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ABSTRACT

The paper compares "standard" mathematics training with the normal human experience of "contextual learning." Contextual understanding permits children to learn various patterns of events and circumstances in their surroundings. The conclusion is that every child is a competent contextual learner, and functions very effectively learning language and stories even before they attend school. The vast majority of lessons in mathematics are not presented as a developmental, contextual flow of related information. Instead, the information is fragmented, disconnected, and presented in steps to be memorized. The benefits of contextual mathematics teaching methodology are explored such as: (1) the learning of mathematics is accelerated due to its inherent contextuality which enables children to experience acceleration in their learning of stories; and (2) rote learning and remediation time is virtually eliminated from mathematics education. Specific examples and comparisons to everyday situations are presented to support the concept of contextual learning in mathematics. Teachers are encouraged to engage learners in mathematical experiences in ways that enable students to use their existing cognitive structures to construct new understandings. (AIM)

Finding and Activating the Real Gift for Learning Mathematics: Implications for Teachers' Scope and Sequence

by

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Everard Barrett and Eleanor Armour-Thomas

What a magnificent creation is the human mind! Experts who study its functionings often express their astonishment at its awesome capacity and power as a computer. In fact, they claim that if our brightest scientists were to develop a computer approaching the capacity of the brain, it would occupy a four story building.

Now take a look at the beautiful, angelic face of your child. It seems incongruous that behind the cuteness of that face exists this computer. Most of us are so enthralled by the visual appeal of children, that we exist in an enchanted state of denial regarding their posession of this awesome power.

There are two magnificent achievements in learning which are accomplished by virtually all children before going to school: they learn the native language and they learn (and retain) stories. An examination of the way their computers functioned for the purpose of learning language and stories will reveal that programs were developed from the contextual linkages experienced within them. With respect to language, the meanings of words, sentences and phrases were discerned from the situations or contexts in which they were used. We all have the experience of learning the meaning of a word from the way it was used in a conversation or discussion. With respect to a story, if someone says the words "wolf," "woods," and "grandma," most people would automatically think of the story Little Red Riding Hood. These three words are links on a chain of dynamically related information. Clearly, the parts are used by our computers to access the whole.

A story structures its content in such a way that it is easily and comfortably assimilated by our mental computers. This structure presents the knowledge within the story as a developmental contextual flow of related information and the ease with which our computers assimilate it makes a statement about the efficiency of acquiring knowledge when it is presented as such a flow. The predominant way in which our computers functioned for our "guaranteed" learning of language and stories was by the activation of their capacities for contextual awareness and retention of information based on internal contextual linkages. Surely, this is our real gift for learning!

This perspective is well supported in the cognitive science literature that uses the concept of scheme to describe the relationship between knowledge structures and cognitive functioning. Schemes are described as modifiable, internal representations of generic concepts stored in memory. According to Rumelhart (1980), schemes exist as prototypes of frequently stored situations that are used to understand and interpret instances of related situations. Case (1974) distinguished three elementary types of schemes: figurative, operative and executive and defined them as follows:

> "...figurative schemes are internal representations of items of information with which a subject is familiar, or perceptual configurations which he can recognize." (pg. 545)
>
> "...operative schemes are internal representations of functions (rules) which can be applied to one set of figurative schemes in order to generate a new set." (pg. 545)
>
> "...executive schemes are internal representations of procedures which can be applied in the face of particular problem situations in an attempt to reach particular objectives." (pg. 546)

Have you noticed how intensely contextual is our existence? We are always functioning within some context. We even dream contextually. What do you mean when you say, "I know," "I understand," or "This makes sense"? You have probably experienced seeing a face, and your computer noting its familiarity, but nevertheless you ask, "Who is that?" How does your computer function so that it might "know" the person? Do you recall how it grappled with the problem of finding at least one link (or association) to that face? Do you remember how just one link could trigger off a host of recollections? This enabled you to place that face in a context of related information which would permit you to declare with confidence, "Now I know who she is!" For example, the face may eventually be associated with a particular high school and a certain incident, and these, in turn, precipitate a flood of contextual memories. This is what it means to know; to understand; to make sense (Barrett, 1992). We know contextually. We understand contextually. We make sense contextually. We think contextually.

