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AUTHOR Utzinger, John
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ABSTRACT

The booklet describes ways in which a logic teacher learned to accommodate learning disabled college students. Information on structuring the course includes general principles (such as clear expectations and a variety of learning modalities), considerations in identifying LD students, and use of a detailed course syllabus. He reviews a typical class session with procedures that are helpful to LD and non-LD students alike. Miscellaneous suggestions are offered concerning pictures and diagrams, drill, examinations, and computer assisted instruction. Concluding remarks focus on the importance of helping students apply logic to everyday situations. Appended material includes exercises to identify students with possible LD and a course syllabus. (CL)

LOGIC FOR EVERYONE

Alternative Techniques for Teaching Logic to Learning Disabled Students in the University

by
John Utzinger
Professor of Philosophy
Central Washington University

HELDS Project
(Higher Education for
Learning Disabled Students)

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Donald L. Garrity, President
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Media Production Department

Participating Faculty

Marco Bicchieri, Anthropology
E. E. Bilyeu, Foreign Language
Ken Briggs, Health Education
Gerald Brunner, Technical and
Industrial Education
Owen Dugmore, Psychology and Counseling
Roger Garrett, Communication
Darwin Goodey, Psychology
Helmi Habib, Chemistry
John Herum, English
Zoltan Kramar, History
Cheryl McKernan, Academic Skills Center
Jan Reinhardtsen, Special Education
Roger Reynolds, Mass Media
Catherine Sands, Anthropology
Frank Sessions, Sociology
John Utzinger, Philosophy
O. W. Wensley, Speech and Audiology
Karl Zink, English

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Participating Departments and Programs

Academic Skills Center,
Donald W. Cummings, Director
Anthropology, Ann Denman, Chair
Chemistry, Don Dietrich, Chair
Communications, Roger Garrett, Chair
Education, Robert Carlton, Chair
Educational Opportunities Program,
Mike Lopez, Director
English, Anthony Canedo, Chair
Health Education,
Kenneth A. Briggs, Director
Philosophy, Chester Z. Keller, Chair
Psychology, John Silva, Chair
Special Education, Dale LeFevre, Director
Sociology, Charles McGeehee, Chair
Technology and Industrial Education,
G. W. Beed, Chair

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Prefaces:

THE HELDS PROJECT AT CENTRAL WASHINGTON UNIVERSITY

The acronym HELDS stands for Higher Education for Learning Disabled Students. It represents a model program funded for three years (1980-1983) by the Fund for the Improvement of Post Secondary Education (FIPSE), a division of the Department of Education. This project was funded as a model for other colleges and universities that are preparing to provide equal academic access for the learning disabled students.

Project HELDS had three major focuses. The first was to provide such access for the learning disabled student under Section 504 of the Rehabilitation Act of 1973. This we did for learning disabled students, most of whom were admitted without modified requirements to Central Washington University. These students were not provided remedial classes. They were enrolled in classes with other college students. The help that we gave was habilitative, rather than remedial, teaching them how to compensate for their weaknesses.

The habilitative training began with identification of those who were learning disabled and included, but was not limited to, such support services as taped textbooks (provided through the services of our Handicapped Student Services Coordinator), readers, writers for tests, extended time for tests, pre-registration with advising to ensure a balanced schedule, the teaching of study skills and tutoring by tutors from the campus-wide tutoring program who were especially trained to tutor learning disabled students.

The second focus of the project was to give a core of twenty faculty teaching classes in the basic and breadth areas a sensitivity to the characteristics of students who were learning disabled so that they could modify their teaching techniques to include the use of more than one modality. This ensured an academic environment conducive to learning for the LD. The faculty members participated in monthly sessions which featured experts in the field of learning disabilities, and in the area of the law (Section 504) that deals with the handicapped student and higher education. There were several sessions in which Central Washington University graduates and currently enrolled LD students shared their viewpoints and experiences with the faculty members. As a result of this some faculty members used the students as resource people in developing curricula for their various disciplines published in this series.

The third focus of the project was to make the university community aware of the characteristics of learning disabilities and of the program at Central. It also sought to encourage other colleges and universities to initiate such programs.

WHAT IS A LEARNING DISABLED STUDENT?

People with learning disabilities have handicaps that are invisible. Their disability is made up of multiple symptoms that have been with them since childhood. Many of them have been described as "dyslexics," but if they are categorized as dyslexic, this will be only one of their many symptoms, as a sore throat is only one of the many symptoms of a cold.

Three concise descriptions of the learning disabled children are provided in Hallahan and Kauffman:

"The National Advisory Committee on Handicapped Children (1968) proposed the following definition, which was adopted by the 91st Congress:

> Children with special disabilities exhibit a disorder in one or more of the basic psychological processes involved in understanding or in using spoken or written thinking, talking, reading, writing, spelling, or arithmetic. They include conditions which have been referred to as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, developmental aphasia, etc. They do not include learning problems which are due primarily to visual, hearing, or motor handicaps, to mental retardation, emotional disturbance, or to environmental disadvantage.

