

Learning Disabilities:

A Handbook for Instructors & Tutors

Sabbatical Project
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INTRODUCTION

The purpose of my sabbatical was to study learning disabilities, particularly as they might impact the mathematics learning of post-secondary students, and to acquire and/or devise effective strategies for helping those students learn mathematics. This handbook is an outcome of my sabbatical project.

Learning Disabilities is a general term that refers to a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning, or mathematical abilities. These disorders are intrinsic to the individual, presumed to be due to central nervous system dysfunction, and may occur across the life span. Problems in self-regulatory behaviors, social perception, and social interaction may exist with learning disabilities but do not by themselves constitute a learning disability. Although learning disabilities may occur concomitantly with other handicapping conditions (for example, sensory impairment, mental retardation, serious emotional disturbance), or with extrinsic influences (such as cultural differences, insufficient or inappropriate instruction), they are not the result of those conditions or influences. (Definition of the National Joint Commission on Learning Disabilities)

Attention Deficit Disorder/Attention Deficit Hyperactivity Disorder will not be addressed here. ADD/ADHD is not a learning disability in itself, but is very common among people with learning disabilities. The syndrome is characterized by serious and persistent difficulties in at least two of the following specific areas: attention span, impulse control, hyperactive behavior. Like learning disabilities, ADD/ADHD is covered by the Americans with Disabilities Act.

The Americans with Disabilities Act of 1990 (ADA) protects from discrimination people meeting at least one part of this three-part definition of disability:

1. A physical or mental impairment that substantially limits one or more major life activities
2. A record of such an impairment
3. Being regarded as having such an impairment

Concentrating, learning and thinking are considered major life activities and therefore are covered under the ADA.

Title II of the ADA requires reasonable modifications and/or the provision of auxiliary aids and services to allow persons with disabilities who are otherwise qualified to participate in public activities, including education. (Another law applies to K-12 education.)

Accommodations in a post-secondary educational setting frequently include sign language interpreters, assistive technology, note-takers, and special arrangements for testing.

LEARNING DISABILITIES

Dyslexia is a specific learning disability that is neurological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede the growth of vocabulary and background knowledge. (International Dyslexia Association)

Dyscalculia involves profound difficulties with mathematics. People with dyscalculia may not understand basic concepts like place value, have difficulty handling money, and have problems with sequencing.

Dysgraphia is a writing or fine motor skills deficit. People with dysgraphia may have illegible writing with inconsistent spacing and capitalization, despite giving appropriate time and attention to the task. They may have great difficulty thinking and writing at the same time.

Symptoms of some of the **underlying deficits** that cause learning disabilities are described in the pages that follow, along with strategies and accommodations that may be used to deal with these deficits.

VISUAL DEFICITS

Visual Processing involves how well a person can use visual information. When the student sees something, especially something complex, does s/he understand it quickly and easily? Can they "visualize" things (like pictures, shapes, words, etc.) in their heads? Can they remember information that they see?

Manifestations include:

- Reversals: b for d, p for q or inversions: u for n, w for m or rotations of letters.
- Loses place frequently.
- Poor visual-motor coordination:
 - holds pencil too tightly; often breaks pencil point
 - illegible handwriting
 - poor spatial planning; erasures
 - slow, inaccurate copying
 - difficulty using separate answer sheet
 - poor directional sense
 - difficulty with eye-hand coordination
 - clumsiness
- Complains eyes hurt and itch, rubs eyes, complains print blurs while reading. Might have severe problems with overhead light.
- Turns head when reading across page or holds paper at odd angles.
- Closes one eye while working, may yawn while reading.
- Difficulty distinguishing subtle differences in shapes (graphemes), remembering visual details and copying accurately. Difficulty copying shapes as well as words and numbers.
- Difficulty remembering general characteristics and seeing differences between things; might see a visual stimulus as unrelated parts rather than as an integrated pattern.
- May not recognize an object/word if only part of it is shown; difficulty filling in missing parts of pictures.

Manifestations of **VISUAL DEFICITS**, continued...

