Anna Berg and Gerald Coleman

A COGNITIVE APPROACH TO TEACHING THE DEVELOPMENTAL STUDENT

There is growing consensus among developmental researchers that a substantial number, perhaps even a majority, of the freshmen admitted into colleges and universities in the United States approach the academic tasks of college-level courses on the concrete operational level of cognitive functioning.[1] Kuhn, et al., report that at least sixty percent of the college age population are unable to operate at the formal level, the highest level of cognitive development.[2] In another study using Piagetian tasks, Schwebel found similar results, reporting a mean score below the level of formal operational thinking for a group of randomly selected university freshmen.[3] Yet nothing less than formal-operational functioning is required to perform college-level work efficiently and effectively.[4]

The undereducated, urban community college student lags far behind the average college or university freshman in the ability to deal with the intellectually complex operations called for in college courses. These students often manage to pass remedial courses through memorization and drilling, strategies which quickly prove inadequate for college level work. Our experience and findings suggest that students do not succeed in regular college courses despite their acquisition of basic reading and writing skills because instruction at the remedial level has been directed at the surface of what our students need to know to succeed and has, by and large, ignored the cognitive structures that would allow them to process, assimilate, and manipulate the content of college programs. The facade of competence quickly crumbles because the basic skills are not supported by underlying cognitive structures. Our research suggests that remedial programs will be more effective if focused more directly on developing these underlying cognitive competencies.

At Passaic County Community College, an inner city school with a large enrollment of educationally disadvantaged students, we are now in the fourth year of developing a remedial curriculum, the "Cognitive Project," that gives educationally underprepared, nontraditional students an

---

Anna Berg is currently teaching at Passaic County Community College, Paterson, NJ. Gerald Coleman is now teaching at Union County College, Union, NJ. Both have made numerous presentations around the country to disseminate their project's theoretical and practical implications. They have coauthored a forthcoming developmental reading and writing text to be published by Holt, Rinehart, and Winston. It is based on the Cognitive Project herein described.

DOI: 10.37514/JBW-J.1985.4.2.03

opportunity to actively experience ways of acquiring, solidifying, and using knowledge while acquiring the basic reading and writing skills necessary for college work. Its strength is that students use cognitive skills to explore basic skills and basic skills to explore cognitive skills. The project has been facilitated through a substantial, federally funded grant and support from the college administration. It now involves all full-time instructors who teach reading and writing to approximately 300 students per semester.

We used several sources as psychological and practical models for the project. Piaget, Inhelder, the cognitive constructivist movement in general, and recent research in cognitive psychology have contributed to the theoretical foundations. Several principles derived from these sources were incorporated into the project design:

1. Cognitive development is the predecessor of all learning. College students cannot assimilate information nor accommodate new modes and levels of intellectual activity unless appropriate cognitive structures are already developed. Rote memorization is an unacceptable alternative.

2. These structures develop through adaptive interaction with learning situations which are challenging enough to create a state of cognitive disequilibrium, but are not so challenging or distant as to be beyond the student's developmental level of functioning. There must be an "optimal mismatch" between where students are functioning intellectually and the activities in which they are engaging.

3. The content and operations of working intellects are organized according to the nature of knowledge systems; cognitive structures underlie thinking across varying and seemingly disparate domains.

We had several existing programs on which to model our efforts. The ADAPT program (University of Nebraska), the DOORS program (Illinois Central), and the SOAR program (Xavier University) use specifically developed materials, activities, and approaches that prepare students intellectually for college work. These programs, however, deal essentially with students already accepted at the college freshman level and are geared, for the most part, toward success in the sciences. Our nontraditional students have college degree aspirations but fall well below college entry-level standards. Therefore, the major task of our project has been to develop and refine materials and tasks appropriate for our nontraditional student population—activities that emphasize the development of nascent intellectual abilities and the solidifying and application across many contexts of already developed ones. Unlike most remedial programs and texts which deal with cognitive structures only indirectly, we have identified cognitive structures as the major objectives of the remedial effort. The "cognitive strands" that the project decided upon became, not means toward ends in the service of basic skill or content area mastery, but the very core of the curriculum.

Guided by weekly faculty meetings, our individual research and consultations with Dr. Miriam Goldberg of Teachers College, Columbia University, and our analysis of the cognitive aspects of actual college courses over the last two years of the project, we have defined, redefined, and finally identified twelve cognitive processes that underlie basic reading and writing skills and college level courses. The curricular materials lead students to explore and develop the following twelve cognitive competencies: inferential reasoning, changing frames of reference, generating possibilities, hypothetical reasoning, problem solving, decision making, understanding and making coherent arguments, metaphoric reasoning, classifying, seriating, understanding complex relationships, and reflection upon internal processes.

These twelve "cognitive strands" are interwoven throughout the program so that they reinforce and strengthen each other while providing a process-oriented structure for the basic literacy skills. This approach contrasts with "thinking skills" programs and texts which deal with "classification" as a discrete topic or chapter, move on to "inference" as a discrete topic, and so on. We do not claim that the twelve strands are an exhaustive taxonomy of thinking skills but that they are a sensible list of cognitive competencies needed in writing, reading, and academic functioning, and that they are more useful for remedial English educators than, for example, Guilford's 120-element "structure of intellect"[5] or the reducing of complexities of the human mind into an overly simplistic hierarchy of Bloom's taxonomy.[6] We developed the strands to make the cognitive demands of mastering basic skills and academic content areas more accessible to remedial educators and to provide a structure for the development of "Explorations" for our project.