Task Force II of a national project (Minimal Brain Dysfunction in Children: Educational, Medical and Health Related Services, Phase Two of a Three-Phase Project, 1969) wrote the following two definitions:

> Children with learning disabilities are those (1) who have educationally significant discrepancies among their sensory-motor, perceptual, cognitive, academic, or related developmental levels which interfere with the performance of educational tasks; (2) who may or may not show demonstrable deviation in central nervous system functioning; and (3) whose disabilities are not secondary to general mental retardation, sensory deprivation or serious emotional disturbance.
>
> Children with learning disabilities are those (1) who manifest an educationally significant discrepancy between estimated academic potential and actual level of academic potential and actual level of academic functioning as related to dysfunctioning in the learning process; (2) who may or may not show

demonstrable deviation in central nervous system functioning; and (3) whose disabilities are not secondary to general mental retardation; cultural, sensory and/or educational deprivation or environmentally produced serious emotional disturbance.[1]

Although the preceding definitions are concerned with children, the President's Committee on Employment of the Handicapped, in their booklet *Learning Disability: Not just a Problem Children Outgrow*, discusses LD adults who have the same symptoms they had as children. The Department of Education (Reference Hallahan & Kauffman) says that two to three percent of the total public school population are identified as learning disabled and that there are over fifteen million unidentified LD adults in the United States, acknowledging, of course, that people with this problem are not restricted to the United States but are found all over the world.

We know that many learning disabled persons have average or above average intelligence and we know that many of these are gifted. In their company are such famous gifted people as Nelson Rockefeller, Albert Einstein, Leonardo da Vinci, Thomas Edison, Hans Christian Anderson, Auguste Rodin, William Butler Yeats, and Gustave Flaubert.

The causes of learning disabilities are not known, but in our project each of our identified learning disabled students shows either an unusual pregnancy (trauma at birth, such as delayed delivery, prolonged or difficult delivery) or premature birth. They oftentimes have a genetic family history of similar learning disability problems.

An exerpt from my *Criterion and Behavioral Checklist for Adults With Specific Learning Disabilities* has been included as Appendix A.

/s/ MCS
6 June 1982
Ellensburg, Washington

[1]Daniel P. Hallahan and James M. Kauffman *Exceptional Children* (Englewood Cliffs, New Jersey: Prentice-Hall, 1978), pp. 121-122.

INTRODUCTION BY AUTHOR

This brief booklet is meant to provide some hints and suggestions to logic teachers at the college level in recognizing and helping the Learning Disabled (LD) student in a normal classroom setting. My specific aim is to pass on some of the strategies and teaching techniques which I have found useful in structuring a beginning logic course and teaching logic to students with learning disabilities, but my more general purpose is to raise the consciousness of my fellow college teachers, to help them become aware of the problems and frustrations of the LD students who will be appearing in increasing numbers in their classrooms.

I wish to stress at the very outset of this study that none of the strategies and techniques that I have used were introduced to help the LD student alone. Indeed, the premise upon which this whole project was based is that any device which would benefit the LD student would also benefit the "normal" student as well, and that none of these strategies would hinder or interfere with the normal progress of the course. In addition we deliberately tried to avoid watering down the course or lowering standards simply to provide a "special education" course for students with learning disabilities.

During our two-year project on the LD college student we learned that very little is known about the causes and treatment of learning disabilities. Further, my own experience has taught me that almost nothing is known about why some students learn logic more quickly and easily than others. As a logic teacher of 20 years I continue to marvel at the ability of some students to "just see" that "all ghosts are invisible" is the logical equivalent of "no ghosts are visible," while others cannot see this and have to take it as a matter of faith, as many of us have to take the fact that 7 times 9 is 63. This state of affairs makes saying anything useful about how to teach logic to LD students doubly difficult. Teaching logic to anybody is a mysterious task, and I would be inclined to agree with Plato that at best the teacher can only act as midwife to ideas and abilities which already lie within the pregnant mind of the learner. However, as anyone who has carefully studied the Socratic techniques will know, the right treatment, the right questions, the right hints and the proper care make all the difference between a still-birth and a successful delivery.

A note on the limitations of this study. I am here offering no quick cures or sure-fire tricks for overcoming the problems of teaching logic to LD students. Most of the classroom procedures and strategies which I describe are merely variations and intensifications of tested educational methods taught in many schools of education. In addition, my method of determining the effectiveness of these tactics was impressionistic and anecdotal. I simply used these tactics in class and then asked my known LD students if they were helpful and why. I had no opportunity to use control groups, pre-and post-testing devices, or statistical analysis of data.

Nevertheless, I think that this project is a necessary first step in trying to identify learning disability problems and making other college teachers more aware of possible areas in which they could become more effective teachers. I hope that some of my experiences and suggestions will stimulate my colleagues to explore new ways of reaching LD students and perhaps lead to more formal research in this area.

II. STRUCTURING THE COURSE

A. General Remarks

As one plans a course with LDs in it, one should keep three simple things in mind: 1. LDs have difficulty structuring material into coherent and significant patterns or systems of meaning. 2. They almost always have problems with reading and writing. 3. They tend to think in concrete and literal terms. To this list one could add that they are almost always bright and highly motivated; attested to by the fact that they tell us that they have survived the frustrations and humiliations of the lower levels of school and have arrived in fact in college. Apart from these generalities, each student is unique, with his own set of difficulities and compensatory patterns.

