

Study of Assistive Technology and  
California Community College Students with Learning Disabilities

Preliminary Report - March 2004

High Tech Center Training Unit  
of the California Community Colleges Chancellor's Office

Contributing authors:

Marcia Krull - Learning Disabilities Specialist, Mount San Jacinto College  
Pauline Waathiq - Learning Disabilities Specialist, DeAnza College  
Susan Matranga - Learning Disabilities Specialist, Los Angeles City College  
Ellen Cutler - Assistive Computer Technology Specialist, Santa Monica College  
Dr. Rose Asera - Research Consultant, Carnegie Foundation  
Carl Brown – Director, High Tech Center Training Unit

*The authors wish to express their appreciation for the enthusiasm and hard work of the students and faculty of the California community colleges participating in the study. It is our hope that their efforts will help to advance the academic success of students with learning disabilities.*

# Study of Assistive Technology and California Community College Students with Learning Disabilities

Preliminary Report - March 2004

## ***Background***

### *Students with learning disabilities in community colleges*

A 1997 study of 672 community colleges by the American Association of Community Colleges found that of students receiving disability services 37% had learning disabilities. The same study found that although 53% of all students in higher education are enrolled at community colleges, 71% of students with learning disabilities are in community colleges. That number is expected to grow as students who have been mainstreamed in secondary school pursue higher education.

More specifically, California Community College Chancellor's Office data for 2001/2002 indicates that a total of 81,835 students with disabilities received services. Of that number, 22,011, or almost 27% of the total, were students with learning disabilities.

Extensive research exists on the nature of learning disabilities and on some accepted accommodations such as the effects of extended testing time. However, there is little research to inform and refine the use of assistive technologies by students with learning disabilities in community colleges. There are, in fact, very few assistive computer technologies which address the specific needs of students with learning disabilities. Additionally, the research that has been conducted to date has been small scale and laboratory-based.

A series of studies by Jerome Elkind and colleagues at the Lexia Institute has examined the use of screen readers that synchronize visual and auditory presentation of text for adults with learning disabilities including dyslexia, as well as attention deficit disorders. These studies were conducted in laboratory settings, and the outcome measures were changes in reading rate and comprehension on standardized reading tests as well as reported changes by students in comfort and stress levels. The findings overall indicate the possibility that screen readers can enhance reading speed and comprehension and can decrease stress and increase enjoyment of reading.

A 1996 study by Elkind et al. examined 50 adults, all of whom had been diagnosed as learning disabled. This sample included students at four-year and community colleges and working adults. Study participants were given the Nelson-Denny Reading Test to determine reading comprehension and speed. In the pretest, both reading speed and timed comprehension were lower than the grade-level norms on the test. The median of their unaided reading speed of the sample populations was 155 words per minute. This score is considerably lower than the normal mean reading rate of high school students, which is 255 words per minute and of college students, which is 300 words per minute. The average timed comprehension scores were also considerably lower than normed adult scores. Half of the participants had comprehension scores at or below the 25<sup>th</sup> percentile. However, when additional time was allowed, comprehension increased; untimed comprehension scores were at the 66<sup>th</sup> percentile.

Participants were then given training on the assistive technology and retested for speed and comprehension on a different form of the test. On the post-test, use of the screen reader increased reading rate up to 180 words per minute (approximately the speed of normal speech). This is a significant difference above the unaided reading rate (155 words per minute), but still below peer norms. Increases in comprehension were small and not significant. Those participants with lower reading scores improved the most, while those whose reading rate or comprehension was relatively good benefited less, and even found that the technology interfered with their performance.

Fourteen participants of the original fifty were given the assistive technology for an extended period of time (three months to one year) and were then given a structured questionnaire about use of the technology. Almost all participants (93%) reported that reading was easier, less stressful and less tiring, even when there were no gains in reading rate or comprehension. Only one participant indicated difficulty integrating auditory and visual information. [source: *Computer-Based Comprehension of Adult Reading Disabilities* Jerome Elkind, Molly Sandperl Black and Carol Murray, published in *Annals of Dyslexia*, vol. 46, Nov 1996]

A second study by Elkind in 1998 using more developed screen reader technology studied the same reading variables: speed, comprehension and perceived comfort. The sample was twenty-

six community college students who had been found to have learning disabilities. On the Nelson Denny standardized reading test, the median reading score of the sample was 149 words per minute, compared to a median of 250 words per minute for community college students. These students reported that they not only read slowly, but could not read for long periods of time without a break. The median timed comprehension score was at the 15<sup>th</sup> percentile, while untimed comprehension was at the 64<sup>th</sup> percentile.

