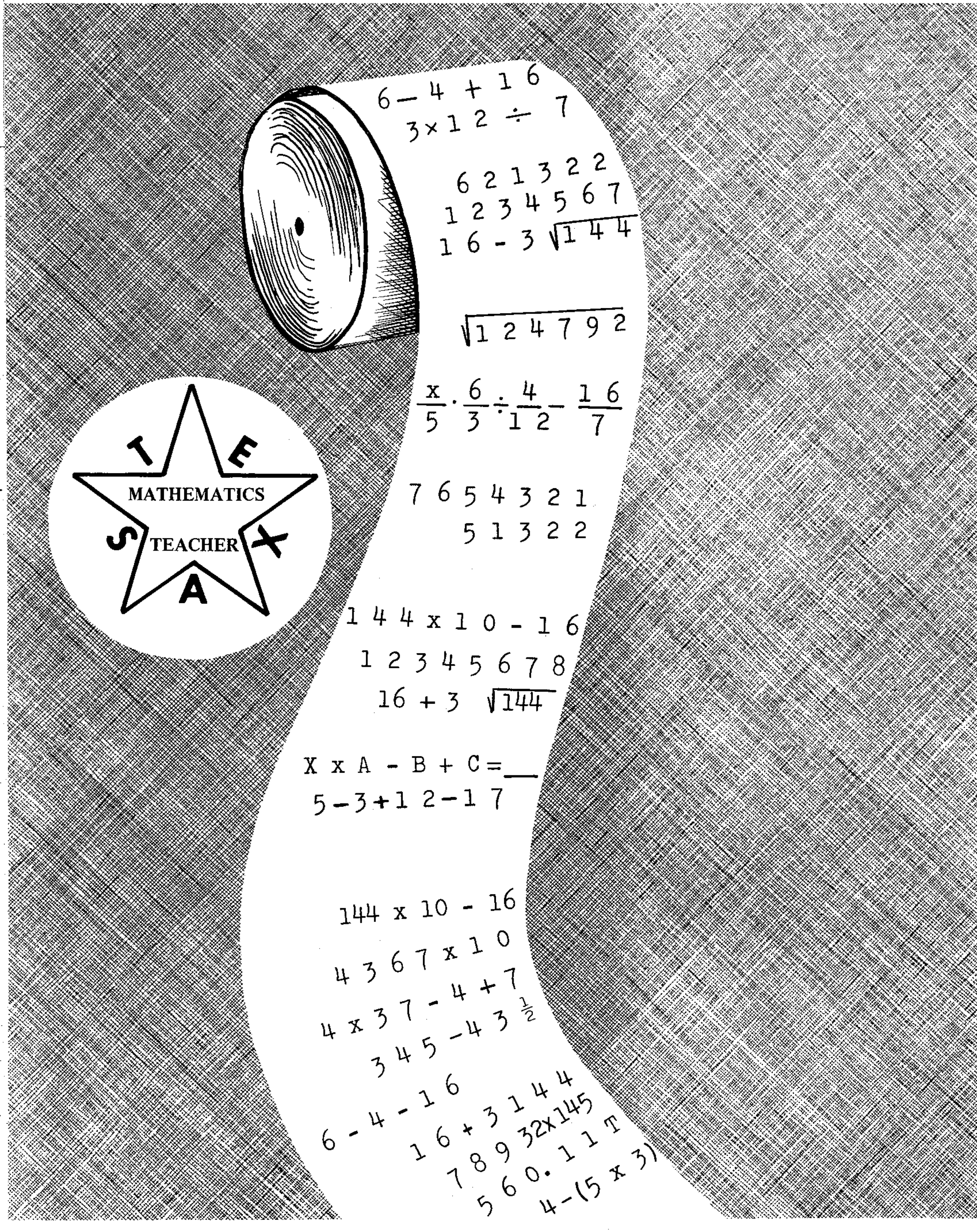
T E X A S
MATHEMATICS
TEACHER
6 − 4 + 1 6
3 × 1 2 ÷ 7
6 2 1 3 2 2
1 2 3 4 5 6 7
1 6 - 3 √1 4 4
√1 2 4 7 9 2
x/5 · 6/3 ÷ 4/12 − 16/7
7 6 5 4 3 2 1
5 1 3 2 2
1 4 4 x 1 0 - 1 6
1 2 3 4 5 6 7 8
16 + 3 √144
X x A - B + C = ___
5 − 3 + 1 2 − 1 7
144 x 10 - 16
4 3 6 7 x 1 0
4 x 3 7 - 4 + 7
3 4 5 − 4 3 ½
6 - 4 - 1 6
1 6 + 3 1 4 4
7 8 9 32x145
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4−(5 x 3)

TEXAS MATHEMATICS TEACHER is the official journal of the Texas Council of Teachers of Mathematics. The views expressed are the contributor's own and are not necessarily those of the publisher or the editor. All manuscripts and correspondence about this publication should be addressed to Mr. J. William Brown, *Texas Mathematics Teacher,* 100 So. Glasgow Drive, Dallas, Texas 75214.