With these things in mind, the instructor should approach his task using the following general principles:

1. The course should be structured in such a way that the learning objectives are absolutely clear and that the sequences and logical patterns are well marked. This holds for the course as a whole as well as for each day's class session.
2. The material that is presented should reach the student in as *many modes* as possible, i.e. he should hear it, see it, write it, say it, feel it, and, if possible, smell it, preferably at the same time. Of course, in many disciplines such as logic this ideal cannot be reached, but as we will see, it can be partially approached.
3. In class lectures and demonstrations one should try to use as many concrete examples, practical applications and dramatic attention-getting devices as is feasible and consonant with the materials and objectives of the daily lesson.

Research has provided us with two other important facts, which should be burned into the memory of every teacher:

1. In a normal lecture or class presentation the attention span of a normal audience is approximately twenty minutes. For the LD student it may be much less than this.
2. Any item of information must enter into the student's consciousness

at least eight times before it becomes part of his working knowledge. This is for the normal person. For the LD students it may take as many as 20 repetitions, in various modes before it is "learned."

I would now like to describe how I tried to incorporate these general principles in an actual logic course which I planned and taught during the HELDS Project, trying to present in as much detail as possible the actual strategies I used which grew out of what I learned in the workshops and my interaction with my LD students.

B. Structuring the Course

At the beginning of the course the students should be given a carefully worked out syllabus. The important features of this syllabus should include: (a) Statement of the general objectives of the course, (b) General and specific requirements and expectations, (c) Specific topics to be covered, (d) An invitation to the students to make known to the instructor any educational problems they may be aware of, such as difficulties in reading, writing, or math.

The syllabus which I used in my Logic 201 appears as Appendix C of this booklet. This is to be considered merely as an example; many improvements and variations will occur to any logic teacher. The important thing is that the student has before him every day a plan of the course so that he can know at a glance where he has been, what he is expected to have learned, and where he is going. The instructor should *read* the syllabus to the class on the first day, stopping to make explanations and elaborations, and asking for questions. It is surprising how many students merely glance at the syllabus in the first few minutes of the class, and then file it away for the rest of the term, never to be looked at again. This will be avoided if the class perceives that the instructor attaches importance to the syllabus and refers to it at regular intervals during the progress of the term.

C. Detection and Identification of the Student

Many LD students are embarassed by their problems so this phase of the process should be undertaken with delicacy and tact. An open, straight-forward approach does no harm if it is done in such a way as to avoid any public attention or undue fuss. I use two methods, neither of which is infallible. 1. An open invitation to the class for any student who is aware of any problems he has with writing, reading, or math to come in for a private interview. In this interview I try to determine what kind of difficulties he had in his previous educational experiences, how he performed in English and math classes in high school, etc. I ask if he enjoys reading and how much reading he does for pleasure on his own. I sometimes ask him to read a few passages aloud to me from some text. (Poor phrasing, missed words, difficulty in pronunciation, halting speech, and misplaced inflection often indicate learning disabilities.)

2. On the first day of class I give all the students a short test containing (a) some simple logic problems, (b) a sample of their handwriting. The test, with the responses of one of my diagnosed LD students, is included as Appendix B. It is important that the students be asked to respond in cursive writing and that they do not print. Most LD students have such difficulties with cursive writing that they have learned never to use it. When asked to write, rather than print, their problems quickly reveal themselves. In these samples I look for slanted lines, irregularly spelled words, missing words, lack of or misplaced punctuation, crowded letters or words, reversed letters or words. In general the paragraph will resemble something written by a third grader who is just learning to write in script for the first time.

In my experience the logic problems on this test are not as helpful as the writing example. Most of my students get the correct answers, and if they do not, it is impossible to tell whether this is due to a learning disability or some other cause.

When this test or the interview reveals a definite problem the next step is referring the student to, in my case, our Educational Opportunities Program (E.O.P.), where a specialist can then take over. Here more elaborate tests and interviews are conducted to determine whether the student is genuinely LD or whether his problems are due to previous educational disadvantages or simple low I.Q. (It should sadly be noted that today many young people are graduated from high schools and accepted for college admission who have never learned the basic intellectual skills.)

The instructor should have fairly close communication with the staff at the E.O.P. so that any follow-up procedures may be taken. Our E.O.P. has resources for taping textbooks, lending tape recorders for taping class lectures, and providing special tutors and academic counselors[1] and even readers to assist with tests. These are all special aids, and will not, of course, be the responsibility of the instructor. It should be emphasized, however, that once the instructor is aware that here is a student with a special learning disability, he will be more inclined to take care in applying the strategies and suggestions discussed below. Open recognition on both sides, frank discussions of problems and emotional support and understanding are very powerful learning incentives for both the student and the teacher.

[1]Specialized therapy for LD students, in the sense of strict remediation of the specific disability, has not in the past proved effective. The best help that can be given by the specialist consists of teaching the student to "get around" his specific problem by developing other compensatory skills.

PART III. THE CLASS SESSION -- THE FIFTY MINUTE HOUR

Learning "logic" requires the development of a number of specific skills, among the most important of which are: (a) grasping the meaning of a general rule or principle, which is the same thing as being able to apply it to a new specific case, and (b) translating ordinary English sentences into formal, standardized sentences, which involves the replacing of one string of symbols with a different string of symbols with "the same meaning."