EXPLORATIONS

"Explorations" are student centered activities that allow students to make connections between reading and writing and the cognitive processes that underlie them, which allow these skills and processes to play off and enrich each other, and which provide what underprepared students need most—new ways of looking at and operating in the academic world.

The following is a brief description of one student exploration, entitled "The Human Being as a Natural Rule Maker." It focuses upon the specific grammatical concern of subject-verb agreement in the present tense. This is a particularly difficult concept for remedial students to master for many reasons, some of which are cultural and some purely cognitive in nature. The cognitive competencies are more than equally focal to this exploration and include class intension (defining) and class extension (recognizing class membership), determining causal relationships, determining analogous structures, re-constructing and applying conventional rules, generating hypotheses and testing them against reality, and reflecting upon internal processes.

The objective of this exploration is, therefore, not merely to teach subject-verb agreement, although this is the content of the exploration, but to do so in such a way as to expose and explore universal intellectual competencies that structure knowledge and purposeful action. To succeed in college, students will need to internalize processes as well as content.

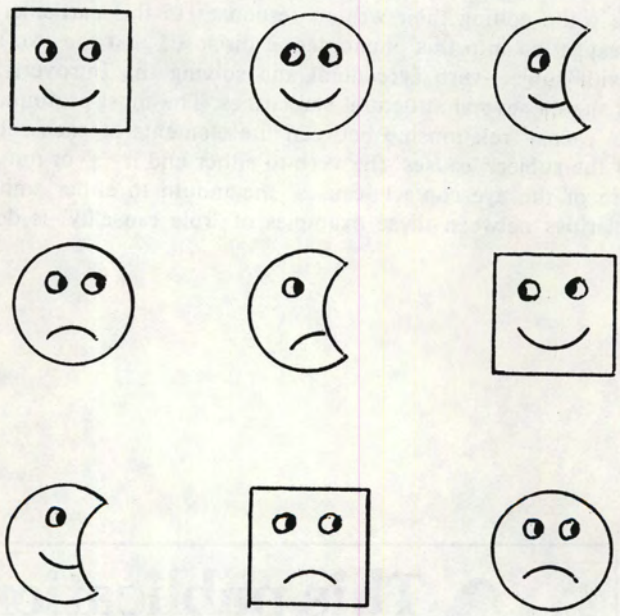
This exploration grew out of our initial work in hypothesis generating and testing. We liberally adapted an experimental paradigm from the cognitive psychology literature.[7]

One of the activities that we invented to make this area of mental life more accessible to our students was the "Introvert-Extrovert" exercise which is shown in condensed form in Figure 1.

The most significant part of this activity is the student analysis section. Students who have already engaged in discovering their own rules for subject-verb agreement still experience great difficulty in applying their rules in actuality. With the introduction of the Introvert-Extrovert activity, we noticed, however, that students were much better able to apply their rule while editing their written responses to this particular exploration. Investigation into this phenomenon disclosed that the two activities, dealing with subject-verb agreement and solving the Introvert-Extrovert problem, shared several structural similarities. The most profound similarity is the "causal" relationship between the elements of each activity: the nature of the subject "causes" the verb to either end in "s" or not; similarly the nature of the eye contact "causes" the mouth to either smile or not. The similarities between these examples of "rule causality" is depicted in Figure 2.

Figure 1

The characters below follow certain rules for smiling and frowning: all □ 's follow their own rule; all ○ 's follow their own rule; and all ☾ 's follow their own rule. Do what you have to do to find these rules and record your methods of solution as you proceed.



The "laws" that students extract from these examples are:

☾	= Introverts:	Enjoy lack of eye contact (smile) and dislike eye contact (frown)
○	= Extroverts:	Enjoy eye contact (smile) and dislike lack of eye contact (frown)
□	= Extroverts:	Enjoy eye contact (smile) and dislike lack of eye contact (frown)