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TEXAS MATHEMATICS TEACHER

Texas Council of Teachers of Mathematics

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PRESIDENT'S MESSAGE

Dear TCTM Members,

Welcome to another year with TCTM! I hope all of you had a safe and pleasant summer and have started the new school year with enthusiasm and high expectations. Sometimes ti's difficult to remain optimistic and cheerful – especially since some committees and groups have made teachers the scapegoat of all the problems facing education today. All sectors of society must work together to define the problem areas and to find acceptable solutions. TCTM offers you, as an individual teacher, an avenue of communication. We will be refining our position and concern in the area of mathematics education and will forward these statements to the appropriate state and national committees. You are urged to join us in this effort. Contact your regional director with your suggestions.

TCTM takes great delight in honoring one of our own. Paul Foerster, Mathematics teacher at Alamo Heights High School in San Antonio, was recently awarded the 1983 Presidential Award for Excellence in Teaching of Science and Mathematics. He will travel to Washington, D.C. in October to be recognized by President Reagan. TCTM was one of the NCTM affiliates recommending Paul for this honor. Congratulations Paul!

Plan now to attend the Fourth Annual Fundamental of Mathematics Conference at UTSA in San Antonio. The Conference hours will be 9 – 5 on Friday, December 9th and 8 – 1 on Saturday, December 10th. More information can be found in this issue of the journal.

I hope each of you have a successful school year.

Sincerely,

Betty Travis

CAMT

PALMER AUDITORIUM

AUSTIN, TEXAS

OCTOBER 11-13, 1984

SI METRICS – HERE YESTERDAY, GONE TODAY?

Nina L. Ronshausen
Texas Tech University

The mid– to late-seventies was the time of the metrication bandwagon. Educators were charged with the principal responsibility for converting the public as well as school children to the new SI metrics. We don't hear much about metrics anymore. Has the "metric issue" gone away?

Going . . . Going . . .

The position of the anti-metrication group could be summed up as, "How could so many be so wrong while we are right?" [1]. Or, as Erma Bombeck put it, "Americans just don't cotton to anything foreign unless they can eat it with bear . . . " [2].

Our ambassador to Canada, Paul H. Robinson, Jr., is quoted as telling the Canadians that U.S. metric conversion is "rubbish" and opposed by most U.S. citizens; further, Canadian insistence on metric conversion could create trade problems between the U.S. and Canada [3]. (About 60% of Canadian exports come to the U.S. and around 50% of them are in metric units.)

Citizens in high places aren't the only ones to express their opposition publicly. In san Diego, at the 16th Open Mike session of the U.S. Metric Board, metric conversion was described as un-American and the direct cause of the inconvenience and soil associated with self-service pumping of gasoline. From Maryland: "After September '82 This Goofy Metric will Be A Dead Issue. Just As Dead As a Stinking Mackrel FISH. Our Pounds-Miles Etc Have kept us In Good Stead For Past Couple Hunderd Years. Beside why Sould We have to Spend Billions to Change . . . Any One With An Ounce of Brains Can See We Really Don't Need It (SIC)" [4].

The date above refers to the demise of the U.S. Metric Board on 30 September 1982. From President Reagan (the USMB has served its purpose of educating the public) to Bob Schieffer of CBS–TV News (despite millions of dollars spent on commercials telling us why we need to go metric, it is the metric system that is about to go), for many people, the demise of the USMB is the best evidence that metrication is dying.

Som groups aren't taking any chances. Resolution No. 35 at the 32nd (1982) International Convention of the International Brotherhood of Electrical Workers calls on the U.S. Congress to name the customary system as our preferred system of units of measure.

Metrication is Alive and Well . . .

Some writers have described the present situation – partly metirc, mostly customary units – as living in a "metric purgatory". But it is easy to gather evidence that, without much publicity, metrication is continuing and probably is unstoppable.

Item: As of January, 1980, the Department of Defense requires all its purchases to be in SI metric units unless inconsistent with safety, the product isn't available in metric units, or there are other economic, operational or technical considerations. A complete set of metric specifications and standards for DOD inventories should be available by 1990.

Item: Any equipment to be supplied to NATO or produced jointly with other nations for use in NATO must be produced to metric specifications.

Item: In March, 1982, President Reagan reaffirmed his administration's support for the policy of voluntary metrication (despite other comments to the contrary).