The former skill appears to be mainly a function of native intelligence. The bright LD student has no particular difficulty in this area if he can get the data into his computer (brain). The latter skill is by far the more troublesome. It requires great sensitivity to the language and the ability to grasp nuances of meaning which frequently shift with slight variations in word order. All students have difficulty with this, but the LD student has added obstacles since sometimes he reads letters and words backwards, transposes words, misses them, misreads them, adds new ones or may transfer them from the sentence above or below.

Each class session should be structured with these problems in mind. Review, repetition, many illustrations and examples, variation in approach, and above all multi-modal presentation are essential. Let me describe a typical class session in which I introduce the concept of the Informal Fallacy, and begin to teach the student to recognize several specific fallacies.

I begin the session with a brief review of the important ideas covered in the previous day's session. Usually I write the key words on the chalkboard, (*printing* them is best), while *saying* them aloud to the class. I ask someone in the class to explain or define them. If a good idea is presented I write this on the board also. I encourage the students to also write them in their notebooks, and perhaps say them softly aloud to themselves, and if possible read them from the appropriate place in their texts. One of my LD students told me that this is what she did and it struck me that in going through this rather complex procedure she was getting the idea in six different modalities: hearing me say it, seeing it written on the board, seeing it written in the book, writing it herself, seeing it as she wrote it on her paper, and hearing herself say it. The taking of notes during class is often quite difficult for a student with writing problems, but another student told me that, even though he could not read his notes the next day, the very act of writing them helped to fix the ideas in his mind. Bright students create ingenious compensatory devices such as this.

In a logic class my main audio-visual device is the chalkboard in conjunction with my own voice. Each important term, as well as its definition, must be clearly and slowly printed on the board and spoken at the

same time. One disquieting comment made by an LD student during one of our workshops gave me pause: when a definition or principle is paraphrased (said in a different way in different words), she could not see the connection; it sounded like a different idea to her. The only thing the teacher can do here is to *try to keep the definitions or statement of principles as uniform as possible.*

The next few minutes are spent in explaining to the class our objectives for the day, printing on the board the new terms or concepts along with their definitions. After presenting the general notion of a fallacy, I begin to explain each specific fallacy by writing its formal structure on the board. "The ad Hominem Abusive" fallacy always has the form: "P is false (or can be disregarded) because Jones said it, and Jones is a Commie pinko rat-fink!" I give several specific examples of this taken from real situations and then I might even draw a picture of it: something to suggest attacking the man and not his argument or statement.

The next step is to have the students try to identify cases of this fallacy and distinguish it from other kinds of fallacy by having them work through the exercises from the text, aloud in class. In the past I have adopted the practice of choosing a student at random and asking that student to read the argument aloud and then identify the fallacy. A brief discussion usually follows this attempt. Then the student to her or his right gets the next problem, and so on. I discovered, however, that LD students, among others, find performing (especially reading) in front of audiences extremely stressful. I therefore make it quite clear to the whole class that a student *need not* do this and may gracefully pass. After about 20 minutes of this kind of work the students should be getting the idea (recognizing the same pattern of arguments in many different contexts). I then say, "Now we are going to have a Quickie Self Quiz. You have eight minutes to do problems 12 and 13 in your notebooks, and then we will correct them." When everyone is finished, I do the problems on the board and students correct their own problems, ask questions, discuss difficulties. No need for grading but this procedure gives the students an idea of where their own specific deficiencies lie.

The last thing I do, and this is useful only for certain units in the course such as constructing Venn Diagrams or constructing proofs in formal logic, is to have the class divide itself up into small groups for mini-workshops. I give everyone five problems and let each group work them out independently and jointly. This accomplishes something which I try to emphasize to the class as being very helpful: working with one or two other persons on a problem gives immediate positive reinforcement, pools joint insights and skills, and helps to reduce the tension and frustration of working alone on a problem, coming to a deadend, and not knowing how to go on. I tell the class that this is the best way to study outside of class as well. While the groups are struggling with their tasks I move from group to group, peer over their shoulders and answer their specific questions. This gives me a very good opportunity to see how in-

dividual students are doing and where their problem areas might be.

At the end of the class period I make sure that I write the homework assignment on the board and tell the class what we will be doing the next day. If possible, I make a little time for reviewing what we have been accomplishing during the day's session and call for any further questions. I stress the importance of at least trying to do the homework exercises *before* coming to class.

IV MISCELLANEOUS SUGGESTIONS AND TACTICS

A. Pictures and Diagrams

The old saw that "one picture is worth a thousand words" is at best a misleading half-truth. Sometimes it takes a thousand words to explain the meaning of one picture. An image or picture by itself means nothing. As Wittgenstein asked: What is required to "see" that an arrow is *pointing?* Is there a single *natural* way to see this? At first when I pointed to a piece of food on the floor to my poodle, her attention focused on me, not the food. The international traffic sign pictures are a case in point. My favorite sign is Figure 2. The first time my young daughter saw this she asked, "Does that mean, 'Don't picnic here, a tree might fall on you!'?" It is also true that verbal explanations must come to an end—there is a point where one must simply say, "I see."