Figure 2

Editing: Normative Behavior--Introversion

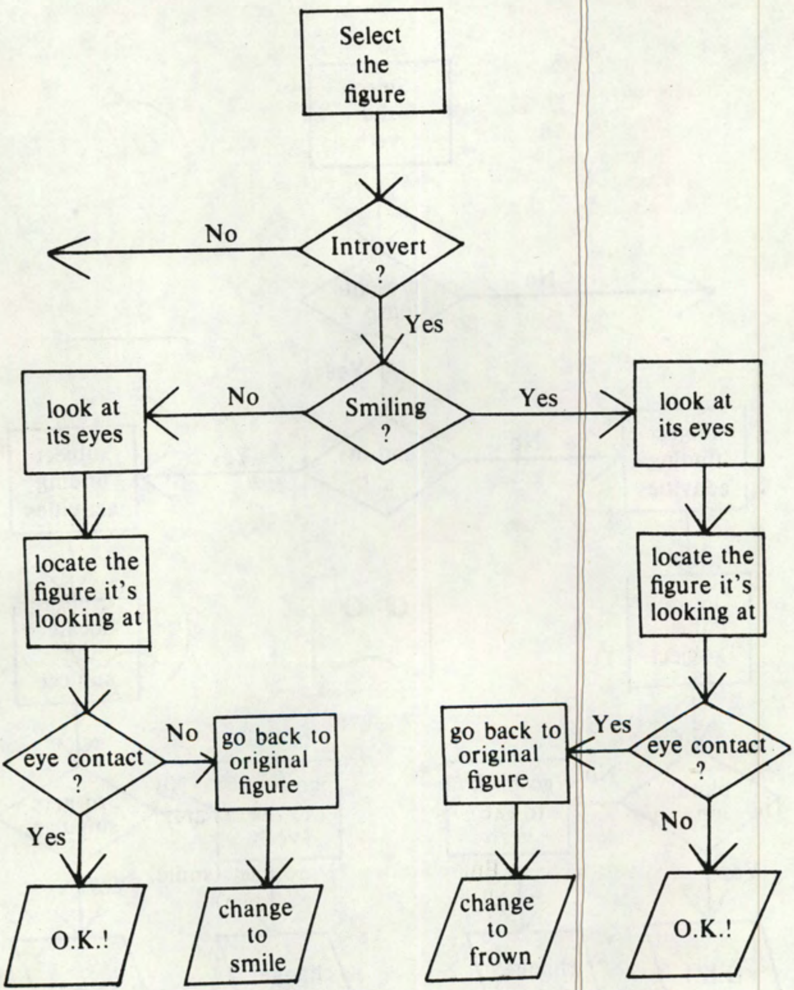
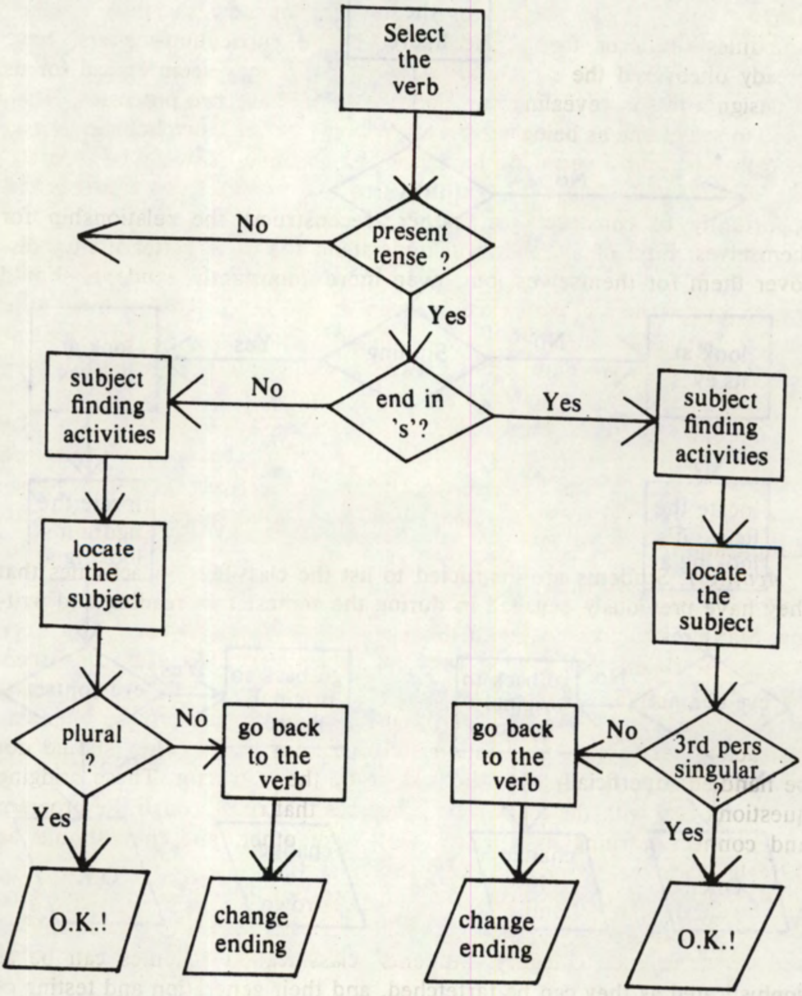


Figure 2 (Cont'd.)

Editing: Subject/Verb Agreement



The algorithmic analysis in Figure 2 shows the structural similarities between the two activities. Both exhibit elements of causal or, more properly, contingent relationship that seem to be at the heart of our students' difficulty. Because students seem to be more able to solve the "extrovert" problem than to deal with similarly structured problems in language usage, this activity provides students an entree into subject-verb agreement.

Entree is, however, different from insight. The question is, whose insight should guide the discovery in light of our students' obvious difficulties—ours or theirs? Because we, the curriculum-makers, have already uncovered the structural relationships, it may seem logical for us to design a lesson revealing our algorithms for these two processes. However, to select one as being *the* structure would be both psychologically and logically unsound. Even if we have the *best* structure, it would be theoretically unsound for us to design activities that would deny students the opportunity to construct (or, rather, reconstruct) the relationship for themselves. First of all, they will understand the rules better if they discover them for themselves, but, even more importantly, students should engage in this mental construction as an end in itself. Rule making, rule verification, correct rule application, and the cognitive skills employed in these activities will be important to students long after they have internalized the vagaries of subject-verb agreement.