As in the 1996 study, students with slowest reading speeds increased their reading rate the most, but those with good reading speeds did not benefit significantly. Those with reading rates below the speed of normal speech read faster, those with faster speeds might even lose performance. Those with poorer comprehension (tenth grade or below) similarly benefited more than students with stronger comprehension. In a structured questionnaire at the time of training, participants thought that the technology might make reading less tiring and stressful and might contribute to sustained reading. Three participants reported difficulty integrating auditory and visual information. {Source: *Computer Reading Machines for Poor Readers*, Jerome Elkind, Lexia Institute January 15, 1998]

### ***The Current Study***

This report describes the initial stages of a study conducted in the California Community Colleges on use of assistive technology by students with a particular pattern of learning disability. The assistive technology consists of a screen reader designed to compensate for deficits in reading speed. The study was organized by the High Tech Center Training Unit that provides training and technology support for California Community College faculty and staff in the use of assistive computer technologies.

The study is designed to examine whether the use of a screen reader can improve the academic performance of students with a learning disability profile that includes deficits in processing speed, in particular, the population of students in the community colleges with a very specific set of learning disabilities who are taking reading-intensive courses in the social sciences.

### *The Technology*

The screen reader employed in the study (PDFaloud) was designed specifically for use by people with learning disabilities. The program contains a number of features similar to many assistive computer technologies designed for use by students with learning disabilities. The screen reader can:

- read text out loud by word, by sentence or by paragraph
- adjust reading speed
- magnify text
- highlight text, and
- access a dictionary that can look up words and read the meaning out loud.

The program selected, PDFaloud, reads documents stored in the "image over text" PDF format. In California Community Colleges, books and other materials are readily available in the PDF format from the Alternate Media specialist at participating colleges, the statewide Distributed Scanning Network or the Alternate Text Production Center (ATPC).

Colleges participating in the study received a site license including the rights to install the software on any campus computer as well as the home computers of all students participating in the study. The intent was to provide the same level of access to books for students using assistive computer technologies as that enjoyed by users of hardcopy books.

### *Research Methods*

This study was designed to be a systematic exploration of the use of assistive technology as a methodology for enhancing the academic performance of students with specific types of learning disabilities. However, the study has been shaped by limitations of doing research in the real world rather than in a controlled or laboratory setting. This study is more in the tradition of action and participatory research, an attempt to see the possible outcomes in real life situations.

The director of the High Tech Center Training Unit invited a research consultant and four experienced Learning Disability (LD) and Assistive Computer Technology Specialists from California community colleges that would not be part of the study sample to join him on an advisory research team. Advisory members include: Marcia Krull from Mount San Jacinto College, Pauline Waathiq from DeAnza College, Susan Matranga from Los Angeles City College, Ellen Cutler from Santa Monica College, Dr. Rose Asera from the Carnegie Foundation and Carl Brown from the High Tech Center Training Unit. This team of six met in May 2003 to decide on the design of the study and the sampling strategy for campuses and students. As a measure of interest and commitment on the part of the LD specialists on the advisory team, three attended in person and one via conference call.

The team of LD specialists discussed how to match the learning deficits of students with learning disabilities with the specific capability of the assistive technology proposed for use. The specialists described particular students they had worked with who could benefit from increased access to text via listening. These would be students who, based on assessment scores, had reading difficulties caused by slow visual processing. This speed deficit would show up in their processing speed index or as a noted difference between timed and untimed comprehension.

They determined that the profile and process for identifying such students would include the following factors:

1. Verification through the formal diagnostic process as having a learning disability;
  2. An aptitude score of 90 or above on any of the scales used in the LD eligibility model. (Three tests are commonly used in diagnostic testing-- WAIS III, Woodcock Johnson-Revised, or an updated WJIII.) A score of 90 would suggest that the student has the potential to transfer to a four-year institution;
- and

3. Having one of two indicators of a processing deficit in reading —  
a significant processing speed deficit as defined by the California Community Colleges LD Model;  
or  
a difference of more than two grade levels between timed and untimed comprehension on the Nelson Denny test, which may indicate a visual processing deficit or a weakness in decoding.