Figure 1

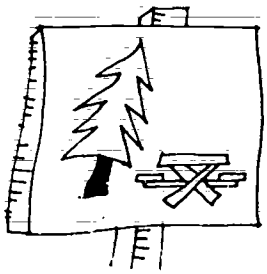

Figure 2

It takes many words of careful explanation to show how a Venn Diagram is the picture of a proposition or a classical syllogism. However, in my work with LD students, I found that once the general idea was grasped, these students had no particular difficulty with the mechanics. In fact, the diagrams prove helpful to *most* students in aiding them in visualizing the structure of an argument and showing them how the classes are related to each other in a classical syllogism.

There are two things which do present some problems: 1. In teaching a student how to "read" a completed diagram, one must somehow make clear that the *shape* of the outline of the class is not important, it is the relation between the classes which counts. For example: to determine if the diagram shows the argument to be valid, the two top circles must show a picture of the conclusion. To show this, I draw a diagram of the

conclusion alone beside the diagram of the whole argument as in this illustration of the diagram of the classical AAA-1 syllogism:

All men are mortal.

All Greeks are men.

All Greeks are mortal.

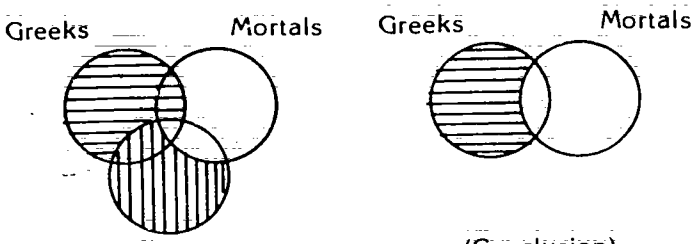

Figure 3

Most LD students take things very *literally*, and the top two circles in the left diagram in Figure 3 really do not look like the circles of the diagram on the right. One must take time to carefully point out that all that really matters is that the picture shows that if anything is in the non-shaded part of the Greek circle it *must* also be in the Mortals circle as well, regardless of the *shape* of the two areas involved. This is a small point, but it is an important one.

2. The second problem that most students have is knowing where to place the X in an area with another line running through it. The general rule is, "If you are not *forced* to put the X on one side or the other, then put it on the line." It is a simple rule, but it takes many, many demonstrations to show students how to correctly apply it. For example, in the diagram of this invalid AOO-1 syllogism, (Figure 4) since the X is not forced to go either on the right or the left of the S circle line running through the middle of the P class, it must be placed *on* that line. Most logic texts do not explain this difficulty very well, but it is the cause of most student errors in diagramming syllogisms.

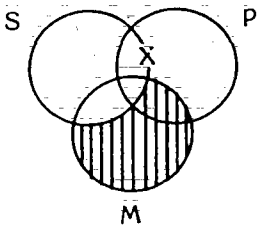

Figure 4

In general the main value of drawing pictures or diagrams on the board to illustrate points is mnemonic. One of my LD students told me that one day in a Spanish class she remembered all of the verbs in that day's lesson because her instructor dropped his notes on the floor. I suspect that this is also the case with drawings on the board or any other bizarre behavior displayed by the instructor which breaks up the monotony of the droning

of his voice. If I write a rule on the board, "Never say 'All swans are not white.'" and then draw a skull with a dagger through it (as in Figure 5), all of the students will remember it. Here again, it is the association of an idea with a concrete image in a different modality which does the trick, and is very helpful to LD students as well as all others.

Figure 5

B. Class Drill

This technique may seem to be Mickey Mouse at the college level, but used sparingly and on the right occasions it can be very effective. I have used it with good results when we are first learning the six rules for a valid classical syllogism and when we are learning the nine rules of inference and the ten replacement rules in propositional logic. One can make a little game of it: I ask, "Can someone give me DeMorgan's theorem?" When someone gives it correctly, I write it on the board and then say it with an English substitution instance, e.g. "You can have neither pie nor cake" is logically equivalent to "You cannot have either pie or cake." When all of the rules are written on the board (in symbolic form) I then point to them at random one by one and ask the class, "Which rule is this?" and have everyone answer in unison. In a few minutes everyone will know the names of the rules, and most will be able to recognize the symbolic expression. I suspect that this would take the place of a couple of hours of silent, solitary memorization. Several modalities are employed as well as immediate and dramatic reinforcement.

C. The 'Meaning' of a Variable

The best way to explain the nature of a propositional variable (or a class variable) is to say that it is a place holder and functions just as a blank on an application form. Then I draw a picture of the formal structure of an argument using different kinds of blanks (wavy lines, dotted lines, dash lines) instead of the different letters S, P, M.

Argument	Argument Form
All men are mortal.	All _____ are ~~~~.
All Greeks are men.	All _ _ _ _ _ are _____.
Thus, all Greeks are Mortal.	All _ _ _ _ _ are ~~~~.

Figure 6

I point out that they can fill in the blanks with any class name they want provided the same name goes into the same kind of blank.

Many LD students have trouble distinguishing between "p" and "q", so I tell them it won't make any logical difference in propositional logic if they use caps. A, B, and C instead of the traditional small letters p and q.

D. Examinations:

I do *not* make up special examinations for LD students, as this would defeat the whole purpose of our project. However, these students do sometimes need to be given special consideration if it can be done without appearing to be unfair to the rest of the class. They may need more time to complete the exam; they may ask to take the test in another room so as not to be distracted; they may need a reader to come with them to read them the test questions. These things can be offered to the rest of the students as well, and usually it presents no real problem.