Contextual understanding of our various environments permit us to influence things that happen in our homes, communities and various institutions. It is the very foundation of our self-esteem. Even a baby, by the age of six months, will have learned to influence the appearance of its mother and all her attendant comforts, by simply crying. There is a contextual linkage between crying and Mom's appearance. That child has influence (and knows it). Contextual understandings also permit us to learn various patterns of events and circumstances in our surroundings. An environment may consequently be perceived as safe or unsafe. By these means, we make our adaptations to life and its many environments. We cannot function in human society without our gift of contextual awareness and retention of information based upon it. We are intensely contextual beings.

The conclusion is inescapable: every child (with the exception of very few who are brain-damaged) is a competent contextual learner, and functioned very effectively in learning language and stories, among other things, before going to school (Barrett, 1992).

Why is it then, that such an enormous number of children are merely mediocre or failing in mathematics as they attend schools across the length and breadth of this nation? We do not have to look far for the answer. You may take some time to reflect on your experience as a student in mathematics from grades one to six. You may also examine the scope and sequence being used in schools for those grades. Your reflections and examinations should remind you of those fragmented, disconnected and meaningless things ("steps") that we were required to memorize and practice. The vast majority of our lessons in mathematics were certainly not experienced as a developmental, contextual flow of related information!

The most of us received a subtle (sometimes very explicit) message in school: only a very privileged few among us were gifted with an aptitude for mathematics. You were called a "math wiz" if you were fortunate enough to be born with it. Those less fortunate would gaze upon these "geniuses" with awe and wonder. As their self-esteem gradually declined toward absolute emaciation, that of the genius would sometimes swell beyond all reasonable proportions. A common misconception among educators is that high achievement in mathematics requires a special aptitude. It does not! The aptitude for learning mathematics is the same gift which we used so powerfully for learning language and stories, before going to school. Some members of the mathematics education establishment appear not to have understood that if mathematical knowledge is presented to learners as a developmental, contextual flow (like a story), the efficiency of its learning and retention will be similar to that of the learning of a story. Since mathematics, above all academic disciplines, is the one most concerned with dynamics of relationships, with contextual, hierarchical, development, this perspective should make a lot of sense to mathematicians and mathematics educators.

Indeed, since the formulation of professional standards for teaching mathematics by the National Council of Teachers of Mathematics (NCTM), the mathematics community of educators, policy makers and researchers has given increased attention to mathematics learning and teaching consistent with these ideas.

A theory that seems to be a powerful catalyst for contextual learning and teaching in mathematics is that of constructivism (Confrey, 1983, 1985; von Glaserfeld, 1974, 1983). The theory holds that all knowledge is acquired through experience, but the character and quality of our experiences are influenced by the cognitive lenses through which we make sense of the world. Although there are differences in the way researchers from various disciplines view the construct, there are some general issues around which they all agree:

1. that knowledge is constructed through a process of reflective abstraction. To engage meaningfully in any mathematical activity (e.g. computing, problem solving), we must reflect on that activity, learning to manipulate it in our minds and to represent it in images or symbols;
2. the process of construction involves the activation of cognitive structures or schemes; and

3. cognitive structures are under continual development. Relatively new and familiar experiences press the individual to adapt. If the activity is purposive, it induces transformation of existing cognitive structures.

The first author of this article was amazed when, many years ago, he first became aware, through intensive observations of himself as he learned and did things (including mathematics), that contextual awareness was such a predominant mental functioning for learning. Subsequent to this amazement was the shock of realizing how utterly disconnected and fragmented were teachers' presentations of mathematics as they habitually followed traditional scopes and sequences. To fill this monstrous gap in mathematics education, the first author has restructured the presentation of arithmetic by transforming that huge mass of fragmented, disconnected and meaningless phrases, bits of information, and steps into a coherent, developmental flow of meaningful ideas, concepts, and processes (Barrett, 1993). It is known as the "Contextual Mathematics Teaching Methodology."

Twenty-three years of the first author's intensive inservice staff development of teachers in many school systems, across the nation, have yielded consistently strong results. This claim is substantiated by many statistical analyses (see Appendix). Many times over the past twenty years, the projects have produced outcomes beyond the performance benchmarks which would qualify as world class standards of achievement. The following are some examples:

1. First graders master split-second responses to addition/subtraction facts through rapid mental processes and know place value up to the hundreds of trillions;

2. Second graders master multiplication facts and long division (as well as associated problem solving) and are able to meaningfully articulate their way through every "step" of the algorithm;
3. Fourth graders master the entire content of arithmetic (as well as the associated problem solving), with full comprehension of the concepts involved, and the ability to meaningfully communicate their understandings of every step in every algorithm;
4. Whole classes of fifth and sixth graders master the entire algebra curriculum traditionally reserved for the brightest ninth graders and pass, "with flying colors," the state-wide exam in Algebra I;
5. Sixth graders master 80% of the trigonometry curriculum; and
6. Every grade, within all the elementary schools of an entire county located in northeastern United States, uses a textbook at least one year ahead of itself (this school system is currently completing its fourth year of the methodology).