The advisory committee determined to select six campuses for the study. The campuses were chosen to be mid- to large-size colleges, mostly in urban or suburban settings, with well established Learning Disability programs. This size and location were chosen because such colleges would have a larger number of students meeting the profile, and those students would be more likely to have computers. The team arrived at a list of twelve possible campuses. All twelve campuses were invited. Those interested responded with letters of application including the signatures of the Learning Disability Specialist, the Director of DSP&S (Disabled Students Programs and Services), and the President of the College. Six campuses were chosen for participation. In the interests of privacy, the names of participating colleges will not be included in the study.

The training for use of PDFaloud was designed by a California Community College LD Specialist, Stacey Kayden from Laney College, who has been involved in technology training for several years. The training was designed specifically to integrate use of the technology into the day-to-day academic setting rather than simply teaching students how to use the technology. This approach was based on an observation by the research team that technology is often regarded as an add-on, separate from academic skills and curricular content. This training was meant to present the technology as an integrated part of academic study.

In July, the HTCTU organized a one-day training attended by one to three people from each participating campus, research team members, and the software developer. The designer of the training curriculum went through the training step by step. Each campus LD Specialist had a chance to become familiar with the program, and each campus was given a copy of the software.

The Learning Disability Specialist on each campus searched through student records to identify no less than 20 and up to 50 students who met the profile and who had taken a social science course in Fall 2002 or Spring 2003. These students made up the baseline group, and their academic achievement would provide the comparison for subsequent students using the screen reader. The Learning Disability Specialists were encouraged to invite these students to take the training, but they were also free to give the training and software to any student who they thought would benefit from using the technology.

### *Conditions and Limitations of the Study*

In designing this study we recognize a number of limitations that constrain not only the design possibilities, but in turn limit the breadth of outcomes. They are the limitations that are associated with doing research in real educational settings. In a nutshell, over a one-year period, the study was designed to evaluate the academic performance (grade point averages) of students with very specific learning disabilities participating in reading intensive courses before and after the intervention of a specific assistive computer technology designed to enhance reading capability.

In this study, for practical and ethical reasons, it was not possible to randomly assign students to an intervention or control group and then compare the academic results. Because of legal mandates it was not possible to deny services to any eligible student, and so even a design with a delayed start by one group was not an option. The choice to use an historic control was a pragmatic way of comparing academic achievement of a similar group of students in social science classes to the academic achievement of a subsequent (and in some cases, overlapping) group of similar students in social science course using the intervention software (PDFaloud).

As an outcome measure, grades are a blunt instrument. They have a very limited range and when taken in average are likely to show very small differences. In addition, many things influence academic achievement in a course, so the effect of one factor—such as use of a particular technological tool—may be minor. We acknowledge the complexity of influences on course

completion and grades, especially among community college students. However, grades are the current academic currency, and any study that did not examine academic achievement based on grades would not be taken seriously. Therefore, we undertake this study looking for any small indicators of possible effect.

Social science courses were chosen because they are reading intensive. The research team initially considered using academic performance in English 1A (Freshman Composition) as the basis of the study. An informal review of grades in English 1A at DeAnza College showed a differential of approximately one half grade point between general class average and students with learning disabilities. However, English 1A is a writing intensive course, rather than reading intensive. Courses that are included that meet social science requirements varied slightly by campus, but in general included anthropology, sociology, psychology, history, geography, cultural studies, economics, political science and in some cases, child development.

In describing the baseline population, we have included the variables of age and gender, but have not included other descriptors. We did not include ethnicity and race because of the ambiguity of interpretation of the categories and because in a relatively small sample, small numbers might have inaccurate implications. In addition, we did not track full- or part-time enrollment; a review of transcripts verifies that some “full-time” enrollment was filled with courses outside of the transfer or Associate of Arts curriculum, such as physical education or learning disability support courses. Many students’ transcripts included some semesters of full- or part- time enrollment, so there is no singular descriptor that would identify their enrollment pattern.