Item: The federal Office of Productivity, Technology and Innovation has been charged with responsibility for metrication. The director, Dr. D. Bruce Merrifield, points out that in our high-technology world, SI metrics will be the predominant measurement system. He has emphsized keen competition in international markets as the main reason that the U.S. should metricate. In 1970, the U.S. had 5% of the world's population and generated some 75% of the world's technology. About now, we produce 50% of the world's technology and in ten years we may produce only 1/3 of it. We aren't lacking in innovation, rather other parts of the world are participating at an increasing rate. The U.S. is the only developed nation that is not officially metric; i.e., the consumers of the world want and expect metric products.

Item: The job of one out of every six U.S. workers depends on our foreign trade. About 30% of U.S. corporate profits come from foreign trade and investment. When items still produced in customary units of measure are sold abroad. It is because the product is superior in quality or price, or is the only one available. Competition can wipe out such advantages quickly.

Item: Since early 1978, the European Common Market has demanded that all imports be packaged and labeled only in metric units. The requirement is waived frequently; competition could remove the need for such liberality.

Item: General Motors, except for the Corvette, is entirely metric. The entire automotive industry, which supplies one of every three U.S. jobs directly or indirectly, will be metricated by 1990.

Item: About 25% of U.S. gasoline sales (including almost every sale in Hawaii) is in metric units.

Item: The 24-hour clock is used in most police departments, many hospitals, parking lots, business time clocks, cash register tapes, computer program printouts, air traffic control and FAA, all military and Coast Guard operations.

Items: Grocers are beginning to metricate. Cartons and pallets in metric units make storage and shipping safer and more convenient (no boxes extending beyond pallets, no wasted space). California's agriculture industry is shipping produce in metric tons.

Item: About 30% of agriculture and construction equipment made in the U.S. is built to metric specifications because so much of it is sold abroad.

Item: IBM is more than half-way in its metrication program.

Item: Polaroid will be totally metricated by 1985.

Item: The President's Productivity Advisory Committee (chaired by former Treasury secretary William Simon) has recommended that no federal, state of local laws impede market-led metrication.

Item: U.S. schools of engineering are metricationg; since 1980, the Fundamentals of Engineering exams have included SI metric units.

SI METRICS – HERE YESTERDAY, GONE TODAY? Continued

Item: Florida and California demand that SI metrics be the primary system of measurement used in school textbooks.

Item: Texas Education Agency's 1983 Proclamation to Publishers (math textbooks) requires that both SI metrics and the customary system be included, with no conversion between systems.

Item: The revised list of TABS objectives will include use of SI metric units.

Meanwhile, In the Classroom . . .

Too many of us suffer from **anti-metrimania,** an attitudinal problem which leads us to believe we will not be able to use metric units effectively [5]. Adults, beisde the concern for looking and feeling dumb, may fear being cheated in the marketplace.

What can classroom teachers do to prevent or combat anti-metrimania? Encourage students to **think metric by doing metric.** Concentrate on activities in which learners:

(1) estimate, ten actually measure;

(2) use the common units of length, mass (weight), temperature and volume;

(3) select reasonable metric units for measuring everyday objects and events.

Act on the principle that a lot of metric knowledge and measuring skills can be developed almost incidentally while learners are involved in entertaining activities. Look at the outline map and metric facts in Fugure 1, "A Metric Texas." A baker's dozen of activities follows, some using the map. Try them and then start doing some "baking" of your own!

1. Make a map of your county, town, classroom or school with metric facts about points of interest.
2. Recall the poem

   Thirty is hot
   Twenty is nice
   Ten is cool
   Zero is ice.

   Which line applies to a walk through Jack Pit Cave? the water of Comal Springs? a summer fishing trip to Lake Amistad? a spring hike to the summit of Guadalupe Peak?
3. Lay out a "walking trail" in the hall or playground. How long will it take to walk the trail until you've walked the equivalent of Jack Pit Cave?
4. Have a "walking race". What's the fastest time to walk a distance equivalent to the length of Jack Pit Cave?
5. Let your students work together to walk a distance equal to the height of Guadalupe Peak. Each student earns a point every time (s)he walks 1 km. How many days does it take?
6. Hang a string from wall to wall across the classroom. Blow up a balloon, fasten it to a holder and put the holder on the string. Who can blow the balloon the longest distance with one breath? in one minute?
7. Measure the volume and weight of a quantity of popcorn before and after popping. What happened? (Try it another time measuring popcorn **and** added ingredients.)
8. Measure the area of your classroom (school). How high would the room (building) have to be to have the conservation storage capacity of Amistad Reservoir? (If your students aren't up to division, try adding the height of the room repeatedly.)
9. We "human beans" are about 98% water, so every kilogram of us is about .00098 m^3 of water. How many "human beans" in your classroom does it take to approximate the production of Comal Springs in one second? one minute? one hour?
10. Place a piece of masking tape on your clothing where the water line would be if you'd been standing in Thrall, Texas on 10 September 1921. What's the greatest one-day rainfall in your town (county)? Place another piece of masking tape on yourself?
11. The 1984 Summer Olympics will be conducted in Los Angeles. Why not have a mini-olympics in your classroom? See 4, 6 above. Create your own "events", measuring metrically.
12. What is the temperature of falling (or just fallen) rainwater? snow? Is it different from the air temperature? Can you make a prediction about air temperature in Thrall on 9–10 September 1921 or Plainview on 4 February 1956?
13. Metrically speaking, how big is a bale of cotton (bushel of wheat, barrel of oil, or unit of your local product)? Does it make more sense to use the customary unit of measure for that local product or the metric unit that results from using a table of conversion factors? Is there a **better** metric unit?