The seven activities below constitute the complete exploration of "The Human Being as a Natural Rule Maker." The activities are covered sequentially over a two- to three-week period. This exploration comes midway through the course after sentence completeness and verb identification.

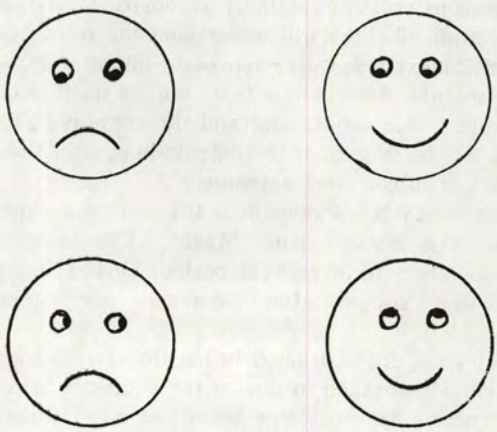
Activity 1. Students are instructed to list the classification activities that they have previously engaged in during the semester in reading and writing. Many instructors deal with this activity as a group discussion or have students work in small groups. Initially, students should try to reconstruct their classification activities. Later, they may scan through their actual work. Time constraints and personal style usually determine the way instructors deal with this question and questions like it. They should not be handled superficially nor summed up by the instructor. These bridging questions deal with the underlying processes that run through the program and connect learning experiences with each other, and they should be actively processed by the learners themselves.

Activity 2. Students are given an unorganized list of twenty-eight sentences and are asked to group them into four categories of equal number and to name each category. Students' classification schemes can be as sophisticated as they can be farfetched, and their generation and testing of hypotheses against the givens is, in a sense, a lesson in itself. When students finally get around to testing "time" as a classification criterion (they have explored the essential role of verbs in conveying time in previous explorations) they notice that such time—"past" and "present"— divides the sentences cleanly but does not conform to the constraints of the problem: four equal categories.

However, a classification of "past not ending in -ed," "past ending in -ed," "present ending in -s," and "present not ending in -s," does conform to the equal category constraint.[8] This portion of the exploration combines students' understanding of the nature of verbs with problem solving through classification and hypothesis generating and testing. It also provides experience in sticking to a task to the end.

Activity 3. Students are informed that they are now going to explore how good they are at creating rules or laws. They are presented several examples like Figure 3 below and are asked to find a rule that accounts for the smiling and frowning behavior of the figures. When their eyes meet, they smile; when they do not, they frown.

Figure 3



An exercise earlier in the semester required students to record on a score sheet each time they heard a word that ended in "s" from a story that was read to them. The actual total is 44, yet students typically hear from as low as 12 to perhaps as high as 30. From this state of "disequilibrium," they explored potential causes for this discrepancy and established the importance of the "s" ending at least in terms of sheer frequency of use. However, subject-verb agreement was not specifically explored at this time.

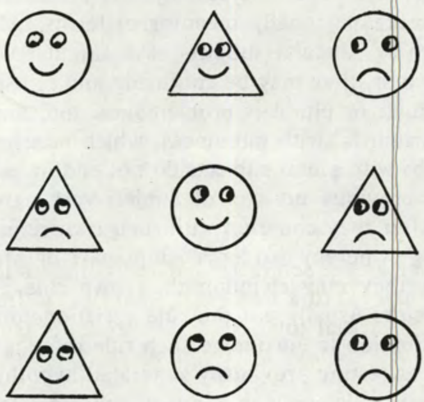
They are also required to explain in depth, in writing, how they made their rule—what they looked for, what they tried out, how they knew when they had found the rule, etc. This activity can be quite demanding for our students because it concerns processes that they may be only vaguely aware of. Finding a way to talk about these processes can be quite difficult.[9] We believe that one reason that Cognitive Project students have demonstrated more sophistication in dealing with essay exams is that they are consistently communicating concepts that are often difficult to express in writing.

Activity 4. Students are now told that they are ultimately going to come up with a rule that explains present tense -s on the end of some verbs and not on the end of others. Before they do, however, they solve another more complex "Introvert-Extrovert" problem involving two different "character-types" (see Figure 4). They are strongly encouraged to think about how they are proceeding and how their strategies here might be useful in helping them to determine their "s-rule."

The way that students encode and solve this problem will be of particular value to them in their subsequent subject-verb agreement work if they engage in it in light of this future activity. It appears that the notion of "anticipatory transfer" has a good deal to be said for it both empirically and from a common sense perspective. It makes sense that transfer of learning is enhanced when the "transfer" activity is connected to the "target" activity *prior* to engaging in *either.* The initial activity is, therefore, embued with appropriate significance and power vis-a-vis the activity of primary interest—in this case, subject-verb agreement.

Figure 4

Two different personality types are depicted below. All △ 's act alike and all ○ 's act alike. They follow two different rules of smiling behavior. Figure out the rules that each personality type follows.



Smiling rule for △ 's: (They smile when they are not making eye contact; frown when they do.)

Smiling rule for ○ 's: (They smile when they make eye contact; frown when they do not.)