This study design depends upon a significant number (fifty or more) of students from the six participating colleges who possess the appropriate learning disabilities profile taking a social science course in Spring 2004. As we collate survey data from students who have been through the training, meeting this number may be problematic.

In addition, the Learning Disability Specialists can give the program and training to the students, but cannot guarantee level of use by students. Thus the treatment has some aspect of unevenness.

The decision was made to designate the Fall 2003 semester for training and time for students to become familiar with the technology. This was fortunate because there was a technical difficulty in Fall 2003; some of the program discs for students to copy the program to their home computers were defective and had to be replaced, in some cases more than once.

Finally this study is being conducted at a time when external and internal conditions within the California Community Colleges are stressful. The state has a major economic deficit that may affect funding, staffing and services.

#### *Initial findings from baseline data*

The six campus Learning Disability Specialists identified a total of 210 students who met the LD profile and had taken a social science course while a student at the college. Of these, 141 had taken a social science course in the academic year Fall 2002-Spring 2003. This group provides the baseline data. Other students in the total sample remain eligible to be part of the study if they complete training with the technology and subsequently take a social science course in Spring 2004. Additionally, newly identified students who match the learning disabilities profile, complete the training, use the software, and take social science courses in spring 2004 may also be included.

The following data are preliminary; some data are missing and will be included in the final report.

Of the 141 students, 76 are female, 65 male. The age range, as is typical in community colleges, runs from 18 (10 were 19 or younger) to over 50 (4 were 50 or above). The mean age is in the mid- twenties, twenty-six to twenty-seven (note, this age is slightly variable reflecting the time duration between data submitted and analysis).

Of the students who have taken social science courses, 75 students have taken one class, 39 students have taken two classes, 17 students have taken 3 classes and 6 students have taken four classes. Social Science courses include those given in general social sciences, women's studies,

anthropology, ethnic studies, archeology, economics, history, geography, political sciences, sociology, and assorted other courses in psychology or justice that are designated as meeting a social science requirement by a campus.

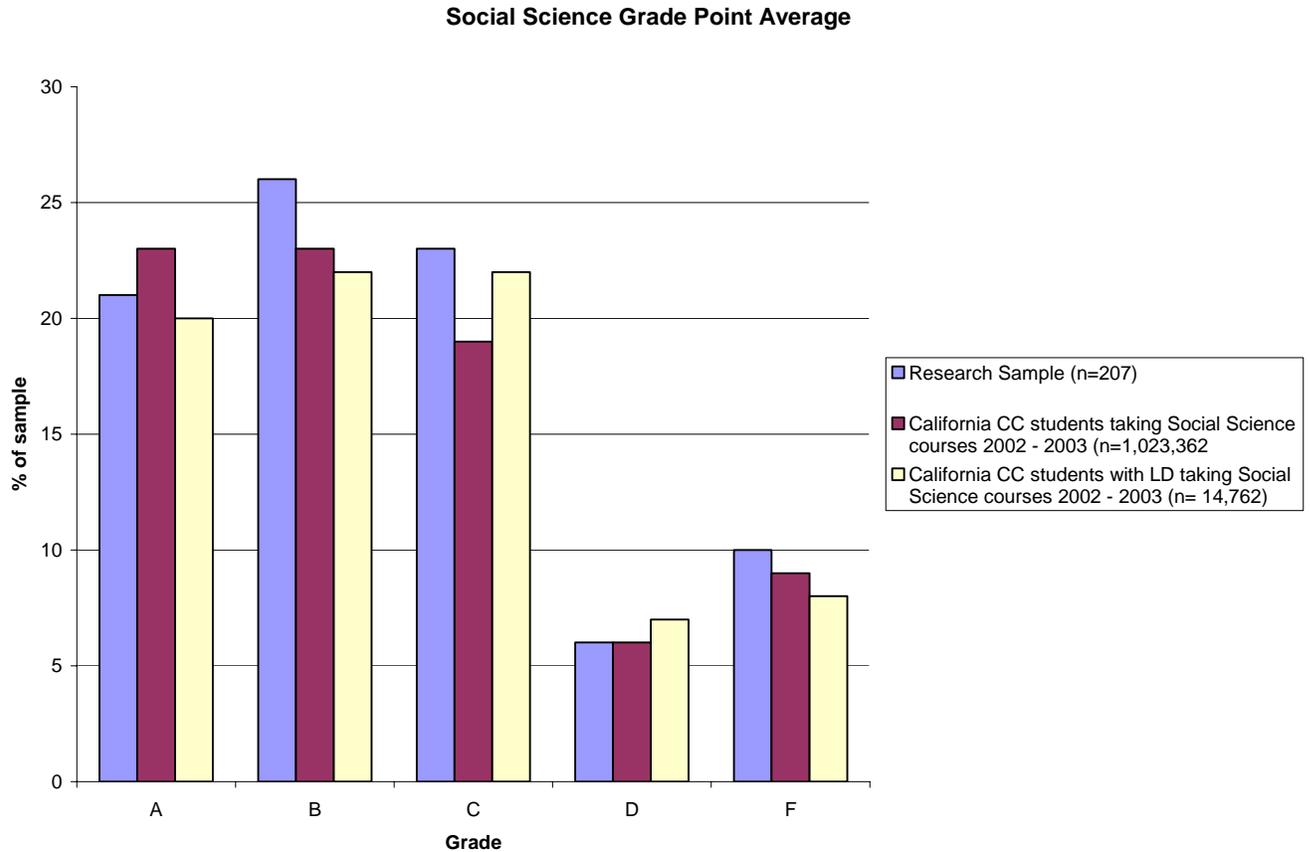
The most commonly taken classes by students in the sample are Introduction to American (or US) Government, Physical Geography, US History through Reconstruction, US History since 1876 and Introduction to Economics. The rest of the course-taking pattern covers a very wide range of social sciences.