ABOUT THE AUTHOR

Dr. Nina L. Ronshausen is associate professor of mathematics education at Texas Tech University and Regional Manager (TX, LA, OK, AR) of the U.S. Metric Association.

FOOTNOTES

1. Clinita A. Ford, Florida A & M University, quoted in **USMA NEWSLETTER** 17 (#6): 6. November–December, 1982.

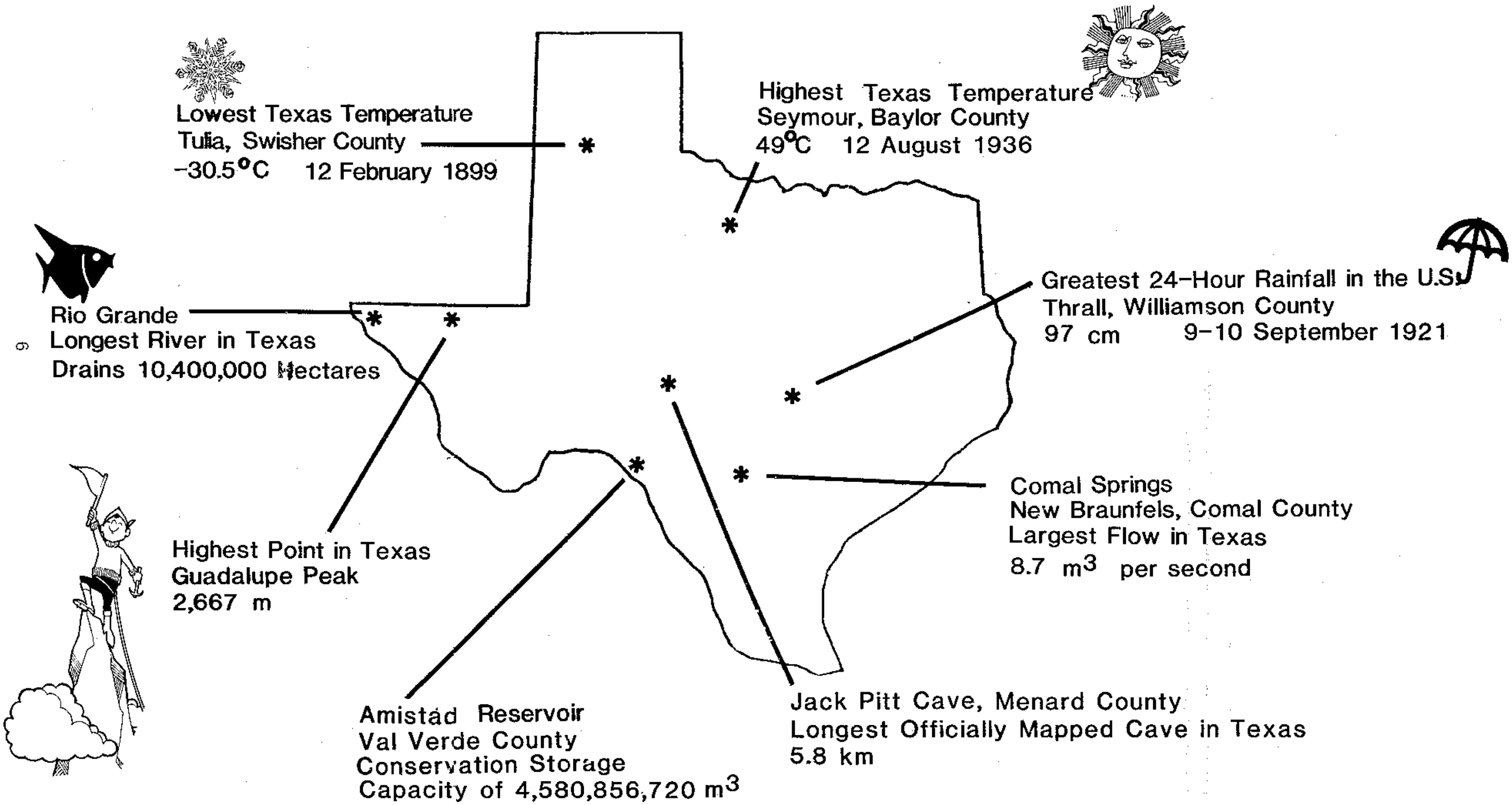
2. Erma Bombeck, "American Refuse To Take Metric System Seriously," syndicated by Field Enterprises, Inc., 3 November 1982.