In many instances, the achievers referred to above were from low socioeconomic backgrounds. The fifth and sixth graders were all from very disadvantaged areas of New York. The program is "tried and proven."

Repeatedly, the first author's projects have been moved through the cycle of implementation, teachers' feedback, evaluation and revision. He has constantly relied on teacher feedback to rethink and alter his methodology and staff development strategies. Hence the pedagogy has been the outcome of intense and sustained "hands-on" staff development within classrooms (which span the socioeconomic spectrum) over a long period of time. By means of these efforts, the gap between pedagogy, as theory, and practical classroom application has been closed. The fusion of content and pedagogy has been accomplished (Barrett, 1994). In fact, mathematical content is literally driven by this pedagogy in the same way that the content of a story is driven by its contextual, developmental structure.

Contextual Mathematics Teaching Methodology delivers an enormous amount of time for problem solving due to the following reasons (Barrett, 1992):

1. The learning of mathematics is tremendously accelerated (it is the inherent contextuality which enables children to experience acceleration in their learning of stories);
2. Rote learning and, consequently, remediation time is virtually eliminated from mathematics education.

The first author recalls an occasion when, as a youngster, he had memorized the addition facts one evening for a test the next day. During the test, he looked at the example 9+7 and the answer did not come immediately. The youngster paused and, with furrowed brow, he waited for the answer to "flash" like a bolt of lightening into his mind. In spite of the deep furrowing of his brow, he was not thinking (there were simply no thoughts). He was only waiting. It soon dawned on him that the answer was not forthcoming and, in a fit of anxiety, he thrust his fingers beneath the desk to begin the habitual counting activity in his last, desperate reach for the answer. He had hardly begun to count, when he sensed the presence of the teacher glaring down at him. His fingers froze. He was caught in the act. His frantic guess at the answer was incorrect.

How does it make sense that such enormously powerful computers as those we call our brains become so utterly discombobulated with such a simple problem? The answer is that the youngster's mental computer was not programmed. It could have been programmed as follows: The larger number nine (9) says to the other number seven (7), "Give me one," with the understanding that nine (9) becomes "teen" (a very useful nickname for ten) and seven (7) becomes six (6); hence the answer, "Sixteen." Similarly, the answer to 8+6 could be determined by means of the following program: The larger number eight (8) says to six (6), "Give me two."

In anticipation that some readers of this article may say that even rote memorization is a program, let us compare the effort on the brain required by the two programs. There are thirty-six (36) of these "higher" addition facts. The memorization of thirty-six facts is certainly more difficult than the awareness of building ten from nine, by means of "Give me one"; ten from eight, by means of "Give me two"; ten from seven, by means of "Give me three"; and ten from six, by means of "Give me four." There is a distinct difference between the way our mental computer functions when it is simply trying to remember the facts of arithmetic or its rote-mechanical steps for doing long division, for example, and when it is processing a program to achieve the same results. In the first instance, there are no thoughts. We are simply waiting for the desired information to "drop" into our minds. In the second instance, there are meaningful thoughts. Our "inner voice" actually articulates the process.

Consider, for a moment, how a detective functions as he grapples with the solution of a crime. He gathers clues and talks to witnesses. His mental computer is fervently engaged with making contextual linkages (some of which are very subtle) among the bits of information he has gathered. Eventually, his computer may construct a whole contextual flow, within which all the pieces fit. He exclaims, with great excitement, "I've got it!" and he is able to describe the commission of the crime almost as if he saw it with his own eyes. Now suppose the witnesses either made untrue or meaningless statements, what might this imply regarding the detective's efforts?

Experience informs us that such statements can actually prevent the mental computer from making the contextual linkages which represent the solution to the crime.