E. Computer Assisted Instruction (CAI)

There are a growing number of colleges and universities in which logic courses are taught almost entirely by computer. In such institutions as Stanford, Ohio State University, Notre Dame and Dartmouth, elaborate programs have been developed in which the student only sees the instructor once a week, and for the rest of the time he works at his computer terminal at his own pace. The full value of this new approach has yet to be completely assessed but a glance at the bourgeoning literature indicates that this is the wave of the future. The question for me is, "What are the implications for the LD student?"

One quarter I employed a unit using one of the programs, 'BERTIE' in a logic class with several of my known LD students. BERTIE is a program developed by James Moor (Dartmouth) and Jack Nelson (Temple) which helps the student construct formal proofs in Sentential and Quantificational Logic. According to Moor and Nelson, "The two main pedagogical advantages of using BERTIE are (i) that it provides immediate feedback to students when they make errors in deductions and (ii) that it assists students in acquiring the strategies and tactics needed to solve problems in natural deduction. BERTIE carefully checks each line of a deduction to be sure the formula entered is well-formed and correctly justified. Thus, the common problems of students believing they know what counts as a well-formed formula while often using ill-formed formulas and of students believing they know how to use the rules of the system while systematically misusing some of them are both alleviated before students take tests on the subject." (p. 1, *A Manual for BERTIE*, Moor and Nelson)

A group of my logic students worked with BERTIE for most of one quarter and in general the results were favorable. The one LD student in the group became fascinated with the computer and spent many hours at the terminal. (He passed the course with flying colors.) Most of the

students reported that they thought they benefited from their work on the program and many said that it was fun. One student commented (not my own student): "I became quite friendly with my terminal. It has no eyebrows." (No doubt referring to the universal 'raised eyebrow' response to a student mistake from a human instructor.) Moor and others report that in controlled studies they conducted they found that students who really used the programs generally did better on their tests than students who received the more traditional logic instruction.

My *a priori* thoughts about CAI are that for an LD student who has great difficulty in writing and organizing written symbols on his page, doing his logic problems on the computer could be of great help. However, there are drawbacks: Learning the keyboard of the terminal and the special language of BERTIE takes extra work and practice, and special motor and perceptual skills which the LD student may not have developed or may not be able to develop. Any tiny mistake in typing in a line of the deduction can result in a response of "Incorrect use of rule cited," etc., and this can be very frustrating.

In using a program like BERTIE, one must remember that the rules of inference and replacement have to be fairly well-learned *before* the student can have much success on the computer. In introducing these rules, I believe, a human instructor is essential.

There are other more sophisticated and flexible logic programs that have been developed and used in various universities. A complete account of one of them, EMIL, appears in the Fall, 1980, issue of *Teaching Philosophy* (Garson and Mellema). The application of new technology to the special problems of the LD student is an area where most of the research remains to be done.

V. CONCLUDING REMARKS

LD college students must work twice as hard and twice as long to achieve the same results as other students. This gives the logic teacher a real incentive to reflect on the value and quality of what he is teaching and how he is teaching it. Most philosophy teachers, scorning courses in educational methods during their undergraduate and graduate training, tend to teach their courses the way they themselves were taught when they were in school. Knowing that there are LD students in one's class and being aware of their special problems and frustrations makes one much more careful and conscious of the way in which one is coming across to all of his students.

In particular, I have begun to ask myself questions about the precise goals and objectives of my own logic course. What exactly do I want my students to carry away from my class? How can my course, which is a required one for all students graduating from my institution, justify itself in

the broader context of the goals of liberal education in a democratic society?

These questions focus themselves on a problem which is not new, but which is currently arousing new concern among logic teachers and textbook writers: should a basic logic course emphasize informal or applied logic, or should it concern itself mainly with formal logic? It is obvious that an ideal logic course should contain both elements but, with limited time, certain important choices must be made.

As may be apparent from my syllabus, I try to strike a balance in my course between pure and applied logic, realizing that most of my students will never have the opportunity to take another course like this again. Informal logic ideally should give the student the skills he will need to evaluate the kinds of arguments he will encounter in real life. The only place he will ever be likely to encounter a classical syllogism or a complex formal deductive argument is in a logic textbook, and if he does hear a fragment of a syllogism he will never have the time to make a Venn Diagram of it to test its validity. Nevertheless, if he never learns what a good and complete deductive argument is, he won't even begin to be able to assess the reasonings, propaganda, Madison Avenue hype or the political and religious bullshit which will be bombarding him from the mass media, friends or strangers that appear at his door with leaflets. The techniques and devices of formal logic are specifically designed to make the assessment of arguments easy and mechanical; if you can make a Venn Diagram or a Truth Table you don't have to think.

As I mentioned earlier, most bright LD students can master the mechanical skills if they are presented clearly and in many different modalities. The problem is in applying them to real life situations: that is, translating ordinary English passages into formal structures which can be handled by the formal techniques. This is by far the hardest part for most students, and it is doubly difficult for the LD. Most of the strategies and tactics which I have described in this booklet are helpful in teaching the LD student the formal techniques of analyzing and assessing neat little textbook arguments, but it is far from clear that they can be useful in enabling him to attack the second and more formidable part of his task — the evaluation of the *extended* arguments he will encounter in an editorial on abortion, a magazine article on sex education in the public schools or a speech on TV advocating the abolition of nuclear power plants.