- Misaligns letters; may have messy papers, which can include letters colliding, irregular spacing; letters not on line. (Complete mental images do not pass between brain and fingers.)
- Poor handwriting, poor spelling (cannot visualize the words).
- Difficulty visualizing math problems, difficulty with cluttered worksheets.
- Slow reading speed; poor comprehension.
- Poor organization/planning/neatness.
- Difficulty rechecking work for accuracy, difficulty using a keyboard or calculator.
- Difficulty learning by demonstration or by video.
- Difficulty extracting information from pictures, graphs, diagrams.
- Difficulty blending information from both eyes for depth perception.
- Visual figure-ground problems:
 - trouble tuning in to any one item on a crowded board, page, etc.
 - difficulty finding specific information in a dictionary or phone book.
 - skipping words or lines, or reading same line twice.
 - trouble seeing an image within a competing background.
- Visual sequencing deficits:
 - poor spelling.
 - difficulty visualizing and completing multiple steps.

VISUAL DEFICITS: STRATEGIES AND ACCOMMODATIONS

- Provide alternatives for written assignments.
- Suggest use of pencil grips and specially-designed pencils and pens.
- Allow use of computer or word processor.
- Minimize copying tasks.
- Suggest use of tracking tools when reading: ruler, text windows (card with slot cutout on edge or interior), dark section on edge of card.
- Use large print books.
- Use books on tape, e-books or screen reader.
- Experiment with different paper types: darker lines, pastels, graph, embossed raised lines.
- Allow student to write answers on test, not a separate paper.
- Use uncluttered format on tests, handouts, overhead, and board. Color-code. Use 1.5 line spacing.
- Format to avoid:

a. 1	c. 10
b. 52	d. 42

 Preferred format:

a. 1
b. 52
c. 10
d. 42
- Even better: use upper-case letters to avoid confusing b and d, “one” and “L”
- Avoid shiny white paper.
- Give instructions in written and oral form. Read problems aloud.
- Suggest that student compare notes with other students.
- Use reader and/or scribe on tests.
- Experiment with different kinds of lighting and colored acetate overlays.

AUDITORY DEFICITS

Auditory deficits involve how well a student can understand auditory information. They affect how the brain perceives and processes what the ear hears. They can affect a person's ability to interact socially. Auditory deficits often coexist with ADD.

Manifestations include:

- Difficulty distinguishing between similar sounds or recognizing subtle differences in sound (phonemes), or difficulty doing so as quickly as normal. Difficulty with spelling, especially words that sound similar.
- Difficulty understanding spoken language, following directions, remembering details.
- May not hear everything said, or hear incorrectly.
- Seeming to hear but not listen. Needing to have words or sentences repeated - saying "what?" a lot, despite having heard much of what was said.
- Unable to distinguish and follow conversation in a noisy setting.
- Difficulty identifying one sound to listen to when there is more than one sound present.
- Often distracted by background sounds/noises.
- Difficulty focusing on verbal presentation or lecture.
- Difficulty following verbal directions, especially directions in a series.
- Difficulty comprehending complex sentence structure or rapid speech. Might interpret words too literally.
- Difficulty remembering people's names, memorizing telephone numbers, following multi-step directions.
- Difficulty remembering specific words or numbers.
- Confusing multi-digit numbers; confusing lists and other types of sequences.
- Difficulty remembering the correct order of a series of instructions.
- Under- or over-sensitivity to sounds.
- May process thoughts and ideas slowly and have difficulty explaining them.

AUDITORY DEFICITS: STRATEGIES AND ACCOMMODATIONS

- Supplement lectures with written material, visual cues, handouts, and manipulatives.
- Show rather than explain.
- Speak slowly and clearly.
- Reduce and/or space directions (give them one at a time); give cues such as “ready?” Ask individuals or class to repeat instructions.
- Give directions both orally and visually. Limit background noise while giving directions or teaching new information.
- Vary pitch and tone of voice, alter pace, stress key words.
- Allow 5-6 seconds for students to respond to questions.
- Have students constantly verbalize concepts, procedures, vocabulary, rules, etc.
- Avoid asking students to listen and write at the same time.
- Help students strengthen note-taking skills. Suggest they compare notes later with others.
- Suggest that students record study material for later playback.
- Encourage students to ask for clarification when necessary.
- Encourage students to sit where they can hear best.
- Make students aware of quiet places for study.

