see at once the results of their responses. The use of computer animation and color-graphics in current generation software provides variety and may aid motivation and attention processes for youngsters (Meyers, 1990; Shriberg et al. 1989). Through the use of synthesized speech, non-speaking children can be provided with language output capability, perhaps for the first time. And, in addition, the organized pre-structured format of computer programs (when carefully selected to match the individual child’s developmental needs), should allow individuals with pre-professional levels of training, such as classroom aides or older student tutors, to work effectively with the young child.

This paper reports on three related studies exploring the usefulness and effectiveness of using computers for training language skills of young children with special communication disabilities. Two of the studies were carried out in an early intervention program with toddlers ages 2–3 years. The third study extended the training approach to somewhat older children enrolled in public school programs for pupils with exceptional needs. Although the ages of these children ranged from 4–10 years, they all functioned in terms of their language and speech development at the early stages of communication (15 months to 3 years). The questions addressed were: Is computer-based intervention effective in teaching vocabulary and general communication skills to young children with language impairments? How effectively does it compare to traditional language intervention provided by a trained graduate language specialist or as an augmentation to a special education classroom language program? Can non-professionals (parents) utilize computer-training effectively with young children with language disabilities?

**Comparison of computer and traditional individual language intervention**

The first study was carried out at two infant/toddler intervention programs in Los Angeles, California, where several of the toddlers had been identified as needing
intensive help with communication skills. All the children were included who met the basic criteria of functioning at a mental age of at least 15 months (judged necessary to comprehend the symbol relationships of the computer graphics), having grossly intact perceptual and motor abilities (glasses, hearing aids acceptable), and speaking or signing in no more than single words. The eight toddlers who met this criteria were followed for their vocabulary and language learning during a computer-facilitated intervention period of 6–10 weeks compared with a similar period of language training using a model of traditional individual language therapy.

**Computer therapy**
The software program used was the Programs for Early Acquisition of Language (PEAL, Meyers, 1985) on an Apple IIe microcomputer with an Echo IIe speech synthesizer and expanded Keyboard. This software was chosen because it allowed interactive, developmentally appropriate instruction with a controlled vocabulary. Current software publishers advertise an increasingly expanded range of programs that can be adapted to intervention in this context.

In this training context, the children pressed large keys with pictures on them to hear the corresponding word accompanied by a related color graphic on the screen. Vocabulary items were selected to portray play contexts that appeal to young children (e.g., a purse and its contents; wind-up toys such as helicopters and cars). Matching objects were available, displayed by the interacting adult. When the children “asked for” an object using the computer, the adult supplied it, and encouraged a brief period of interactive play. Adults gave general verbal encouragement, labeled objects and graphics following the child’s interest, and commented on the child’s actions in simple language, but otherwise there was no pressure for performance. Rather, this was more of an interactive play session focused around the computer and corresponding objects.

**Traditional therapy**
Traditional speech and language individual therapy (Fey, 1986) was conducted on the floor of a carpeted room, utilizing a standard set of motivating toys and objects. Graduate level language clinicians used a flexible routine, following the child’s non-verbal interests, providing language models, reinforcing any communication attempts, and responding contingently during turn-taking and play routines.

Since there were so few subjects, a reversal design was used to strengthen inferences. Subjects were paired based on developmental level and diagnostic category (Down syndrome, unspecified developmental delay, failure to thrive). Then one member of each pair was randomly assigned to receive the computer intervention first while the other member of the pair received the traditional therapy first. After approximately 10 weeks, they switched interventions. The children’s communication skills were measured before starting, at the midpoint when training programs were switched, and after both treatments were completed. A repeated measures MANOVA was used to establish an extremely significant effect of training over time \[F(2,12) = 37.05, p < .001\] on a composite measure of formal language tests given by researchers, parents and teachers.
a detailed report of this research see Schery and O'Connor, 1986). Simply stated, both interventions yielded positive gains for the children. No differences large enough to be clinically significant between the two training approaches were found. The computer condition had facilitated language comprehension as effectively as traditional intervention procedures. Since a skilled language specialist was present in each condition, the presence of a responsive and perceptive adult may have been a critical variable in effecting such communication growth: this was not formally assessed in this study.