This is not the place for a full discussion of the many subtle and difficult-to-teach skills that anyone must have in order to become a critical thinker[1]. I merely want to point to the fact that these things —

[1]An excellent account of the new work that is being done in the area of informal logic appears in the April, 1981, issue of *Teaching Philosophy*, "The New Logic Course: The State of the Art in Non-Formal Methods of Argument Analysis," by Ralph Johnson.

sensitivity to meanings, detecting logical structure in masses of rhetorical verbiage and metaphorical foofaraw, separating the wheat from the chaff in ordinary discourse — are difficult to teach and extremely hard for the LD student to learn.

It will be obvious from my brief comments that much work is waiting to be done — for which I hope I have provided an incentive and a beginning direction.

Address of author:

John Utzinger, Associate Professor of Philosophy
Department of Philosophy
Central Washington University
Ellensburg, WA 98926
Phone: (509) 963-1594

APPENDICES

APPENDIX A

Criterion and Behavioral Checklist for Adults with Specific Learning Disabilities

1. Short attention span.
2. Restlessness.
3. Distractability. (The student seems especially sensitive to sounds or visual stimuli and has difficulty ignoring them while studying.)
4. Poor motor coordination. (This may be seen as clumsiness.)
5. Impulsivity. (Responding without thinking.)
6. Perseveration. (The student tends to do or say things over and over. Mechanism that says "finished" does not work well.)
7. Handwriting is poor. (Letters will not be well formed, spacing between words and letters will be inconsistent, writing will have an extreme up or down slant on unlined page.)
8. Spelling is consistently inconsistent.
9. Inaccurate copying. (The student has difficulty copying things from the chalkboard and from textbooks; for instance, math problems may be off by one or two numbers that have been copied incorrectly or out of sequence.)
10. Can express self well orally but fails badly when doing so in writing. In a few cases the reverse is true.
11. Frequently misunderstands what someone is saying. (For instance, a student may say, "What?", and then may or may not answer appropriately before someone has a chance to repeat what was said previously.)
12. Marked discrepancy between what student is able to understand when listening or reading.
13. Has trouble with variant word meanings and figurative language.
14. Has problems structuring (organizing) time -- The person is frequently late to class and appointments; seems to have no "sense of how long a "few minutes" is opposed to an hour; has trouble pacing self during tests.

15. Has problems structuring (organizing) space -- The student may have difficulty concentrating on work when in a large, open area -- even when it's quiet; may over or under-reach when trying to put something on a shelf (depth perception).

16. Has difficulty spacing an assignment on a page, e.g., math problems are crowded together.

17. Thoughts -- ideas wander and/or are incomplete in spoken and written language. Student may also have difficulty sequencing ideas.

18. Sounds -- A student's hearing acuity may be excellent, but when his brain processes the sounds used in words, the sequence of sounds may be out of order: e.g., the student hears "aminal" instead of "animal" and may say and/or write the "aminal."

19. Visual selectivity -- May have 20/20 vision but when brain processes visual information, e.g., pictures, graphs, words, numbers, student may be unable to focus visual attention selectively; in other words, everything from a flyspeck to a key word in a title has equal claim on attention.

20. Word retrieval problems -- the student has difficulty recalling words that have been learned

21. Misunderstands non-verbal information, such as facial expressions or gestures.

22. Very slow worker -- but may be extremely accurate.

23. Very fast worker -- but makes many errors and tends to leave out items.

24. Visual images -- Has 20/20 vision but may see things out of sequence, e.g., "frist" for "first," "961" for "691." Or, a student may see words or letters as if they are turned around or upside down; e.g., "cug" for "cup," or "dub" for "bud," or "9" for "L" for "7," etc.

25. Makes literal interpretations. You will have to have them give you feedback on verbal directions, etc.

26. Judges books by their thickness because of frustration when learning to read.

27. Has mixed dominance: e.g., student may be right handed and left eyed.

28. Moodiness :: Quick tempered, frustration.

29. Cannot look people in the eyes and feels uncomfortable when talking to others.

30. Has trouble answering yes or no to questions.

Students with specific learning disabilities which affect their performance in math generally fall into two groups:

1. Those students whose language processing (input and output) and/or reading abilities are impaired. These students will have great difficulty doing word problems; however, if the problems are read to them, they will be able to do them.

2. Those students whose abilities necessary to do quantitative thinking are impaired. These students often have one or more problems such as the following:

A. Difficulty in visual-spatial organization and in integrating nonverbal material. For example, a student with this kind of problem will have trouble estimating distances, distinguishing differences in amounts, sizes, shapes, and lengths. Student may also have trouble looking at groups of objects and telling what contains the greater amount. This student frequently has trouble organizing and sequencing material meaningfully on a page.

B. Difficulty in integrating kinesthetic processes. For example, a student will be inaccurate in copying problems from a textbook or chalkboard onto a piece of paper. The numbers may be out of sequence or the wrong numbers (e.g., copying "6" for "5"). Problems may be out of alignment on the paper. Graph paper is a must for them.

C. Difficulty in visually processing information. Numbers will be misperceived: "6" and "9," "3" and "8" and "9" are often confused. The student may also have trouble revisualizing. i.e., calling up the visual memory of what a number looks like or how a problem should be laid out on a page.