ABOUT MEMORY

INPUT

- via senses
- sensory memory very brief
- visual and auditory memory deficits may occur with learning disabilities

PROCESSING

- initially takes place in working memory (also known as short-term memory)
- storage requires rehearsal and understanding of information
- working memory is small (holds approximately 7 “chunks” of information)
- working memory stores information quickly but briefly
- Working memory holds bits of information while they blend into a full thought or concept
- working memory deficits common with learning disabilities

STORAGE

- in long-term memory if well-established in working memory
- long-term memory stores information slowly but for long time
- storage is apparently unlimited in size
- storage is associative, via connections among bits of information
- “strong” long-term storage requires understanding
- “strong” long-term storage requires continual review
- long-term memory involves language skills rather than abstraction skills; language skill common with learning disabilities

RETRIEVAL

- can be hampered by negative emotion
- strong retrieval is only possible with strong storage (connected and reviewed)
- information goes back to working memory
- working memory deficits common with learning disabilities

WORKING MEMORY DEFICITS: SUGGESTIONS

- concentrate on performing one task or subtask at a time;
- develop definite and consistent steps to use with particular operations;
- summarize steps in writing; refer to summary while working problems;
- practice skills until they become automatic;
- use self-monitoring techniques;
- use “chunking” of related information to free up space in working memory;
- memorize often-used facts to fluency to free up space in working memory;
- rehearse/review constantly;
- understand, don’t just memorize;
- organize information in outlines, concept maps, etc.;
- use both visual and auditory senses for reinforcement (kinesthetic, too);
- study in a quiet place so sounds (other than “white noise”) do not interfere with working memory.

Learning something one day but forgetting it the next is probably due to

- insufficient rehearsal
- insufficient understanding
- insufficient review

SYMPTOMS COMMONLY RELATED TO LEARNING DISABILITIES

Academic Symptoms

- poor performance on group tests
- reversals in reading and writing
- difficulty in copying accurately from a model
- slowness in completing work
- easily confused by instructions
- difficulty with tasks requiring sequencing

Cognitive Symptoms

- difficulty discriminating size, shape, color
- difficulty with temporal (time) concepts
- distorted concept of body image
- poor organizational skills
- difficulty with abstract reasoning and/or problem-solving
- disorganized thinking
- often obsesses on one topic or idea
- poor short-term or long-term memory
- lags in development milestones (i.e. motor, language)

Physical Symptoms

- general awkwardness
- poor visual-motor coordination
- hyperactivity
- overly distractible; difficulty concentrating
- lack of hand preference or mixed dominance

Behavioral/Social Symptoms

- impulsive behavior; lack of reflective thought prior to action
- low tolerance for frustration
- excessive movement during sleep
- poor peer relationships
- overly excitable during group play
- poor social judgment
- inappropriate, unselective, and often excessive display of affection
- behavior often inappropriate for situation
- failure to see consequences for his/her actions
- overly gullible; easily led by peers
- excessive variation in mood and responsiveness
- poor adjustment to environmental changes
- difficulty making decisions

When considering these symptoms, it is important to remain mindful of the following:

- No one will have all of these symptoms.
- Among LD populations, some symptoms are more common than others.
- All people have at least two or three of these problems to some degree.
- The number of symptoms seen in a particular individual does not give an indication as to whether the disability is mild or severe. It is important to consider if the behaviors are chronic and appear in clusters.

Taken from www.ldonline.org/ld_indepth/general_info/lavoi.early.html .

SUGGESTIONS

SELF-DETERMINATION

Self-determination and goal-setting have been found to be crucial factors in the success in postsecondary education of students with learning disabilities. Encourage students to set goals and to evaluate their own progress.

TRANSITION FROM HIGH SCHOOL

College freshmen may have heard about the differences between high school and college, but the reality can come as a shock. And college instructors may not be fully aware of the instructional climate in today's high schools. (Find more about this topic on following pages.)

INSTRUCTING ADULTS WITH LEARNING DISABILITIES

Instruction should be highly structured, explicit, connected, and promote generalization. It should focus on the experience of learning from the student's perspective. (Find more about this topic on following pages.)