"Truth-telling" in the teaching of mathematics (Barrett, 1992) is similarly vital to the mental computer's efforts in the construction of mathematical contextual linkages and flow. In fact, untrue and meaningless statements deactivate the gift for learning in children. Can we take it for granted that false and meaningless statements are never made in classrooms across this nation? The fact is that the overwhelming majority of statements made by teachers when presenting the various algorithms of arithmetic (involving whole numbers, fractions and decimals) are either false or meaningless. Let us take a look at the traditional teaching of long division, for example. Consider the problem below:

$$31\overline{)26,357}$$

The first statement our teachers taught us to make was "thirty-one can't go into two." This statement is untrue for two reasons. In the first place, there is no two in 26,357. What was called "two" is really 20,000. Secondly, there are a lot of 31's that can "go into" 20,000.

The next statement we were taught to make was "thirty-one can't go into twenty-six." This is also untrue because what was called "twenty-six" is really 26,000 and there are a lot of 31's that can "go into" 26,000.

Next, we were taught to say "thirty-one can go into two hundred sixty-three." That is not 263, it is 26,300. At this point, we were taught to say, "Three into twenty-six is eight." The truth is "thirty into twenty-six thousand is approximately eight hundred."

We then were taught to multiply 31 by 8 and subtract the answer (248) from 263 (15 is left). The truth is that we are multiplying 31 by 800 and subtracting the answer (24,800) from 26,357 (1,557 is left). What we have really done so far is to take 800 thirty-ones away from 26,357.

Following this, we were taught to "bring down" the 5, place it next to the 15 (making it 155) and say, "Three into fifteen is five." The truth is that the 5 brought down is really 50, the 15 is really 1,500 and the 155 is really 1,550. Besides, we should say, "Thirty into one thousand five hundred is fifty." Please note that "bring down" is a meaningless statement. Did your teacher ever explain it to you?

We then were taught to multiply 31 by 5 and subtract the answer (155) from 155 (0 is left). The truth is that we are multiplying 31 by 50 and subtracting the answer (1,550) from 1,557 (7 is left). What we have done is take 50 thirty-ones away from 1,557 and, altogether, we have now taken 850 thirty-ones away from 26,357.

Finally, we were taught to "bring down" the 7 and note that 31 cannot go into 7. The truth is that we cannot take any more 31's out of 7. In a problem such as this one, children sometimes think the answer is 85. But when the truth is told, they understand that they have taken away 850 thirty-ones from 26,357 (using two subtractions) and have a remainder of 7.

When taught in this manner, long division will make perfect sense to second graders (as accomplished on numerous occasions in the first author's track record). Under traditional circumstances, the absence of truth makes the meaning of long division so inaccessible to youngsters' mental computers, that they are either forced to "abandon reason" in order to cope with the rote-mechanical "remember-the-steps" approach, or they will have no access to the "answer."

The first author recalls his own struggle with long division as a youngster. He was utterly frustrated in his zealous attempts to understand it. In spite of the teacher's false and meaningless statements, his demeanor conveyed to the bewildered youngster that he ought to be understanding. He would even ask, "Don't you understand?" One day, the youngster became so angry, in response to his predicament, that he said to a friend, "Stop trying to understand that stuff. Just do what he says!" Following this decision, the youngster quickly found himself getting the right answers to long division. He did not understand what he was doing, but he was getting them right. His math scores increased. He was rewarded with higher grades in spite of his decision to stop seeking understanding and simply follow the "steps"! What a colossal contradiction to the mission of an educational institution! But what did that frustrated youngster really mean when he said, "Stop trying to understand?" It was as if his ego was alienating his intelligence as follows (Barrett, 1992):

> "You know, Intelligence, you are the part of my mind that always wants to understand and make sense of things. In fact, when you figure things out, people tell me I am smart and I feel intelligent. That's a great feeling. But as far as this long division is concerned, you're making me look bad. My teacher keeps asking me, 'Do you understand?' I have waited a long time for you to figure it out, but you just can't do it. I have come to the conclusion that I can't use you to learn math anymore. You are just not user-friendly."

Have you ever had the experience of teaching mathematics to a student who, at some point during your explanations, said to you, "Don't explain, just show me the steps."? Do you remember saying these words yourself? "Don't explain" means that these students have made the decision never to involve their intelligence, which is the required functioning of their mental computers for grasping the explanation.

No child should ever have to make such a horrible decision. The denial of intelligence (which is our means of accessing contextual linkage and flow), by competent contextual learners, causes psychological damage which may symptomize itself as physical or mental illness, extreme anxiety, and fearing or hating mathematics. To "teach" mathematics by means of untrue and meaningless statements is a nuisance to children. It deactivates their intelligence (Barrett, 1992).