**Effect of adding computer language training to traditional special classroom language program**

Based on the prior study, funds were obtained from the US Office of Education to look at the effectiveness of the computer training with a larger, more heterogeneous, group of school-aged children with special language learning needs. These children all attended self-contained special classes of 6 to 12 children in the San Gabriel Valley of Los Angeles County, California. Individual children had received diagnoses of severe retardation, multiple handicaps, severe emotional disorders including autism, and cerebral palsy. They all functioned between 15 and 36 months developmental age and had been identified as having severely depressed communication abilities, either being non-verbal, non-signing or communicating at no more than the single symbol level. This time graduate students in communication disorders came to the schools to provide the computer language instruction as an enhancement to the regular special education program. The classrooms were all staffed by special educators who focused on teaching to individual children’s needs. Each participating child had language development as a primary goal, but each classroom teacher was free to pursue that goal as he or she saw fit within the classroom curriculum. The additional computer training was conducted twice a week over a period of 10 weeks, for a total of 16 individual 30-minute sessions. It was carried out on the child’s school campus, usually in a separate room close to the classroom or in a closed-off portion of the classroom itself.

Here too a reversal design was used, with subjects being initially paired for similar age, developmental levels and diagnoses. Then one member of each pair was randomly assigned to receive the computer enhancement during the first 10-week phase (Phase 1) and the other member of each pair received the computer training during the second 10-week phase (Phase 2). During the alternate phase, each child received only the classroom-based language instruction from the special education teacher which continued throughout the study for all participants. All 52 children were tested at each of three points on a battery of measures, including a criterion test of the actual vocabulary in the software program, a cluster of formal and criterion-referenced language skill measures gathered from three sources (the researchers, the classroom teachers, and the parents) and lastly a composite score measuring social/interpersonal skills reported by teachers and parents.

**Results**

Table 1 shows the results of this study. Perhaps not surprisingly, analysis with the criterion test vocabulary showed the strongest effect of the computer training: that is,
the targeted vocabulary showed the greatest difference between computer training and no-training conditions (regular classroom curriculum only). The children in the Phase 1 computer training group initially showed marginally lower ability to recognize the vocabulary before training (pretest mean score of 10.77 versus 14.25 for children in Phase 2 training). By the midpoint testing, they earned scores significantly above the students not getting training until the second phase (mean score 23.09 vs. 16.67). During Phase 2, the second group, now receiving computer instruction, made significant gains while the Phase 1 participants (who now were receiving just the classroom training) remained about the same. In other words, the children made the most rapid vocabulary gains during the time they were receiving the additional computer training. Over the same period of time with only the classroom language program, the children did not show comparable progress. Follow-up testing 6 weeks after all training had stopped showed that both groups had maintained the specific vocabulary gains they had made. Results on the general language tests (General Language Skills Composite Variable) showed a similar, though less extreme, pattern and the parents’ and teachers’ ratings of social/interpersonal communication skills (Social Interpersonal Composite Variable) also showed the effects of the computer training, although not every gain noted was significant in this area. More technical information on the variable construction can be found in Schery and O’Connor (1992).

In summary, the pattern was consistent in showing positive effects of the computer intervention, not only on trained vocabulary, but more generally on related language measures and even on the indirect measure of communication abilities in social/interpersonal functions. While the actual magnitude of change over this 6 month

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<th>Table 1: ANCOVA results comparing language scores for children in Phase 1 versus Phase 2 computer training</th>
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** significant at the p < .001 level
* significant at the p < .10 level
period was not large, the differential effect of having the computer training added to the special classroom program was clearly evident and supported the use of computer intervention for developing vocabulary and communication skills even for children with severe disabilities. The children were able to utilize the technology successfully and to sustain interest for at least a 10-week period of training. In some individual cases the response was dramatic: one totally mute four-year-old girl with diagnoses of retardation and autism began to echo words for the first time while on the computer. Teachers, and especially parents, were pleased at the opportunity for these children to obtain individualized attention while participating in the computer training. So, while clearly not a panacea, the computer training in this situation, like for the two-year-olds in the earlier study, did seem to have a generally positive effect on the vocabulary growth and general language acquisition of these special needs children.

None of the children in these two studies was capable of utilizing the computer training program independently: they were either too young or too disabled. In both studies, a trained professional or advanced graduate student facilitated the computer training condition. Special educators rightly pointed out that teachers in these children’s classrooms would not be able to sit and interact on a routine basis with a student who was using the training program any more than they could already provide individual instruction for each child. Their request was to find ways to utilize computers as an extension of communication training opportunities beyond what the professional in charge could already provide. This led to the third study, conducted as a pilot project in California State University’s early intervention program, Centro de los Ninos.