The students in the sample took a total of 239 social science courses. Of these, 207 (86%) were completed with a grade of A, B, C, D, or F; two received grades of Incomplete; and 32 (13%) were not completed, receiving a W. Of the 207 classes completed with a grade, 21% of the students received an A; 26% received a B; 23% received a C; 6% received a D, and 10% received an F. The average grade of this distribution is 2.5 (C).

In order to compare this information to a broader student base, we were able to secure systemwide data from the California Community Colleges Chancellor's Office. Interestingly, this study's findings of grade distribution and grade point average of the 207 participating students is very similar—similar enough that no statistical test seems needed—to the California Community Colleges system-wide distribution and average for 1,023,362 students taking social science courses for 2002-2003. The average grade was 2.5. In the entire system, 23% of students received an A; 23% receive a B; 19% received a C; 6% received a D, and 9% received a grade of F; 17% withdrew and did not complete the course. (1% received Incomplete; 1% Pass, and 1% No Pass)

Further, of the 14,762 students with learning disabilities taking social science courses in the California Community College systems during 2002-2003, the average grade was 2.49. In the entire system, 20% of students received an A; 22% received a B; 22% received a C; 7% received a D and 8% received an F. Seventeen percent (17%) withdrew and did not complete the course; 1% received incomplete; 1% received Pass and 1% received No Pass. While the overall grade point average was .06% lower, 2% fewer A's and 3% more C's were awarded, the grade

point averages of students with learning disabilities remains remarkably similar to those of their nondisabled peers.



**Survey data:** In addition to baseline data, students who took the training were asked to complete a short survey. At the moment we have surveys from 60 respondents, all of whom meet the learning disability profile. Most, but not all, were part of the baseline sample, and there is no way to predict whether they will take social science courses in the Spring 2004 semester. Responses to two questions illustrate the potential for technology with this population. Of the 60 students, 54 have access to computers at home. Of the 60, 42 have never used assistive technology, twelve have used it occasionally, and six have used it regularly.

This is an ongoing study. Our initial conjecture, that students with the learning disability profiles we have identified would most likely have lower grade point averages in social science courses,

has proven incorrect. In fact, the students appear to be virtually identical in their academic performance within social science courses to students system-wide. Additionally, the data suggests that a very large number of students who have computers at home and may potentially benefit from assistive computer technologies are not currently using such software.

The final portion of the study will be completed during Summer 2004. Hopefully, we will have collected sufficient data to comprise a meaningful sample with which to compare the academic performance of this group with the academic performance of our baseline group within the framework of social sciences.