LEARNING STRATEGIES

Helping students acquire cognitive and metacognitive learning skills is seen as crucial to their success. Summarizing, outlining, paraphrasing and mapping are examples of cognitive strategies. Planning, monitoring and evaluating your own learning are metacognitive strategies.

Ideally, strategies and content knowledge (how and what to learn) are taught together. Learning strategies courses taken concurrently with other courses are highly recommended.

NOTETAKING

Students who have notetakers should, where possible, still be encouraged to take notes. This can help them maintain concentration and work towards independent note-taking skills. Students who have notetakers should USE the notes provided. For example, they might transfer information from their notes to a section/chapter review sheet.

UNIVERSAL DESIGN FOR INSTRUCTION

Universal design in architecture incorporates physical accommodations such as wide doorways into plans for new buildings. Universal design for instruction incorporates learning accommodations such as multi-modal presentations into plans for coursework. (Find more about this topic on following pages.)

DIFFERENCES BETWEEN HIGH SCHOOL AND COLLEGE REQUIREMENTS

HIGH SCHOOL		COLLEGE
6 hours per day, 180 days, 1,080 hours total	<i>CLASS TIME</i>	12 hours per week, 28 weeks, 336 hours total
Whatever it takes to do your homework – 1-2 hours per day	<i>STUDY TIME</i>	Rule of thumb: 2 hours of study time for 1 hour of class – 3-4 hours per day
Weekly, at the end of a chapter, frequent quizzes	<i>TESTS</i>	2-4 per semester, at the end of four chapters, at 8:00 a.m. on the Monday after Homecoming!
Passing grades guarantee you a seat!	<i>GRADES</i>	Satisfactory academic standing = C's or above!
Take attendance May check your notebook Write info & homework on the blackboard Impart knowledge & facts	<i>TEACHERS</i>	Rarely teach you the text Often lecture non-stop Require library research List assignments in a syllabus
Structure defines the day most of the time. Limits are set by parents, teachers, and other adults.	<i>FREEDOM</i>	The single greatest problem most college students face! Should I go to class? Should I plan on 4,5,6, or 10 hours of sleep?

From: Shaw, S.F., Brinckerhoff, L.C., Kistler, J.K. & McGuire, J.M. (1991)

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Principles of Instruction for LD Students

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Following is a list of principles which apply as teachers work with adult students with disabilities. While this list is not all-inclusive, it has the added benefit of improving instruction for learners with other types of learning problems as well:

- Be highly structured and predictable.

Always: explain the purpose of the lesson; break down tasks into small, sequential parts; present directions one step at a time, using both oral and written directions;

- Include opportunities to use several senses and learning strategies.

Always: provide auditory, visual, and concrete cues; use physical demonstration of abstract concepts, such as left/right; use color for visual impact; encourage the student to repeat verbal information; act out action verbs.

- Provide constant structure and multi-sensory review.

Always: preview and review major points, both orally and visually; ask the student to state in his/her own words what has been presented; make frequent eye contact to maintain attention and encourage participation.

- Recognize and build on learners' strengths and prior knowledge.

Always: relate new materials to daily life; combine life skills such as reading medicine labels and filling out forms with phonics, word recognition, and reading comprehension; provide success-oriented activities.

- Simplify language but not content; emphasize content words and make concepts accessible through the use of pictures, charts, maps, time lines, and diagrams.

Always: use visual aids such as overhead projectors, films, videos, slides, chalkboards, flip charts, computer graphics, or illustrations; use games, songs, rhymes to help students listen to sounds.

- Reinforce main ideas and concepts through rephrasing rather than through verbatim repetition.

Always: provide intensive instruction until the materials is mastered; allow ample time for learning a task (a student with a learning disability will take longer to master new material); provide instruction to help transfer of learning from one task and setting to another; set up small discussion groups to allow time for each student to talk and use the language they have already developed.



Key #3: Implement LD-Appropriate Instruction

Characteristics of LD-Appropriate Instruction

What do we mean by LD-appropriate instruction? There are important characteristics described in Bridges to Practice: Guidebook 4. LD-appropriate instruction is

■ **Structured** – involves systematically teaching information that has been chunked into manageable pieces.

■ **Connected** – shows the learner how information in and among units and lessons are linked to the learning process and to the learner's goals.