A pedagogy consistent with constructivism by necessity must reject the notion of the teacher as a disseminator of information and the learner as a passive receiver of that information. In contrast, the teacher must engage learners in mathematical experiences in ways that enable them to use their existing cognitive structures to construct new understandings. Teachers' awareness of truth in long division, for example, enables them to develop the critical thinking tasks, activities and problems which permit young learners to create the desired algorithm and also to model it (Barrett, 1994). It is impossible to similarly model the untrue and meaningless statements currently being made by the vast majority of teachers. How, for example, could we model the statement "thirty-one can't go into two" in the long division example discussed previously in this article? How could we model "bring down"? Similarly untrue and meaningless statements with respect to other operations on whole numbers, fractions and decimals also make it impossible for learners' mental computers to create meaningful algorithms and model them.

Finding and activating the real gift for learning mathematics in virtually all children has profound implications for curriculum and staff development in mathematics education. The success of the first author's interventions, over the past twenty-three years (with the vast majority of participating teachers), has been based on a teacher workshop/classroom demonstration model (approximately six teacher workshops and eight to fourteen classroom demonstration lessons evenly distributed throughout the school year) by means of which they enthusiastically accept and implement the first author's "no-gap" restructuring of arithmetic as the secure foundation into which he anchors the various branches of the elementary mathematics program. This enables teachers and their pupils, for the first time, to experience mathematical content as an **internal** contextual, developmental and integrated flow. Teachers using this methodology understand that arithmetic, as restructured for consistent internal contextual development (described in Mathematics Power Learning for Children: Activating the Contextual Learner, Books I, II and III, Barrett, 1993), is not merely one of the branches of the mathematics curriculum: **it is the trunk from which the branches grow** (Barrett, 1995). Without a proper contextual development of "number sense," numeration and the basic operations as a necessary foundation, children cannot make significant progress in the various branches.

This common sense view of the content of the mathematics program for elementary schools is the basis of a new, realistic and potent scope and sequence in various stages of development within school systems using the first author's methodology. The restructuring of arithmetic is the flow to which is attached, at various points, topics, applications, games, tasks, projects and critical thinking/problem solving from the various branches. An attachment is made at a point in the flow where all its arithmetical prerequisites have been experienced (Barrett, 1995). Hence, this scope and sequence **guarantees** that children have mastery of prerequisite skills and concepts necessary for effective participation in the various activities. It virtually eliminates remediation from children's experience, thereby releasing an enormous amount of time for their conceptual development, critical thinking activities and otherwise meeting NCTM standards.

The authors believe that the "missing-link" which will deliver widespread application of NCTM standards is the contextual, no-gap, truth-telling restructuring of arithmetic. A scope and sequence which anchors the significant contributions of NCTM into the restructured arithmetic will make solid contributions toward the achievement of world class standards in this nation. No single program is the panacea for mathematics education; but there is a panacea in a properly anchored mix!

There ought to be no more surprise about fourth graders mastering all of arithmetic and fifth graders mastering Algebra I, than there is about three year old children learning their native language and five year old children learning and retaining stories. In both instances, their mental computers are using the ability to learn a body of knowledge through awareness of its internal, contextual relationships. We should, instead, be shocked that so many millions of people, for so many years, have suffered the condemnation of failing mathematics.

Some readers of this article are quite convinced that they dislike (even hate) mathematics. The authors are equally convinced that the object of their disfavor is not mathematics, but the imposter which bears its name: the meaningless, noncontextual, rote-mechanical, show-me-the-steps activity which requires an enormous amount of memorization. The real flavor of mathematics is experienced when students receive it as an internal contextual flow. Then the learning of mathematics is as certain, enjoyable, accelerated and retainable as the learning of a story (Barrett, 1991).

If this article communicates to teachers, administrators and policy makers that virtually all children have the aptitude for learning mathematics, it has served its purpose well. As to whether this aptitude actualizes into mathematical achievement or not, depends on whether teachers and parents know how to activate the real gift for learning within their children.

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PROFESSOR B CONTEXTUAL MATHEMATICS EDUCATION
ASSESSMENTS FROM 1976 THROUGH 1990

PROFESSOR B CONTEXTUAL MATHEMATICS EDUCATION ASSESSMENTS FROM 1976 THROUGH 1990

1976-1978

In 1976, thirty-four out of fifty-one fifth, sixth and seventh graders whose mathematics scores had been previously low, passed a New York State Board of Regents Mathematics test intended for ninth graders. This experience took place in Roosevelt, New York at the Roosevelt Elementary School.