Next, students are asked to explain how they found their rules and how they knew that they were correct. The rules generated are less important than the effort expended in reflecting upon the processes of generating and testing hypotheses in rule making and the cogency of their written communication upon this reflection.

Both parts of the question should be dealt with—generation and verification of rules are equally vital processes, different in kind as well as difficulty. Rule making requires students to engage in exploring the nature of language conventions, regularities, and occasional contradictions. These inductive, hypothesis-generating processes are vital intellectual skills. Rule application, on the other hand, is a cognitively demanding, deductive process that is too often overlooked. Many students who can generate hypotheses find it very difficult to test them on the sample sentences. Because these thinking capabilities are important for effective functioning in college and elsewhere, instructors should allow students to engage in this testing activity fully rather than pointing out how student-generated rules do not fit the sample sentences.

Activity 5. Students are given a representative list of present tense sentences and asked to create a rule that explains what makes the "s" appear at the end of present tense verbs. (We include the "I" and "you" exceptions but other instructors often exclude the exceptions during the initial rule making phase.) When students find a rule that *fits* all instances, they write it formally. Using traditional terms such as "1st person," "2nd person," "3rd person," and other half-remembered jargon is discouraged in favor of the students' own, more personally meaningful terms. Also, many students have notions such as "singular subjects have singular verbs," which are, at best, trivial. At worst, they may be confusing and nonsensical. The idea of a *verb* being singular or plural is problematical too, and most of our students have associated "s" with pluralness, which interferes with generating a valid rule—verbs with plural subjects do not end in "s." It is always better that they forget previous notions of subject-verb agreement if, indeed, they have any. After they come up with their own rules, there is considerable "rule trading" whereby students adopt part of other students' rules that they like or they may abandon their own rule entirely in favor of another's. Instructors usually put the rule variations on the board or type them up for distribution to encourage such rule refining activities.[10]

Activity 6. Just as testing previously generated hypotheses is not a simple reversible operation, rule applying is not merely a matter of rule making in reverse. This activity has two parts. The first engages students in finding correct instances of already given rules. We continue along the "introvert-extrovert" line (any number of other rule application activities could be substituted), presenting students with a group of "introvert-extrovert" figures and the behavior rules that each "type" should follow. However, students are informed that several "impostors" may be present. It is their job to find the impostors by proving that they are not "rule followers." This activity isn't as easy as it sounds. We feel that it is important, however, since it increases the likelihood of "anticipatory transfer" to the second part of this activity—subject-verb agreement editing of previously written work, where the problem is identical— there may be some "impostor" verbs hiding out in their writing as well.

Activity 7. Students have previously explored the usefulness of memorization and mnemonics for learning material that is essentially arbitrary in its structure. Subject-verb agreement is a conventional regularity that is essentially arbitrary in nature. This activity requires students to design their own mnemonic devices as aids for remembering their own rules. After this activity, if a student wishes to forsake his or her mnemonic for another's that is perfectly acceptable. However, each student should engage in the mnemonic-creating process—most college professors will not provide mnemonic aids for them later on.

FINDINGS

Entering students scoring below the 8th grade level (approximately) in reading, writing, and computing were randomly assigned at registration to Comparison and Experimental Groups at the Basic Level and were taught by full-time faculty, meeting in morning sessions. The Comparison Group was taught according to the objectives of the Academic Foundations Division's reading and writing syllabi by instructors with many years of experience in teaching these courses. The Experimental Group was taught by instructors with at least one semester of experience in the project using materials and activities like the "Rule Making" exploration which had been designed by the codirectors during the project's pilot year.

The data which were gathered on these two groups are encouraging. While we expected to find significant differences in favor of the Experimental Group on the Thorndike-Hagen Cognitive Abilities Test, we were surprised by the Experimental Group's strong performance on the standardized reading and holistically scored writing tests and by the pass-fail percentages resulting from these tests. Because we emphasized cognitively based, student-centered activities that took considerable time away from drilling, practice, and traditional reinforcement exercises in the basic skills usually tapped by standardized tests—in fact we did none of it—we expected that the Experimental Group would at best achieve parity with the Comparison Group on these measures. We assumed that the comparatively little time we did devote to basic skill exploration might make up in quality what it lost in quantity. We felt that the traditional skill building approaches aimed at success on standardized exit criteria would not be of lasting value, but we did not expect to find such differences in favor of the Experimental Group on the standardized tests themselves.

COGNITIVE ABILITIES

The development of cognitive skills was measured by the Thorndike-Hagen Cognitive Abilities Test which tests cognitive development in the verbal, quantitative, and nonverbal areas.

The Experimental Group's adjusted posttest means were significantly different from the Comparison Group's posttest means on the Verbal Battery total at the .001 level of significance and the Quantitative Battery total at the .05 level of significance. These two batteries, are designed to measure analytic reasoning skills, levels of abstract reasoning, short-term and long-term memory for verbal and quantitative concepts and, in problem solving, resistance to distraction. The posttest differences on the Non-Verbal Battery were not significant. However, the relationship of the Verbal and Quantitative scores to the Non-Verbal score is very important. Students who score higher on the Non-Verbal Battery than on the Verbal and Quantitative Batteries may have relatively well-developed reasoning abilities but they process information quite differently from the highly verbal student. These students are effective in perceiving and manipulating spatial relationships and tend to organize and handle data in complex wholes and patterns.[11] Because of the verbal, analytic, and abstract nature of much of college-level work, we were concerned that pretest scores for both groups on the Non-Verbal Battery were as high as or higher than Verbal and Quantitative scores.