■ **Informative** – involves making sure that the learner is informed about how the learning process works, what is expected during the instructional situation, and how she can improve learning and performance.

■ **Explicit** – involves providing detailed explanations and models to the learner about how to approach, think about, perform, and evaluate learning and performance.

■ **Direct** – is characterized by high rates of teacher or tutor leadership and control during the initial stages of information acquisition, followed by careful monitoring of the learner's performance as she gradually assumes control of and masters the information.

■ **Scaffolded** – involves the frequent use of connected questions and collaboratively constructed explanations to create a context for learning that is based on the learner's prior knowledge.

■ **Intensive** – involves helping learners to maintain a high degree of attention and response during instructional sessions that are scheduled as frequently as possible.

■ **Process-sensitive** – involves re-shaping the activities within the instructional sequence to take into consideration various cognitive barriers that might inhibit learning.

■ **Accommodating** – involves providing specific and general adaptations that are legally required to reduce or eliminate the impact a learning disability might have on successful learning and performance.

■ **Evaluated** – involves adapting instruction based on an assessment of the learner's progress and his or her response to previous attempts at instruction.

■ **Generalizable** – involves using activities before, during, and after information has been mastered both to ensure continued application of the information and to increase the learner's success outside of the literacy setting.

■ **Enduring** – means that the program providers acknowledge and commit the time necessary to ensure that learners master the information and use it to increase their successes in life.



A list of characteristics from a NIFL monograph (Hughes, 1998) is compared with the list of characteristics from *Bridges to Practice: Guidebook 4* in the following table. As you read the table developed by Amanda Keller, identify which characteristics are already present in your teaching and which ones might be your next steps on this journey.

Effective instruction for adults with learning disabilities	Characteristics of LD-appropriate instruction from <i>Bridges to Practice: Guidebook 4</i>
<p>Teach important skills: Deciding what is important to teach is critical given the limited amount of time for instruction in most literacy programs. Adults with LD should be involved in deciding what is important, and skills should be as functional as possible.</p>	<p>Connected</p>
<p>Teach less better: Most adults with LD need explicit, intensive instruction combined with numerous practice sessions to truly master a skill or strategy. It is more effective and efficient to pick fewer (but important) skills and teach them to mastery rather than trying to teach a wide range of skills in a cursory fashion.</p>	<p>Intensive Explicit Enduring</p>
<p>Teach explicitly: Because of the learning characteristics of many adults with LD, a direct and explicit approach to teaching is more effective than more “discovery” types of approaches.</p>	<p>Explicit Direct Informative</p>
<p>Teach contextually: Literacy skills and strategies should be taught and practiced in the context of “real-life” situations.</p>	<p>Connected Generalizable</p>
<p>Explain what is to be learned and why it is important: Briefly explaining the purpose of the skill, strategy, or activity prior to teaching it clarifies expectations for the adult with LD. Further, discussing the relevance of what is to be learned can increase learner motivation.</p>	<p>Connected Generalizable</p>
<p>Check the old before teaching the new: Before beginning instruction on a new skill or strategy, verify whether the adult with LD has retained any prerequisite skills or knowledge needed to perform the new skills. This type of review is best conducted by requesting that the adult demonstrate performance of the prerequisite skills rather than merely inquiring whether or not he or she can perform them.</p>	<p>Connected Structured Evaluated</p>

Effective instruction for adults with learning disabilities	Characteristics of LD-appropriate instruction from <i>Bridges to Practice: Guidebook 4</i>
Model what is to be learned: A clear demonstration of the skill or strategy is a must prior to practicing it. Effective modeling includes both a clear and exaggerated demonstration as well as a comprehensive description of any covert thinking or decision-making.	Direct Explicit Scaffolded Structured
Use supported practice: After viewing a demonstration/ model, adults with LD benefit from supported or guided practice in a new skill or strategy. Via a series of prompts and/or questions, they are guided through the skill as a way of providing a high level of initial support and success.	Scaffolded Process-sensitive
Use controlled materials: During initial stages of practice, it is sometimes effective to control the difficulty of the task in which the new skill or strategy is practiced. Initial practice in “easy” materials allows the adult with LD to focus on learning the new skill. Task difficulty can be added when success is achieved in controlled material.	Structured Scaffolded Enduring Evaluated
Provide practice, practice, practice (and more practice): Adults with LD need multiple practice opportunities over time to retain new skills or information. Independent practice (with no guidance or prompting) should be provided only when a high level of success has been achieved during prompted practice.	Enduring Intensive
Require frequent responses: Adults with LD learn better when they stay involved during instructional sessions. One effective way to do this is to ask frequent questions related to the information being taught. This facilitates involvement and provides important information about the adult learner’s level of understanding.	Generalizable Intensive
Provide corrective feedback: Adults with LD should receive corrective feedback as soon as possible in a matter-of-fact manner. Learning rate is enhanced when feedback about quality and correctness of performance is provided in this way.	Evaluated Informative