3. "For Canada, Metric Drive Inches Ahead," **New York Times,** 14 March 1982.

4. Letter to the editor, **AARP News Bulletin.** July–August, 1982.

5. B. R. Yvon, **et al.** "Training Metric Leaders." **The Arithmetic Teacher** 19 (#8): 43–47. April, 1982.

A METRIC TEXAS



USING (MICRO) COMPUTERS IN HIGH SCHOOL TRIGONOMETRY

by S. Singh
Southwest Texas State University

#1. INTRODUCTION

We are living in the age of portable microcomputers. The time is upon us when a majority of the high school students will either bring their microcomputers to the classroom or the school will provide the microcomputers. This will bring about a considerable change in the attitudes of our society concerning the method of presentation and the subject-matter taught in high schools. It will be expected that the skills that can be routinely performed on a microcomputer are carefully distinguished from the conceptual skills, and, that they are presented accordingly. On the subject-matter side, a terminal student (a student who is not going to attend college) of high school will expect and demand courses in which computational rather than analytic aspects of the subject are emphsized.

In this regard, the high school curriculum in mathematics and, more importantly, the high school mathematics curriculum for the students who will not attend college or who are not mathematically gifted requires a careful restructuring and reevaluation so that the computational aspects are properly presented. These computational aspects must be carefully related to the conceptual aspects of the curriculum depending on whether or not the student is college bound. The purpose of this article is to point out how this may be accomplished in a course on tri onometry (the word "trigonometry", without any further qualifications, will mean "plane trigonometry" throughout this article).

First, we briefly trace the historical development of trigonometry in #2. This helps us motivate our later discussions in #3 concerning the subject organization of trigonometry and its presentation in this "age of the microcomputer". In order to exemplify and illustrate our point of view given in #3, we present some usable "software" (computer programs written in BASIC*) which can be immediately used on any microcomputer.** More importantly, we hope that this will inspire teachers to write their own similar software based on their educational needs.

#2. DEVELOPMENT OF TRIGONOMETRY: A BRIEF HISTORY

Trigonometry is an ancient science. We divide its history into two periods and briefly discuss each one as follows.

The Early Period

The subject of trigonometry in its very early stages of development was mostly known to astronomers and surveyors from Bablyon, Egypt and Greece. Perhaps the earliest allusion to trigonometry appears in an Egyptian scroll, Ahmes Papyrus (circa 1650 B.C.). Many historians call the Greek astronomer, Hipparchus (circa 140 B.C.), "the father of trigonometry." An earlier astronomer, Aristarchus of Samos (circa 260 B.C.), had implicitly used the tangent of an angle to compute distances from the earth to the sun and moon. Heron of Alexandria (circa 50 A.D.?) is credited with a formula for finding the right angle of a triangle. Another astronomer, Menelaus of Alexandria (circa 100 A.D.), studied spherical trigonometry. At the end of this period comes Ptolemy's famous book, **Almagest** (circa 150 A.d.), which contains many theorems about trigonometry. Several historians contend that most of the theorems in **Almagest** are due to Hipparehus.

---

*BASIC is the most commonly used language on microcomputers. A word of encouragement: a mathematics teacher will have very little problem acquiring a working knowledge of BASIC.

**The teacher needs access to a microcomputer or a terminal attached to a mainframe computer.

The Analytic Period

The subject of trigonometry made steady progress until the major development of analytic trigonometry in the 17th and 18th centuries. Many contributed to this development, but historians credit Leonhard Euler (1707–1783) for systematically developing trigonometry from the analytic or functional point of view; this appeared in "Introductio in Analysin Infinitorum". In modern times, E. W. Hobson's, "Treatise on Plane and Advanced Trigonometry". which first appeared in 1891, is perhaps the most comprehensive and monumental work available today. A later edition of Hobson's book (which this author can find) is the 17th edition published by Dover Publications, Inc., New York, 1957.

#3. HIGH SCHOOL TRIGONOMETRY WITH (MICRO) COMPUTERS: A REORGANIZATION

We organize the subject of trigonometry into the following two classes which are somewhat overlapping:

I. Computational Trigonometry

II. Analytic or Functional Trigonometry

This organization follows the historical development given in #2. We will give a brief list of topics in each class and indicate how microcomputers may be used in each part to facilitate the teaching-learning process.

Topics in Computational Trigonometry

1. A review of geometry, the rectangular coordinate system, and degree and radian measures.
2. Solving right triangles: Definitions of trigonometric functions, evaluation of trigonometric functions, and applications.
3. Solving oblique triangles: The Law of Sines, the Law of Cosines, the area of a triangle.
4. Graphing basic trigonometric functions.
5. A brief discussion of inverse trigonometric functions and their graphs.