The posttest means show that while the Comparison Group continued to maintain this troublesome nonverbal superiority (it actually increased), the Experimental Group made progress in improving the verbal reasoning/nonverbal reasoning balance—verbal reasoning began to take primacy as both improved over the semester.

Table 1 below displays posttest means adjusted for pretest differences and F-scores denoting significances for the Thorndike-Hagen Cognitive Abilities Test

Table 1

Thorndike-Hagen Cognitive Abilities Test
Adjusted, Posttest Means

Variables (raw scores)	Experimental	Comparison	F-Score[1]
Verbal 1 - Vocabulary	7.54	4.12	11.1**
Verbal 2 - Sentence Completion	13.25	10.94	7.8**
Verbal 3 - Verbal Classification	7.55	5.21	4.1*
Verbal 4 - Verbal Analogies	13.50	9.42	7.3**
Verbal Total	42.15	27.36	18.0***
Quant. 1 - Relationships	12.12	9.24	6.1**
Quant. 2 - Number Seriation	9.79	7.71	5.7*
Quant. 3 - Equation Building	7.84	7.89	0.4
Quantitiative Total	29.52	25.31	4.3*
Non-Verbal 1 - Figure Classif.	11.37	10.99	0.1
Non-Verbal 2 - Figure Analysis	13.57	11.03	4.5*
Non-Verbal 3 - Figure Synthesis	18.90	16.90	2.3*
Non-Verbal Total	42.65	39.67	1.5

[1] * Significant at .05 level

** Significant at .01 level

*** Significant at .001 level

READING.

Pretest, posttest, and adjusted posttest means on the Reading Battery of the Test of Adult Basic Education for the Experimental and Comparison Groups are shown in Table 2 below. The vocabulary and comprehension adjusted posttest means for the Experimental and Comparison Groups were significantly different at the .05 and .001 levels respectively. Total posttest score means were also significantly different in favor of the Experimental Group at the .001 level.

Table 2

Test of Adult Basic Education—Reading

Raw Scores

Variables	Experimental	Comparison	F Scores[3]
Vocabulary:			
Pre-test Means	19.89 (7.4)[2]	14.08 (6.3)	
Post-test Means	27.00 (8.2)	19.53 (6.4)	
Adjusted Post-test Means[1]	24.60	21.93	6.13*
Comprehension:			
Pre-test Means	22.96 (7.0)	20.69 (6.5)	
Post-test Means	25.19 (8.1)	18.74 (6.2)	
Adjusted Post-test Means	24.74	19.18	25.14***
Total:			
Pre-test Means	42.85 (6.4)	34.85 (6.4)	
Post-test Means	52.75 (8.1)	38.00 (6.3)	
Adjusted Post-test Means	50.26	40.49	21.00***

[1] Covaried for pre-test means.

[2] Grade equivalents are shown in parentheses.

[3] * Significant at .05 level.

** Significant at .01 level.

*** Significant at .001 level.

WRITING.

The area of most striking improvement for the Experimental Group was writing. Table 3 shows the mean scores of holistically scored pre- and post-semester essays. Each essay was scored by two readers, a combined score of 5 being the criterion for progress to the next level. Essays were numbered and mixed so that readers were unaware of student name or group. Students in the Comparison Group improved, but slightly; students in the Experimental Group improved dramatically.

Table 3

Holistically Scored Essay Data

(Combined Score—Two Readers)

Spring 1981 Cohort	Experimental (n=22)	Comparison (n=19)
Pre-test Mean	4.0	4.3
Post-test Mean	5.9	4.8
Fall 1981 Cohort	Experimental (n=82)	
Pre-test Mean	3.6	—
Post-test Mean	6.0	—

Again, the Experimental Group did no grammar drilling or practice and, in fact, wrote few essays that could be seen as even remotely similar to the exit essay. The writing that project students did engage in was typically related to the intellectual explorations and usually entailed written explanations of how they solved problems, how they came to particular conclusions, or what they were experiencing internally. That is, they reflected, in writing, upon the nature of their thinking or reasoning processes in particular situations and wrote about the relationships between explorations, mental processes, the basic skills, and academic matters in general.

The grammatical topics examined by project students—the nature of verbs, the nature of the sentence, and subject-verb agreement—were explored in ways that allow students (l) to generate and test hypotheses regarding standard English usage, (2) to experience "disequilibrium" when their old notions do not match reality, (3) to establish grammatical categories according to student-determined criteria, and (4) to analyze concepts such as the arbitrary yet lawful nature of grammatical rules, contingent relationships in "grammatical rule causality"[11] and the process of applying self-generated or given rules.[12] The data for the Fall 1981 semester was gathered after the experimental design collapsed. We found ourselves unable to maintain a Comparison Group—it simply became impossible to keep instructors out of the project.