D. Poor sense of time and direction. Usually, students in the second group have the auditory and/or kinesethic as their strongest learning channels. They need to use manipulative materials accompanied by oral explanations from the instructor. They often need to have many experiences with concrete materials before they can move on successfully to the abstract and symbolic level of numbers.

APPENDIX B

Test Used for Initial Indentification of Students With Possible LD Problems

Philosophy · Dr. Utzinger

I. Exercises in reasoning:

1. If it is true that *No logic students are lazy*, which of the following statements must also be true?

   a. Some lazy people are logic students.
   (b) No lazy people are logic students.
   c. Some non-logic students are lazy.
   d. All lazy people are logic students.
   e. Some logic students are lazy.

2. If no football players are stupid and some football players are millionaires, then it follows that:

   (a) No millionaires are stupid.
   b. Some stupid persons are millionaires.
   c. Some millionaires are not stupid.
   d. All millionaires are stupid.

3. What conclusion most naturally follows from the following two statements:

   a. If today is Sunday, then the Jacuzzi will be cold.
   b. The Jacuzzi is not cold.

   Therefore: Today is Sunday

II. Write a short paragraph about yourself and your academic background and/or career plans. PLEASE DO NOT PRINT.

May name is Ken and my academic Skills are Sometimes Impaired By Dyslexyia But only in The mathematics ~~subjects~~. Reading Wrighting & Arithmetic. I understand The Concepts But faltter in the writen work. I Have taken several Special Classes and Have done well. I Hope to go into Special Ed & Ed in general I would like to work with Kids and eventaly with the Deaf as Skigne with the Hands.

APPENDIX C

SYLLABUS

INTRODUCTION TO LOGIC: Phil. 201
Professor John Utzinger
Office: L & L 100-M
TEXT: *Introduction to Logic*, 5th Edition, by Irving Copi.

I. *Course Overview:* The basic purpose of the study of logic is to develop the ability to recognize the difference between good and bad reasoning. This involves both a general awareness of what an argument is—as opposed to other forms of belief manipulation such as appeals to emotion, propaganda, brainwashing—and the learning of special skills and techniques for analyzing the difference between valid and invalid arguments. This course should help you to construct and present your own arguments more clearly and rationally and to protect you from being taken in by the phoney arguments of others. The main emphasis of this course is on deductive logic.

II. Requirements and Expectations:

A. Reasonable class attendance: A word to the wise—The material in large parts of this course is developed in a progressive, step-by-step manner. If the first few days of a particular unit are missed, it will be very difficult to understand the later parts of the unit. It is *your* responsibility to make sure you find out what went on in classes you are forced to miss.

B. Text: Readings will be assigned in class as appropriate. They should be done before you come to class. The text is also our workbook and it is imperative that you bring it to class each day. We will be working examples and problems from the text in class every day. It is a good idea to try to do as many of the problems assigned as you can *before* class period.

C. Grades. Your course grade will be based on four hourly examinations and a comprehensive final exam. Each hourly exam will constitute one sixth of your grade and the final will count one third of your grade. Make-up exams will be given only in cases of extreme and unavoidable emergencies, sicknesses, etc. All other missed exams will count as E (flunk)!

D. If you have any special reading, writing or math difficulties or disabilities, please make these known to the instructor early in the quarter. There will be a tutor available for individual instruc-

tion. The instructor will be happy to make appointments for extra help.

III. Specific Objectives and Topics:

A. Informal Logic

1. Introduction to basic concepts: proposition, argument, premise, conclusion, truth, validity, soundness deduction, induction.
2. Developing basic skills: Recognizing arguments, analyzing arguments for premises and conclusion, distinguishing between inductive and deductive arguments.
3. Recognizing common informal fallacies: Ad Hominem, ad Populum, ad Ignorantiam, etc.

B. Classical Deductive Logic

1. Analysis of the four basic kinds of categorical propositions, A, E, I and O.
2. The traditional square of opposition.
3. Simple logical relations between propositions: immediate inferences.
4. Constructing Venn Diagrams for the four kinds of propositions.
5. Standard Form Categorical Syllogisms.
6. The Venn Diagram technique for testing syllogisms.
7. The Six Rules for testing the validity of syllogisms.
8. Translating ordinary English sentences into standard form propositions and arguments.

C. Symbolic Logic

1. Introduction to the symbolic language: special symbols for conjunction, negation, disjunction, material implication, material equivalence.
2. Learning the Truth Table Technique for determining contingent, tautologous and self-contradictory statement forms.
3. Logical implication and logical equivalence.
4. Arguments and argument forms:
   a. The long Truth Table technique for testing the validity of arguments.
   b. The short Truth Table technique for testing validity.
5. Translating ordinary English into the symbolic language.
6. The Method of Deduction: developing skill in constructing formal symbolic proofs.

Formal proofs of validity.
a. The nine Rules of Inference.
b. The ten Rules of Replacement.

D. Special Unit: Logic and Computers

1. Computer Theory: the logical foundations of the digital computer.
2. Computer assisted instruction: the use of BERTIE Program for developing skills in constructing formal proofs.

HELDS Project
Myrtle Snyder, Director HELDS
Educational Opportunities Program
Central Washington University
Ellensburg, Washington 98926
(509) 963-2131
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