<p>Effective instruction for adults with learning disabilities</p>	<p>Characteristics of LD-appropriate instruction from <i>Bridges to Practice: Guidebook 4</i></p>
<p>Promote generalization: Often adults with LD have difficulty transferring what they learn to different settings or to different, but related tasks. It is, therefore, imperative that activities and techniques designed to promote skill or strategy generalization is built into literacy instruction.</p>	<p>Generalizable</p>
<p>Be prepared: Implementing the above principles requires preparation. Good teaching may appear “spontaneous”; however, that impression is illusory. The amount of time put into planning is directly related to the quality (effectiveness and efficiency) of instruction.</p>	<p>Structured Scaffolded</p>
<p>Use accommodations only when necessary: While reasonable accommodations are required by law and are necessary for appropriate instruction and assessment under certain circumstances, two important warnings apply regarding their use: (a) creating a situation where adults with LD become dependent on others versus becoming independent learners and (b) not providing the instruction needed to benefit fully from the accommodation</p>	<p>Accommodating</p>
<p>Use caution when selecting instructional techniques and programs: Many products and approaches purport to be effective with adults with LD. While some may have intuitive appeal and make grandiose claims, there may be no empirical support for their use. Become a cautious consumer. Adults with LD should not be the victims of poor instruction as a result of instructors’ jumping on educational bandwagons.</p>	<p>Scaffolded Structured Process-sensitive</p>

Principles of Universal Instructional Design

1. **Determine the essential components of the course**

Identify the knowledge and skills students must attain to successfully complete the course.

2. **Provide clear expectations and feedback**

Be sure expectations and feedback convey the essential components of the course.

3. **Explore ways to incorporate natural supports for learning**

Some disability-related accommodations benefit all students; explore ways to infuse these natural supports in all courses.

4. **Provide multimodal instructional methods**

Students learn in a variety of ways, seek opportunities to use all learning styles.

5. **Provide a variety of ways for demonstrating knowledge**

Create alternative ways for students to demonstrate knowledge and skills e.g., option of writing a paper or making a presentation.

6. **Use technology to enhance learning opportunities**

Put materials on-line, arrange for course specific list-serves; select software that is compatible with screen readers.

7. **Encourage faculty-student contact**

Invite students to use e-mail and available office hours to ask questions and solicit feedback.

Compiled from Chickering and Gamson's Seven Principles for Good Practice in Undergraduate Education.

Taken from <http://www.lotf.ca/english/projects/index.htm> (and reformatted).

Principles of Universal Design for Instruction©

<i>Principle</i>	<i>Definition</i>	<i>Example(s)</i>
Principle 1: Equitable use	Instruction is designed to be useful to and accessible by people with diverse abilities. Provides the same means of use for all students, identical whenever possible, equivalent when not.	Using web-based courseware products with links to on-line resources so all students can access materials, regardless of varying academic preparation, distance from campus, etc.
Principle 2: Flexibility in use	Instruction is designed to accommodate a wide range of individual abilities. Provide choice in methods of use.	Using varied instructional methods (lecture with a visual outline, group activities, use of stories, or web-based discussions) to support different ways of learning.
Principle 3: Simple and intuitive	Instruction is designed in a straightforward and predictable manner, regardless of the student's experience, knowledge, language skills, or current concentration level. Eliminate unnecessary complexity.	Providing a grading rubric for papers or projects to clearly state performance expectations.
Principle 4: Perceptible information	Instruction is designed so that necessary information is communicated effectively, regardless of ambient conditions or the student's sensory abilities.	Selecting text books, reading material, and other instructional supports in digital format so students with diverse needs can access materials through print or by using technological supports (e.g., screen reader, text enlarger).
Principle 5: Tolerance for error	Structuring a long-term course project with the option of turning in individual project components separately for constructive feedback and for integration	Instruction anticipates variation in individual student learning pace and prerequisite skills.