It is interesting to note that when the experimental design collapsed as the project expanded for the 1981-1982 academic year, the holistically graded writing scores showed even greater progress from pre- to posttest than the Experimental Group achieved during the previous semester. These findings were achieved with new instructors and with much larger Ns. This pattern of increased improvement can also be seen in Table 4 which shows pass-fail/repeat data based upon the departmental exit criteria for writing, reading, and math for both groups. The mean scores achieved during the experimental semester (Spring 1981) were actually improved upon in the Fall, and with many more students participating after the Comparison-Group instructors joined the project. This development suggests that it was not the nature of the instructor that leads to the significant between-group differences but the nature of the instruction.

LONGITUDINAL FINDINGS.

The project's primary goal is to achieve results at the college level, and it is there that the success or failure of the approach must be assessed. Because the project is relatively young and because the instructional materials and activities now operate only at the basic level, we have only fragmentary findings.

Table 4

Pass-Fail Data

Spring 1981 Cohort

Variable	Experimental Group			Comparison Group		
Subject:	N	Pass	Repeat-Fail	N	Pass	Repeat-Fail
Reading	32	19 (59%)	13 (41%)	31	10 (32%)	21 (68%)
Writing	32	16 (50%)	16 (50%)	31	8 (36%)	23 (74%)
Math	32	17 (55%)	15 (45%)	31	10 (32%)	21 (68%)

Fall 1981 Cohort

Variable	Experimental Group			Comparison Group		
Subject:	N	Pass	Repeat-Fail	N	Pass	Repeat-Fail
Reading	99	62 (63%)	37 (37%)	—	—	—
Writing	84	59 (70%)	25 (30%)	—	—	—
Math	77	49 (64%)	28 (36%)	—	—	—

Initial longitudinal findings are based upon three cohorts (Fall 1979, Spring 1980, and Fall 1980) that enrolled and were placed at the basic, remedial level at Passaic County College during the project's pilot year and the first semester of the expanded Title III Project.

We do know that Cognitive Project students remain at Passaic County Community College in greater numbers after three semesters than do Comparison Group students—Experimental Group N=50, Comparison Group N=30 (each group began with approximately 150). More importantly, we know that the Cognitive Project delivers more students into the college-level programs and with fewer detours and repeated courses along the way. Of the fifty Experimental Group students from the initial cohorts, 90% were enrolled in college-level programs in their third semester compared to 65% for the Comparison Group. Three semesters are optimal for a basic-level student to reach full college-level work. Further longitudinal research to assess how well these students are doing in their college programs is under way. We have, unfortunately, no data on students transferring to other institutions.

CONCLUSIONS

A cognitive approach to remediation appears to accomplish more than other programs. Approaches which devote full time to practicing the basic skills appear to make learning them more difficult. Like other forms of knowledge, the basic skills cannot be bullied into existence through practice alone. Unless the intellectual foundations are nurtured, practice can only be partially effective. Our results suggest that the quality of time spent on basic skills tasks may be more important than the amount of time spent. Sigmund Tobias of City College, The City University of New York, supported this position in an article on the effect of instructional mode on achievement. He contended that the theory that spending more "time on task" results in higher achievement is only partially correct; what counts is how the student uses that time and what the student is thinking while studying the materials.[13] Our results also imply that direct instruction aimed toward exit criteria on standardized tests is not always particularly helpful. We are not saying that standardized tests are invalid exit criteria for remedial programs. The point is that it is not necessary—and apparently much less effective—to devote the entire remedial effort toward passing standardized tests. This is even truer since so much more will be demanded of our students when they leave remedial programs.

It is important to note that a student may be a concrete operational thinker in many realms of activity, especially cognitive manipulations of unfamiliar subject matters, yet formally operational in others. In large part, Passaic County Community College students come from backgrounds rich in interaction, adversity, and complexity. They have already overcome many emotionally and intellectually trying situations that have demanded survival strategies of enormous mental adaptiveness. Yet these students are typically unable to transfer their nonacademic intellectual skills to academic work, and it is easy for educators to allow academic deficiencies to obscure cognitive efficiencies. It is clear that a carefully designed curriculum beginning at the level and in the areas where our students are "smart" can make a significant difference in terms of academic success, provided that the structure of this integrated curriculum makes use of every opportunity to enhance the transfer. When intellectual abilities in one area indeed transfer to other areas of cognitive life, students make rapid progress in the basic skills and content-area subjects, think more positively about themselves, and handle the intellectual demands of college life.

While the Cognitive Project is no longer funded by the Federal Government, the curriculum materials and the cognitive approach continue to be used extensively in the Academic Foundations program by both project faculty and new faculty because it has improved the quality of life in the classroom for both students and teachers. The students' enthusiasm seems to stem from the fact that they begin to understand what learning is all about. The faculty are enthusiastic about their ability to meet a basic student need more directly, since the curriculum attempts to respond to the students where they are in their thinking processes rather than to respond only to deficiencies demonstrated on standardized reading and writing tests. Follow-up interviews with basic skills students who participated in the Cognitive Project and the Comparison Groups and who went on to college-level work revealed that students tend not to use most of the specifics of basic skills courses, such recipes for better reading and writing as SQ3-R, proofreading lists, and outlining formulae. Teachers report, however, that students who participate in the Cognitive Project tend to be more open and willing to *hear* what their instructors are saying, to explore new concepts, to think for themselves and, in general, to know when they know and when they don't know, and above all, to ask.