Topics in Analytic Trigonometry

1. Trignometric functions of a real number
2. Identities of all kinds.
3. Inverse trigonometric functions.
4. Graphing functions which involve trigonometric functions.
5. Trigonometric equations.
6. Topics: Parametric equations, complex numbers, and/or logarithms.

A high school course in trigonometry for the students who will not attend college or who are not mathematically gifted may consist of computational trigonometry alone. This is where the microcomputers are the most suitable. The values of the trigonometric functions can be computed and printed by using a microcomputer. Then, these values can be used for solving practical problems and sketching graphs of these functions. In #4, we will give a computer program for solving right triangles and we will indicate its uses. In a subsequent article, we will give the most general computer program for solving triangles. We also give a computer program for finding the area of a triangle by Heron's formula.

Analytic trigonometry is a necessary background for the college student of engineering sciences and other sciences. The main application of microcomputers to analytic trigonometry is in the realm of graphing. There are many commercially available software packages in graphics that the teacher may find useful. No knowledge of computer programming is needed to use these packages. With the availability of computer graphics, graphing becomes a valuable teaching-learning tool rather than an end in itself.

In summary, our point of view is that the student as well as the teacher may write small computer programs, like the one given here, for the purpose of teaching-learning computational trigonometry. A good graphing package can be a valuable aid to the teaching-learning process of computational as well as analytic trigonometry.

#4. COMPUTER PROGRAMS

We now give the following two computer programs. The first program named **SOLVRT** is useful for solving right triangles and finding their areas. The second program named **AREA** is useful for finding the area of a triangle when the three sides are known. We do not give our program **SOLVE** which solves triangles and find their areas since it is lengthy. We may present **SOLVE** separately in the near future.