Principle 6: Low physical effort	Instruction is designed to minimize nonessential physical effort in order to allow maximum attention to learning. <i>Note: This principle does not apply when physical effort is integral to essential requirements of a course.</i>	Allowing students to use a word processor for writing and editing papers or essay exams.
Principle 7: Size and space for approach and use	Instruction is designed with consideration for appropriate size and space for approach, reach, manipulations, and use regardless of a student's body size, posture, mobility, and communication needs.	Using a circular seating arrangement in small class settings to allow students to see and face speakers during discussion—important for students with attention problems.
<i>Principle 8: A community of learners</i>	The instructional environment promotes interaction and communication among students and between students and faculty.	Fostering communication among students in and out of class by structuring study and discussion groups, e-mail lists, or chat rooms.
Principle 9: Instructional climate	Instruction is designed to be welcoming and inclusive. High expectations are espoused for all students.	Creating a statement on the syllabus affirming the need for students to respect diversity, underscoring the expectation of tolerance, and encouraging students to discuss any special learning needs with the instructor.

Note: Adapted from Principles of Universal Design for Instruction by Sally Scott, Joan McGuire and Stan Shaw. Center on Postsecondary Education and Disability, University of Connecticut. Copyright 2001.

From <http://www.ncset.hawaii.edu/institutes/mar2002/papers/pdf/postsecondary%20supports%20.pdf>

MATH SUGGESTIONS

Deficits in the areas of visual processing and visual processing speed are thought to underlie many of the difficulties faced by students with learning disabilities when they study mathematics.

Math texts, with their many symbols and abrupt structure changes, can be a visual minefield. Reading from a crowded board or overhead is another challenge. Some students find it difficult to shift between vertical and horizontal presentations.

For these reasons, **handouts** should use large print, visually simple and uncluttered. Instructors and tutors can show students how to color-code material that might be troublesome – for example, the exponents, factors, + and – signs in polynomials. Tables and graphs can be hard to read and might also benefit from added color. (The coordinate axes can be particularly elusive.) Parts of a textbook page can be covered while students concentrate on just one portion.

Tests should follow the same guidelines as other handouts. Lined scratch paper might be helpful. Students with fine-motor problems may need a great deal of space to show their work. Ideally, answers are written directly on the test rather than on a separate piece of paper. Capital letters can help students distinguish between B and D in multiple-choice questions.

Direct Instruction is a method recommended for teaching algorithms.

- Step 1. Instructor introduces topic and reviews prerequisites.
- Step 2. Instructor visually and verbally demonstrates, step-by-step.
Students watch and listen.
- Step 3. Students talk instructor through the steps.
- Step 4. Guided practice.
- Step 5. Closure.
- Step 6. Independent practice.

The **concrete-representational-abstract** sequence is recommended for teaching concepts. College students are sometimes reluctant to use manipulatives. However, studies have shown that handling concrete materials is very beneficial, even at the college level, and especially for students with learning disabilities. Concept mapping can help students discern and remember connections among related topics.

Some **miscellaneous** remarks:

- Encourage students to talk their way through problems. This is especially helpful for students who are auditory learners or students who have visual deficits.
- Students who have not mastered basic facts may benefit more from using tables (as an interim measure) than from using a calculator. Tables show relationships and require more thought.
- Note that students with learning disabilities may have trouble remembering sequences of numbers or sequences of steps. Also, students with directional issues may find the number line confusing.
- Estimation skills are important for all students.
- Students may have developed unusual but successful strategies – respect them.
- The discovery method of learning may be especially difficult for students with learning disabilities. They might need additional support with this approach.