The fact is that basic skills are—properly understood—not basic at all. Nothing is basic for an individual who doesn't already possess the competency. What we term basic is often at the upper reaches of our students' working intellects. Piaget often speaks of a sort of cognitive amnesia, a universal phenomenon whereby human beings are completely insensitive to previous structures of knowledge once they have moved on to higher levels of intellect. It seems to be a quality of human nature to consider all that we personally know and are familiar with to be "basic" knowledge. All of us, remedial student and professor alike, need to understand the nature of what we are in the process of learning. We believe that those who approach learning through understanding can not only acquire content but can gain ways of viewing knowledge and experience that will never leave them.

NOTES

[1] According to Piaget, human intelligence follows roughly four stages of development: (a) Sensorimotor (0-1½ years)—emphasis on coordination of actions; (b) Preoperational (2-6 years)—use of symbols in play,

language, and mental imagery; (c) Concrete-operational (6-11 years)—reversible mental operations and thought connected to the concrete; (d) Formal operations (11 or 12—adolescence)—ability to deal with the potential rather than only the concrete, and understanding of relations between relations. While a particular individual may not necessarily pass through all four stages, the order of progression is invariable because of the very organization of each stage; i.e., one could not skip a stage nor could one proceed through the stages in a different order.

[2] D. Kuhn, J. Langer, L. Kohlberg, and N. Haam, "The Development of Formal Operations in Logical and Moral Judgement," unpublished research paper, sponsored by Columbia University International Scientific Research Pool Grant, 1974.

[3] M. Schwebel, "Formal Operations in First Year College Students," *Journal of Developmental Psychology* 91 (1975): 133-141.

[4] Our analysis of the cognitive demands of four introductory- level college courses at Passaic County College (Psychology I, Management, Accounting I, Physiology) indicates that many of the classroom, assignment, and test demands of these courses could be handled by the dedicated concrete thinker with the skill and the will to memorize definitions, systems, classifications, etc. Much, however, calls for intellectual manipulations that are clearly formal in nature. We conclude that concrete-operational students would have difficulty, to say the least, in weaving their way toward a degree at the college by avoiding formal task demands or through heroic compensations, such as rote memorization of almost all course content.

[5] J.P. Guilford, *The Nature of Human Intelligence* (New York: McGraw-Hill, 1967).

[6] Benjamin S. Bloom, *Taxonomy of Educational Objectives: Cognitive and Affective Domains*, 2 vols. (New York: David McKay, 1956).

[7] M. Levine, *Theories in Cognitive Psychology: The Loyola Symposium.*, Ed. R.L. Solso. Hillside, NJ.: Lawrence Erlbaum Associates, 1974.

[8] An exercise earlier in the semester required students to record on a score sheet each time they heard a word that ended in "s" from a story that was read to them. The actual total is 44, yet students typically hear from as low as 12 to perhaps as high as 30. From this state of "disequilibrium," they explored potential causes for this discrepancy and established the importance of the "s" ending at least in terms of sheer frequency of use. Subject-verb agreement however, was not specifically explored at this time.

[9] For an excellent analysis of this facet of cognitive development see Jean Piaget, *The Grasp of Consciousness* (Cambridge, MA: Harvard University Press, 1976).

Both parts of the question should be dealt with—generation and verification of rules are equally vital processes, different in kind as well as difficulty. Rule making requires students to engage in exploring the nature of language conventions, regularities, and occasional contradictions. These inductive, hypothesis-generating processes are vital intellectual skills. Rule application, on the other hand, is a cognitively demanding, deductive process that is too often overlooked. Many students who can generate hypotheses find it very difficult to test them on the sample sentences. Because these thinking capabilities are important for effective functioning in college and elsewhere, instructors should allow students to engage in this testing activity fully rather than pointing out how student-generated rules do not fit the sample sentences.

The following "rules" have been taken directly from student papers to give the reader an idea of what to expect with this approach:

a. Verbs in the present tense end with "s" if the subject is singular with the exception of I and you.

b. When the subject is singular the verb ends in "s" when it's in the present, except for I and you.

c. When there is a singular noun or pronoun as the subject in a sentence in the present tense, you put an "s" on the end of the verb, except for I and you.

d. Plural subjects have verbs that don't end in "s" in the present tense. The singular subject I and you also have verbs that don't end in "s."

[10] Cognitive Abilities Test, *Examiner's Manual* (Boston: Houghton Mifflin, 1978) 51.

[11] For example, as was demonstrated in the student exploration section, the endings of present tense verbs are contingent upon ("caused" by) the number of the subject.

[12] Our experience indicates that even when a student constructs a rule, it does not guarantee that the rule will, or even can, be applied by the same student. We speculate that an operation central to Piagetian theory—operational reversibility—may not be completely integrated into many students' cognitive functioning, particularly in situations of an abstract, formal nature. Editing (rule verifying) is not a simple matter of reversing the process of rule making, or more precisely, such reversibility is not a simple matter.

[13] Sigmund Tobias, "When Do Instructional Methods Make a Difference?" *The Educational Researcher* (April 1982):5.