SOLVRT

```
10   PRINT
20   PRINT TAB (9) "*"
30   PRINT TAB (9) "* *"
40   PRINT TAB (9) "* Y *"
50   PRINT TAB (9) "*    *"
60   PRINT TAB (7) "A  *        * C   SOLVING RIGHT
     TRIANGLES"
70   PRINT TAB (9) "*         *"
80   PRINT TAB (9) "*          *"
90   PRINT TAB (9) "*   Z    X  *"
100  PRINT TAB (9) "* * * * * * * * * *"
110  PRINT TAB (17) "B"
120  PRINT "---------------------------"----------"
130  PRINT "NOTE: (1)  ANGLES X, Y, Z ARE OPPOSITE TO
     THE SIDES A, B, C, RESP.."
140  PRINT "      (2) ANGLE Z=90 AND THE ANGLES ARE
     MEASURED IN DEGREES."
150  PRINT "---------------------------------------"
160  PRINT "THERE IS FIVE TYPES OF INPUT DATA."
170  PRINT "CHOOSE ONE OF THE FOLLOWING AND GIVE
     TWO VALUE AS INPUT:"
180  PRINT TAB (8) ;"1. AN ACUTE ANGLE X AND THE
     HYPOTENUSE C."
190  PRINT TAB (8) ;"2. AN ACUTE ANGLE X AND THE
     OPPOSITE LEG A."
200  PRINT TAB (8) ;"3. AN ACUTE ANGLE X AND THE
     ADJACENT LEG B."
210  PRINT TAB (8) ;"4. THE HYPOTENUSE C AND THE LEG
     A."
220  PRINT TAB (8) ;"5. THE LEGS A AND B."
230  PRINT "---------------------------"----------"
240  PRINT "YOUR CHOICE OF INPUT FROM 1 TO 5 IS:"
250  GOTO 270
260  PRINT "INCORRECT INPUT: CHOOSE A NUMBER FROM
     1, 2, 3, 4, or 5."
270  INPUT K
280  IF K   1 AND K   2 AND K   3 AND K    4
     AND K   5 THEN 260
290  PRINT "YOUR TWO VALUES ARE:"
300  INPUT U, V
310  PRINT "---------------------------------------"
320  IF U  =0 or V  =0 THEN 1070
330  IF K = 1 THEN 380
340  IF K = 2 THEN 450
350  IF K = 3 THEN 520
360  IF K = 4 THEN 590
370  IF K = 5 THEN 680
380  X = U
390  C = V
400  Y = 90 - X
410  IF Y  = 0 THEN 1070
420  A = C*SIN (X*ATN(1)/45)
430  B = SQR(C*C-A*A)
440  GOTO 750
450  X = U
460  A = V
470  Y = 90 - X
480  IF Y  = 0 THEN 1070
490  C = A/SIN(X*ATN(1)/45)
500  B + SQR(C*C-A*A)
510  GOTO 800
520  X = U
530  B = V
540  Y = 90 - X
550  IF Y  = 0 THEN 1070
560  C = B/COS(X*ATN(1)/45)
570  A = SQR(C*C - B*B)
580  GOTO 860
590  C = U
600  A = V
610  IF C  = A THEN 1070
620  B = SQR (C*C - A*A)
630  X = ATN(A/B)
640  X = X*45/ATN(1)
650  Y = 90 -X
660  IF Y  = 0 THEN 1070
670  GOTO 920
680  A = U
690  B = V
700  C = SQR(A*A+B*B)
710  X = ATN(A/B)
720  X = X*45?ATN(1)
730  Y + 90 - X
740  GOTO 980
750  PRINT "INPUT: ACUTE ANGLE X = ";X, "HYPOTENUSE
     C = ";C
760  PRINT "RIGHT ANGLE Z = 90 ."
770  PRINT " ---------------------------------------"
780  PRINT "ANSWER: ACUTE ANGLE Y = ";Y,
     "LEG A = ";A,"LEG B - ";B
```

```
790   GOTO 1030
800   PRINT "ANSWER:ACUTE ANGLE X = ";X,"LEG A = ";A
810   PRINT "RIGHT ANGLE Z = 90."
820   PRINT " ------------------------------------"
830   PRINT "ANSWER: ACUTE ANGLE Y = ";Y,
      "HYPOTENUSE C = ";C
840   PRINT "LEG B = ";B
850   GOTO 1030
860   PRINT "INPUT:ACUTE ANGLE X - ";X;"ADJACENT
LE    LEG B = ";B
870   PRINT "RIGHT ANGLE Z = 90."
880   PRINT " ------------------------------------"
890   PRINT "ANSWERE:ACUTE ANGLE Y - ";Y,
      "HYPOTENUSE C = ";C
900   PRINT "LEG A = ";A
910   GOTO 1030
920   PRINT "INPUT:HYPOTENUSE C = ";C,
      "LEG A = ";A
930   PRINT "RIGHT ANGLE Z = 90."
940   PRINT " ------------------------------------"
950   PRINT "ANSWERE:ACUTE ANGLE X = ";X,
      "ACUTE ANGLE Y = ";Y
960   PRINT "LEG B = ";B
970   GOTO 1030
980   PRINT "INPUT:LEG A = ";A,"LEG B = ";B
990   PRINT "RIGHT ANGLE Z = 90."
1000  PRINT " ------------------------------------"
1010  PRINT "ANSWER:HYPOTENUSE C = ";C,
      "ACUTE ANGLE X = ";X
1020  PRINT "ACUTE ANGLE Y = ";Y
1030  PRINT
1040  PRINT "UNIQUE TRIANGLE WITH AREA:";SQR((A=B=C)
      *(A=B-C)*(A=C-B)*(B=C-A) )/4
1050  PRINT "------------------------------------"
1060  GOTO 1080
1070  PRINT "THERE IS NO TRIANGLE FOR YOUR INPUT."
1080  PRINT
1090  PRINT "DO YOU WANT TO CONTINUE?  TYPE YOUR
      ANSWER: YES OR NO."
1100  INPUT NS
1110  IF NS="YES" THEN 10
1120  END
```

TYPICAL OUTPUT FROM SOLVRT

```
     *
     * *
     *Y  *
     *     *
A    *       *   C        SOLVING RIGHT TRIANGLES
     *         *
     *           *
     * Z       X  *
     * * * * * * * *
          B
----------------------------------------------------
NOTE: (1) ANGLES X, Y, Z ARE OPPOSITE TO THE SIDES
      A, B, C, RESP..
      (2) ANGLE Z = 90 AND THE ANGLES ARE MEASURED IN
      DEGREES.
----------------------------------------------------
THERE IS FIVE TYPES OF INPUT DATA.
CHOOSE ONE OF THE FOLLOWING AND GIVE TWO VALUE AS
INPUT:
        1. AN ACUTE ANGLE X AND THE HYPOTENUSE C .
        2. AN ACUTE ANGLE X AND THE OPPOSITE LEG A .
        3. AN ACUTE ANGLE X AND THE ADJACENT LEG B .
        4. THE HYPOTENUSE C AND THE LEG A .
        5. THE LEGS A AND B .
----------------------------------------------------
YOUR CHOICE OF INPUT FROM 1 TO 5 IS:
     ?1
YOUR TWO VALUES ARE:
     ?40, 20.5
----------------------------------------------------
INPUT: ACUTE ANGLE X = 40  HYPOTENUSE C = 20.5
RIGHT ANGLE Z = 90 .
----------------------------------------------------
ANSWER" ACUTE ANGLE Y = 50  LEG A =  13.1771    LEG B =
     15.7039

UNIQUE TRIANGLE WITH AREA:  103.466
----------------------------------------------------
```