In 1977, Hempstead, New York third graders scored an average of 4.3 on the Metropolitan Achievement Test. In Cold Spring Harbor, New York, fourth graders scored 6.2 on the California Achievement Test. Roosevelt, New York second graders scored 4.6 on the Iowa Test of Basic skills; Glen Cove, New York third graders scored an average of 4.5 on the California Achievement Test and 33 out of 54 first graders "topped" the California Achievement Test by achieving the maximum score.

During the 1977-78 school year, the Barrett Method of Mathematical Instruction was offered in the Glen Cove, Hempstead, and Mount Vernon, New York school districts; grades one through three. The children were pre- and post-tested using either the California Test of Basic Skills or the Metropolitan Achievement Test. Tables 1-4 represent the results of Barrett's instructional strategies.

GLEN COVE
TABLE 1
GRADE EQUIVALENT AVERAGES FOR THE ENTIRE LANDING SCHOOL
GRADES 1-3

GRADE	N	(1) PRETEST G. E. MEAN	(2) POSTTEST G.E. MEAN	(3) AVERAGE GAIN (IN MONTHS)	(4) AVERAGE GAIN (IN MONTHS) PERMONTH
1	54	*	2.4	*	*
2	54	2.0	3.3	13	1.6
3	53	3.3	4.5	13 (rounded)	1.6

* No pretest was administered to the first grade.

This table presents data obtained from the Landing School in Glen Cove. Column 3 refers to the average gain (in months) for participating students in that school during the eight month interval between administrations of the California Achievement Test. Column 4 presents the average gain (in months) for each month of instruction. At grades two and three, this was a 1.6 month increase for each month of instruction.

Since no pretest was administered to the first grade, a base level was not obtained. The 2.4 grade equivalent average of the post-test is an underestimate, since many of the students scored at the uppermost point on that test.

It is important to note that the achievement test used does not assess knowledge of the advanced concepts which students of the Barrett approach had mastered.

GLEN COVE
TABLE 2
PERCENTILE AVERAGES FOR THE ENTIRE LANDING SCHOOL GRADES 1-3

GRADE	N	PRETEST PERCENTILE MEAN	POSTTEST PERCENTILE MEAN	GAIN
1	54	*	78	*
2	54	48	73	25
3	53	60	71	11

* No pretest was administered to the first grade.

As can be seen by reviewing the percentile scores on this table, the average student in each of grades 1, 2 and 3 scored higher than 78, 73 and 71 percent of students in a representative national sample on the post-test.

HEMPSTEAD
TABLE 3
GRADE EQUIVALENT AVERAGES

GRADE	N	(1) PRETEST G. E. MEAN	(2) POSTTEST G.E. MEAN	(3) AVERAGE GAIN (IN MONTHS)	(4) AVERAGE GAIN (IN MONTHS) PER MONTH
2	96	2.2	3.3	11	1.6
3	96	2.8	4.3	15	2.2

This table presents data obtained in the Hempstead Public School District. Pretest and post-test data, as well as the average gain in scores over the seven month interval between administrations of the Metropolitan Achievement Test (column 3), are listed.

In order to place these gains in a standard perspective, column 4 is the average gain per month. By reviewing this column, it is clearly seen that second and third graders gained an average of 1.6 and 2.2 months, respectively for each of the seven months of instruction.

MOUNT VERNON
TABLE 4
GRADE EQUIVALENT AVERAGES FOR THE WASHINGTON SCHOOL
GRADES 1-3

GRADE	N	PRETEST G.E. MEAN	POSTTEST G.E. MEAN	AVERAGE GAIN (IN MONTHS)
1	102	1.1**	2.4	13
2	74	1.4	3.3	19
3	70	2.2	4.3	21

(contd.)

GRADE	AVERAGE GAIN (IN MONTHS) PER MONTH	AVERAGE PRETEST PERCENTILE	AVERAGE POSTTEST PERCENTILE
1	1.9	*	*
2	2.7	*	*
3	3.0	20	65

Table 4 represents the scores of students who took both the pretest and post-test in the Washington school. The gains were very large at all levels, ranging from an average rate of "growth" of 1.9 months for each of the seven months of instruction between administrations of the achievement test at the first grade level to 2.7 months at the second grade and 3.0 at the third grade level.

At the third grade level, the average student scored at the 20th percentile in October 1977. In May 1978, the average third grader (these are the same students) scored at the 65th percentile.

