

## Programming and the Dyslexic Student: Computer Science 102

Although it is becoming increasingly accepted that word processing is a helpful tool for the dyslexic student, it is less well-known that teaching a dyslexic student computer programming can help develop and reinforce skills that are essential for dyslexic students and that are emphasized across Landmark's curriculum. The skills that are developed by learning programming include organization, logical thinking, problem solving, sequencing, learning the structure of a language, following rules, writing descriptively, and proofreading carefully.

To understand better how learning to program a computer can be helpful for a dyslexic student, one needs to know what a program involves. A program is a series of instructions for a computer to follow line by line. A computer can "understand" only one step at a time, so it is crucial that the programmer breaks any complicated instructions into individual steps. Lengthy programs must be broken down into units, similar to paragraphs, of related information. A well-written program has sections of prose, called "documentation" or "commenting," throughout the program to explain in general what the program is doing at any point. Additional prose is needed so that the computer can ask the user to do something (e.g., "Type in your name"). One student said, "I find programming very challenging, and I enjoy it a lot. I look at it as a puzzle. I have to tell the computer how to do something."

Students in Bruce Gordon's Computer Science 102 class have learned the necessary steps to write successful programs. After an assignment is given, the first step in creating a working program is to determine how the computer will solve the problem. This requires the programmer to think in broad terms and to use problem-solving abilities.

Students then create a flow chart, composed of a series of symbols, e.g., a diamond, rectangle, and

arrows, to show a decision-making process. A flow chart is the skeleton for a computer program. It serves the same function for writing a program as an outline does for writing an essay. It is critical for the programmer to be able to break ideas down into steps and to organize them coherently. This step can be especially challenging, albeit useful, for the dyslexic student.

Once the flow chart is written, the programmer must then translate the geometric symbols into the language in which the computer is being programmed. Learning a computer language, like learning a foreign language, is not easy for a dyslexic student, but a computer language, such as BASIC, is systematic and rule-driven—much more than any oral language—and therefore, may be somewhat easier to learn.

By looking at some of the rules that govern a computer language, it is easy to understand how helpful it is for students to learn one. Every computer language has very precise rules for syntax. Some of the main rules are that there can only be one instruction at a time and that the lines of the program must be in the proper order. In learning these rules, a dyslexic student is forced to learn sequencing skills. Since the computer executes the lines of a program sequentially, the programmer must give instructions in a logically correct order.

Not only is the sequence of instructions critical for a program to run successfully, but it is essential that the details (which may be troublesome for dyslexics) within each line of instruction are absolutely precise. Words must be spelled correctly; commas, spaces between symbols, and punctuation marks must be positioned exactly; capitalization can make a difference; and word choice is critical.

If any of these rules are broken, the program will not run and the computer will give the programmer immediate, helpful feedback. Not only will it show an error message, but it will inform the programmer where the error is in the program (e.g., "syntax error in line 70"). Therefore, the programmer must look critically at his or her work. Says student Marc Boegner, "What I like about computer programming is that the computer never makes a mistake. It follows your instructions to a 'T.' If you make a mistake, it won't do



what you want. It makes you analyze your mistakes."

Aside from the computer's requirements for precision in the details of the program, it also requires the program to be well-organized. Often, a poorly organized program will not run, because the lack of organization is the result of faulty logic. It is in the programmer's interest to have a logically organized program, because it is easier to find and fix errors. Occasionally, a poorly organized program will run if it is a short program, but it will take the computer longer to execute the commands, and will thus lose efficiency. As with written essays, another person reading the program will have difficulties following it if it is not well organized. Thus, a student with poor organizational skills will be forced by the computer to improve them.

Like a written essay, the structure of a computer program is based on the outline, or flowchart. For lengthy programs, it is essential that similar information is grouped together, as in paragraphs. Often, long programs are made up of shorter programs, called "subroutines," each of which has a particular function to do. A poorly structured lengthy program not only will be difficult to understand and be less efficient, but, unlike a written essay, it usually will not even work at all. The ability of the computer to react so concretely to poor organization makes it an excellent tool for teaching students organization skills.

The last step in writing a program is to make it easy for someone else to understand just by looking at it. According to instructor Bruce Gordon, "the difference between a good, working, easy-to-understand program and the bare minimum requires the programmer to use a lot of English." This means writing comments at the beginning of the program, at the beginning of each section, and throughout the program. In addition, the prompts that the computer gives to the user should be easy to understand.

Learning programming is an important part of a general studies curriculum. It is particularly beneficial for dyslexic students, because it incorporates so many of the skills that dyslexic students need to learn, and it can help them to apply those skills to other subject areas. More research needs to be done in this field to document these benefits.

## Summer Workshop for Math Teachers

This summer, from August 15 to August 19, Landmark College will be offering a summer math workshop for teachers of learning disabled pre-algebra and algebra students. The week-long workshop "Reaching the L.D. Pre-Algebra and Algebra Student: Manipulative Materials Make the Difference" will be presented by Joan McNichols, M.S., and Deborah Gilman-Day, M.S.

Joan McNichols is president of the Orange County Branch of the Orton Dyslexia Society and is a math specialist at The Newport Center for Educational Therapy in Newport Beach, California. She has led numerous workshops in teaching math to learning disabled students at national and regional conferences of the Orton Dyslexia Society and the Association for Children with Learning Disabilities.

Deborah Gilman-Day is currently a math consultant, a language therapist, and the executive secretary of the Orange County Branch of the Orton Dyslexia Society. In addition to her extensive teaching experience, she has spoken at many Orton Dyslexia Society conferences, both nationally and regionally.

This interactive, hands-on workshop will be held from Monday morning until Friday noon. Teachers attending the workshop will learn how to teach the following concepts most effectively to learning disabled students: polynomials, integers, the Pythagorean theorem, area and volume, rational expressions, ratios, proportions, percents, linear equations, and word problems.

The cost of the workshop, including continental breakfast, lunch, and workshop materials, is \$250. Lodging at Landmark will be available for Sunday through Thursday nights for an additional \$50. The possibility of earning graduate credit is being explored; if available, there will be an additional per-credit fee. Please register by July 1, 1988, as space is limited. If you would like more information about the workshop, please contact Carolyn Olivier at the College.