**Comparison of professional and non-professional trainers**

Once again, two-year-olds who were functioning above the 15-month level but who were having significant difficulties developing communication skills were identified for this study. The children were trained using the same procedures, but this time each child’s progress was compared under two conditions: one where the professional communication specialist facilitated the training and, alternately, where a trained non-professional (a volunteer mother of a handicapped toddler) oversaw the training. These mothers had received three, 20-minute training sessions on the use of the computer, the software, and the general principles of supporting learning in young children; none of them had previously worked with a computer nor taught any child other than their own. The notion behind the study was that the structure afforded by a carefully designed computer intervention program should make it possible for parent volunteers to work effectively with these young children. If so, this could extend the time that the children received interactive, individualized attention within the class day or possibly through tutorial sessions before or after school hours. The professional teacher/clinician then would gain time to concentrate on other aspects of the children’s learning needs and, in effect, utilize computer technology to accomplish “more for less”.

**Results**

Of the five children who completed the training over 3 months, all made measurable progress in vocabulary acquisition. Four of the five children also made notable improvement.
in general language development, as measured by a battery of formal tests including the *Peabody Picture Vocabulary Test* (Dunn and Dunn, 1981), the *Initial Communication Processes Observational Scales* (Schery and Wilcoxen, 1982), and the *Brigance Inventory of Early Development* (Brigance, 1979). Four out of five of the toddlers made more vocabulary growth when they were working with the paraprofessional, and three of the five also made more general language progress in this condition. This pilot study suggested that with relatively little formal training, paraprofessionals (in this case volunteer mothers) can be successful in facilitating language development with young, language disabled children. Interestingly it seems that they were perhaps more successful than even the professional. Part of the explanation for this may lie in the fact that four out of five of the children were from Hispanic backgrounds, and both paraprofessionals in the study were Hispanic, whereas the professional was not. With such young children, the issue of “cultural match” for learning style may be very salient. The mothers may have been unconsciously using culturally determined interaction and learning support styles that were familiar to and facilitative for these toddlers (Iglesias, 1985).

In summary, the results of three related studies that examined the effectiveness of computer-based intervention to teach language and communication skills to young children with language disabilities suggest that this approach can be useful in remedial programming for these children. Table 2 summarizes some of the key points that these studies have suggested.

It seems apparent that computers can be introduced successfully with chronologically or developmentally quite young children. When used in an interactive fashion, computers not only successfully engage such young children, but the results of language facilitation using this approach appear to be essentially as effective as individual training from a graduate level professional. Clearly this training can provide a measurable addition to a special class, even one where language learning is a focus of the general curriculum. Furthermore, there is some suggestion that paraprofessionals can be trained to provide computer-based language intervention with relative ease and with effectiveness. Given these outcomes, it is important to consider ways to best use the computer as an intervention tool.
Planning computer-based language intervention

What needs to be considered before using the computer as an intervention tool for young children with language disabilities? If computer intervention is to be effective, the teacher or clinician needs to consider the following:

**Intervention planning**
In an era when educators and clinicians are experimenting with the computer to discover its possible contributions, interventionists need to reaffirm their theoretical principles (Schwartz, 1990; Steiner and Larson, 1991). It is best to plan the intervention first, and then determine if the computer might enhance the remedial plan. Examine some possible “instructional scenarios” used with the children who demonstrate language impairments. What areas of language have been identified as targets? What activities or learning sequences have been employed to reach these goals? How can the computer be incorporated into such activities or learning sequences?

**Software selection**
Effective computer-based intervention is contingent upon the selection of appropriate software (Haugland, 1992; Lee, 1987; Majsterek and Wilson, 1989). This is time-consuming when computer-based program planning begins, but software needs to be evaluated to determine the following:

a) Developmental level: The content of the software used must be developmentally appropriate to the student (Clements and Nastasi, 1992; Neuman, 1991; Robinson, 1991).

b) Appropriateness: The program features—including the type of stimuli, the requirements for responding and the reinforcement provided—need to be carefully examined to determine if they will provide a positive learning experience for students (Steiner and Larson, 1991).

**Intervention context**
When children can be grouped or paired, it provides an environment where positive social skills can be facilitated and reinforced. This can be the opportunity to encourage the appropriate use of pragmatic communication skills such as turn-taking, listening, taking another’s perspective, and topic maintenance. Equally important to consider is the location where such intervention should take place. Can it be a part of a learning center in the classroom where the communication specialist can work with a group of children that the classroom teacher has identified as having similar needs? Computers can be placed on moveable tables, making them transportable to any location in the clinic or school environment. When making plans to implement computer-based intervention, make the context an important consideration.

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