It was possible to obtain pretest and post-test scores of students who were third graders in the Washington school during the 1976-77 year. These students averaged at the 2.6 grade level on the pretest and 3.8 on the post-test. The interval between pre- and post-tesing for this group was 10 months, as opposed to seven months for the Barrett-trained students. Using an analysis of covariance (to take differences in pretest scores into account), it was found that the gains in the Barrett group were significantly higher than those of the previous year's third grade group. This, despite the fact that the Barrett students received three months less time of instruction.

While these data do not reflect the results of a controlled study, it is clear that they are consistently positive across all levels studied. The magnitude of these gains are certain to generate interest amongst professional educators.

* These data not available at the time this table was developed.

** These were 29 students who scored below the lowest level of this test. These students' scores were counted as if they scored at the 1.0 grade level. This inflated the pretest scores to the level noted and caused the "gain" columns to reflect underestimates of the actual development of students in the first grade.

1978-1979

SUMMARY OF FINDINGS OF STANDARD MEASURES OF MATHEMATICS ACHIEVEMENT IN THE COLD SPRING HARBOR AND NEW YORK CITY PUBLIC SCHOOLS

During the 1978-1979 school year, Cold Spring Harbor students in grades three, four and five gained averages of 2.0, 1.3 and 1.9 months in total math respectively for each month of instruction. The test used was the California Test of Basic Skills.

The average student in grades two through five scored higher that 85% of his/her peers in total math when compared with a representative national sample. Care must be taken not to view Cold Spring Harbor as exceeding 85% of public school districts in total math. In fact, that figure would be substantially more than 85%.

Despite declining math scores nationally, this year's third, fourth and fifth graders scored an average of a half year, nine months and one full year higher (respectively) on total math than did traditionally taught Cold Spring Harbor students in those same grades three and four years earlier (those years were averaged together for the purpose of this summary).

At all grade levels (three through five), substantially more students scored above the 90th percentile nationally than did traditionally taught Cold Spring Harbor students in 1975.

1979-1980

In February of the 1979-1980 school year, the Barrett method was introduced to teachers within Community School District Number 3, of the New York City Public School System. Professor Barrett trained teachers of kindergarten and first graders within three schools. He also supplemented the training by having teachers observe demonstration lessons with their own classes. The schools involved were Public Schools 113, 165, and 191. Control and experimental classes were formed within each grade.

The training process developed during three months was totally mental. Children did not write anything. The final test administered represented essentially the first time children were asked to translate math concepts into writing.

In the kindergarten classes, students were able to count to 100, add or subtract, mentally, any combination of numbers up to 10 and were able to add, with carrying, combinations up to 20.

The first graders were able to do these aforementioned items, plus recite, with understanding, the 2, 3, and 4 times tables. They were able to add or subtract multi-digit numbers. This process also included carrying.

The gap between the Barrett trained experimental kindergarten and the control kindergarten was significant. In each of the experimental classes the greatest concentration of students scored in the 90+ range. In the control classes, the greatest concentration of students scored in the 0-49 range.

First graders did significantly well. In a P.S. 191 experimental class, for example, eight students scored over 95% while in the control class, a second grade class in the same school, only five students scored over 95%. At P.S. 113, 10 students in the experimental (first grade) class scored over 91% as compared to only ix students who scored over 91% within the third grade control class.

1980-1981

The Barrett Method of Mathematics Instruction was implemented in four Boston City Public Schools during the 1980-1981 school year. The four schools were: Hennigan, Hale, Guild and McKay. Kindergarten and grade one teachers were provided with instructions by Barrett in their classrooms as well as in after school workshops. One second grade teacher also participated in the program, but unofficially.

Evaluating the results of a mathematics program in kindergarten and first grade was very difficult in light of the limited scope of standard tests at these levels. These tests are, at best, insensitive to many of the skills children of this age range are capable of learning, but are not traditionally taught. It was decided to use non-standard tests to measure the acquisition of specific skills, many of which are not ordinarily expected of kindergarten and first graders.

TABLE 5
MEANS AND STANDARD DEVIATIONS OF FIRST GRADE SCORES ON BOTH TESTS

TEST	N	MEAN	STANDARD DEVIATION
TEST 1	88	19.2	4.98
TEST 2	65	20.7	5.56

First graders averaged 19.2 items correct on the first non-standardized test and 20.7 on the second (Table 5).