RESOURCES

URL	ORGANIZATION	CONTENT
www.ldanatl.org	Learning Disabilities Association of America	Comprehensive information for parents, teachers, practitioners in related fields, and adults with LD.
http://ldlink.coe.utk.edu/	Center for Literacy Studies, University of Tennessee Knoxville.	Contains material from the National Institute for Literacy. Includes a research-based guide “Bridges to Practice” for educators serving adults with learning disabilities. All materials are online.
http://www.heath.gwu.edu/	National Clearinghouse on Postsecondary Education for Individuals with Disabilities, George Washington University.	Resource papers, fact sheets, newsletters, resource directory, counselor’s toolkit, other publications, student voices, useful answers.

BOOK TITLE	AUTHOR/EDITOR	CONTENT
<i>Learning to Think, Learning to Learn: What the Science of Thinking and Learning Has to Offer Adult education</i>	Jennifer Cromley. 2000. Online at http://www.nifl.gov/nifl/fellowship/cromley_report.pdf	How adults learn, and what this means for teachers; a comprehensive resource.
<i>Keys to Effective LD Teaching Practice</i>	Lindop, Margaret H. ed. 2002 http://www.cls.utk.edu/keys_to_ld.html	Guidelines, tools, strategies for teaching adults with learning disabilities.
<i>Mathematics and Learning Disabilities Handbook</i>	Nolting, Paul. 2000.	Many practical ideas for working with students with visual, auditory, memory deficits.
<i>Math Study Skills Workbook</i>	Nolting, Paul. 2005.	Teachers can also learn from this workbook for students.
<i>Teaching in the Disciplines: Classroom Instruction for Students with Learning Disabilities</i>	Shea, Lynne C. and Strothman, Stuart. Eds. 2002.	Visual arts, psychology, world languages, literature, speech and communication, mathematics, history and humanities. Published by Landmark College, a two-year college for students with learning disabilities.
<i>Understanding Learning Disabilities at the Postsecondary Level</i>	Shea, Lynne C. and Strothman, Stuart. Eds. 2003.	Meeting the needs of college students with LD, AD/HD. Accommodations, social and emotional issues, advising and counseling. Published by Landmark College.
<i>How the Special Needs Brain Works</i>	Sousa, David. 2001	Implications and strategies to consider for disorders in the areas of attention, speech, reading, writing, math, sleep, emotional/behavioral, autism. Differentiates between “qualitative” and “quantitative” learning styles in mathematics.

ARTICLE TITLE	JOURNAL	AUTHOR	CONTENT
Self-determination: a key to success in postsecondary education for students with learning disabilities	<i>Remedial and Special Education</i> , v24 i6 p339(11)	Field, Sharon; Mary D. Sarver; Stan F. Shaw. (2003)	
Creating successful learning environment for postsecondary students with LD.	<i>College Reading and Learning</i> , v33 i2 p131(15)	Harrison, Shari. (2003)	Using cognitive and metacognitive learning strategies. "The effective instructor sees learning as an active process of relating new meaning to existing meaning, which involves making connections between past, present and future learning."
Universal Design for Instruction: A New Paradigm for Adult Instruction in Postsecondary Education.	<i>Remedial and Special Education</i> , v24 i6 p369(11)	Scott, Sally S; Joan M. McGuire; Stan F. Shaw. (2003)	Good information from leading practitioners.
Math Learning Disabilities	Division for LD Journal of Council for Exceptional Children. Online at http://www.ldonline.org/ Follow links to "LD In Depth", then "math skills".	Garnett, Kate. (1998)	Types of Math LD and how to help students. Clear, practical, to the point.
Mathematics and learning disabilities	<i>Journal of Learning Disabilities</i> , v37 n1 4-15	Geary, David C. (2004)	Good explanation of mechanisms.
Accommodating Math Students with Learning Disabilities	<i>Focus on Basics</i> , September 2000; v4 issue B. Online at http://www.ncsall.net/?id=325	Kenyon, Rochelle. (2000)	Lists teaching strategies and modifications.
Dyscalculia: a unifying concept in understanding mathematics learning disabilities	<i>Australian Journal of Learning Disabilities</i> , 8 (4). Online at http://www.edfac.unimelb.edu.au/LED/ELAGE/documents/MLDR-Dyscalculiatypes.pdf	Munro, John. (2003)	Describes six types of difficulty in dyscalculia. Also presents neuropsychological correlates.