1982-1984

In 1984, thirty-four at-risk fifth graders in Bedford-Stuyvesant, Brooklyn, New York took the New York State Ninth Year Algebra Regents Examination. Sixty-three percent passed with six pupils scoring 90% or above.

The percentages below reflect children's growth in mathematics as measured by the New York City Mathematics Test administered in grades 2 through 6 during April 1983.

The relatively high 1982 scores in P.S. 44 were the result of previous exposure to Barrett methodology.

P.S. 44 (District 13)

Grade	1982	1983
2	53%	66%
3	77%	92%
4	58%	75%
5	56%	81%
6	54%	62%

P.S. 207 (District 3)

2	11%	38%
3	18%	30%

P.S. 144 (District 3)

2	14%	52%
3	32%	69%

1984-1985

The results of the implementation of the Barrett method of Mathematics Instruction within two New York City Public School Districts.

COMMUNITY SCHOOL DISTRICT #5
MANHATTAN, NEW YORK

Background

Professor Barrett conducted a project in District #5 during the school year 1984-1985. Schools involved were P.S. 30/31, P.S. 154 and P.S. 133.

Results

The overall increases in grade equivalence for the eight grade four classes involved averaged out at 1.7.

The greatest increase was in the two "Gates" classes with 3.23 and 2.39 for 7G1 and 7G2 respectively. The comparative city-wide increase for Gates classes was 1.1 for grade four and 1.3 for grade seven in the 1982 - 1983 school year.

Considering that three of the five grade seven classes were at 2.5 or more grades below grade six in 1982-1983, the rise to "within grade equivalence" in 1983-1984 is a marked increase (Class 7G1 is at 6.55 grade level from 3.32 and 7G2 is at 5.20 grade level from 2.81).

COMMUNITY SCHOOL DISTRICT #13
BROOKLYN, NEW YORK

Eighty percent of the pupils at P.S. 44 were on grade level after taking the 1984 New York City Standardized Test in Mathematics. Math scores of this school (consisting of approximately 90% high-risk students) outdistanced students at P.S. 8, Brooklyn, which is located within a high middle income area. A fifth grade class of thirty-four students at P.S. 44 took the New York State Ninth Year Algebra Regents Examination and achieved a passing rate of 63%. Forty percent of the sixth grade students achieved high school level in mathematics.

1989-1990

REPORT OF THE RESULTS OF THE BARRETT METHOD OF MATHEMATICAL INSTRUCTION WITHIN THE ATLANTA, GEORGIA PUBLIC SCHOOLS

During the 1989-1990 school year, the Barrett Math program was piloted in selected sections of grades kindergarten through seven in five Atlanta Public elementary schools: Campbell, Carter, Hope, Slater and Pitts.

Teachers received initial and follow-up training in the Barrett Math method of instruction. Implementation of instruction was monitored by local school administrators, a staff development coordinator, as well as Professor Barrett.

At the end of the school year, experimental student gain in mean normal curve equivalent (NCE) points was compared with the gain in NCE points for control students. Comparisons were made in three mathematics sub-tests: computation, concepts and problem solving, as well as a culminating math exam.

Results indicated that the experimental students outperformed the control students in total mathematics and in all of the mathematics subtests. These differences were highly significant. The performance of the experimental students was also significantly greater than the performance of the control student in mathematical problem solving.

A review of individual school performance, revealed that there was a wide range of average student performance within the five schools. However, the average NCE gains for program students at Campbell Elementary School was greater in total mathematics and in all mathematics subtests than were gains by program students at the other four schools.

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Association for Supervision and Curriculum Development's 51st Annual Conference and Exhibit "DANCING TO THE RHYTHM OF LIFE: AN INVITATION TO BECOMING" (New Orleans, Mar. 16-19, 1996).

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July, 1, 1996

Dear Colleague:

I am writing at this time to bring you up-to-date on our recent activities and publications. I also want to take this opportunity to invite you to submit to ERIC/EECE any recent conference or other papers related to elementary and early childhood education. In particular, I invite you to submit your presentation at the **Association for Supervision and Curriculum Development's 51st Annual Conference and Exhibit Show "DANCING TO THE RHYTHM OF LIFE: AN INVITATION TO BECOMING"** held in New Orleans on March 16-19, 1996, for possible inclusion in the ERIC database. Your paper is eligible to be considered for inclusion, **IF:**

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Sincerely,

Lilian G. Katz

Lilian G. Katz
Director

Enclosures