AREA

```
10    PRINT
20    PRINT
30    PRINT "FINDING AREA OF A TRIANGLE BY HERON'S
      FORMULA."
40    PRINT
50    PRINT "------------------------------------
60    PRINT "YOU MAY CHOOSE ANY THREE REAL NUM-
      BERS AS YOUR INPUT. THIS PROGRAM",
70    PRINT "WILL FIRST DETERMINE WHETHER THERE IS A
      TRIANGLE WHOSE SIDES ARE",
80    PRINT "HAVE LENGTHS EQUAL TO YOUR NUMBERS. A
      SUITABLE ANSWER IS GIVEN."
90    PRINT "------------------------------------
100   PRINT "YOUR THREE NUMBERS ARE:"
110   INPUT A, B, C
120   IF A   = 0 OR B   = 0 OR C   = 0 THEN 240
130   IF A+B    = C OR A+C   = B OR B+C   = A THEN GOTO
      200
140   S = (A+B+C)/2
150   R = SQR(S*(S-A)*(S-B)*(S-C))
160   PRINT
170   PRINT "AREA FOR THE TRIANGLE IS :";R
180   PRINT " ------------------------------------"
190   GOTO 280
200   PRINT "AREA CANNOT BE FOUND SINCE THERE IS NO
      TRIANGLE WHOSE SIDES HAVE",
210   PRINT "LENGTHS EQUAL TO THE GIVEN THREE NUM-
      BERS."
220   PRINT " ------------------------------------"
230   GOTO 280
240   PRINT "AREA CANNOT BE FOUND SINCE THERE IS NO
      TRIANGLE WHOSE SIDES",
250   PRINT "ARE NEGATIVE.  USE ANY THREE POSITIVE
      REAL NUMBERS AS INPUT AND",
260   PRINT "TRY AGAIN."
270   print" ------------------------------------"
280   PRINT "DO YOU WANT TO CONTINUE?  TYPE YOUR
      ANSWER YES OR NO."
290   INPUT K$
300   IF K$ = "YES" THEN GOTO 100
310   END
```

TYPICAL OUTPUT FROM AREA

```
FINDING AREA OF A TRIANGLE BY HERON'S FORMULA.
----------------------------------------------------
YOU MAY CHOOSE ANY THREE REAL NUMBERS AS YOUR
INPUT.  THIS PROGRAM WILL FIRST DETERMINE WHETHER
THERE IS A TRIANGLE WHOSE SIDES ARE HAVE LENGTHS
EQUAL TO YOUR NUMBERS. A SUITABLE ANSWER IS GIVEN.
----------------------------------------------------
YOUR THREE NUMBERS ARE:
     ?3, 4, 5
AREA FOR THE TRIANGLE IS : 6
----------------------------------------------------
```

We now point out how these programs may be used; the teacher may find additional uses. First, teachers may use these programs as a spring-board to learn BASIC in order to write their own similar programs depending on their needs. In fact, I became interested in programming by trying to understand a useful program that somebody else had written. Second, these programs may be used to generate interesting problems for the purposes of testing and homework (which the student may be required to solve by using a calculator). Third, the existing answers may be easily verified; this applies to the problems in the textbook or other problems for which the answers are not readily available. Finally, the students enjoy solving problems by using these programs if they have access to a microcomputer in school or at home. I have found that this often motivates them to learn the related concepts more clearly. A teacher who teaches both trigonometry and computer programming to the same class may find these programs particularly useful since their analysis and study will provide reinforcement for both.

We have not included our general program for solving triangles since it is lengthy. We plan to publish it at a later date.

THE ELEPHANT SYNDROME
An Alternative Look at the Mathematically Precocious Student

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The ability to quickly and comprehensively generalize a mathematical situation has been widely accepted as one of the more prominent characteristics of the mathematically talented and gifted student (Heid, 1983; Krutetskii, 1976). Therefore, when attempting to identify the mathematically precocious, it is necessary to assess differing degrees of ability, with regard to generalization skills. This is usually done in an individualized setting which makes the recognition of mathematical ability less difficult. This emphasis has the potential for overlooking the ability to retain and apply generalizations following their acquisition.

The importance of retention of generalizations for further use was acknowledged by Krutetskii (1976). In a comparison of capable and very capable pupils to those less capable, he identified certain characteristics regarding retention of mathematical information. It was found that capable or very capable pupils memorized the problem type, method of solution, and logical reasoning pattern. Information of this tyepe was retained for long periods of time without reinforcement. Data and information specific to the problem were retained for shorter periods of time. When superfluous data were introduced into the problem, details were usually forgotten after a period of time. In general, capable students internalized the type of problem and method of solution and retained problem-specific data for relatively shorter periods of time.

Krutetskii (1976) found that average students retained problem—specific data relatively well, but failed to retain the problem types or method of solution. It was concluded that the average student tried equally as hard to retain problem—specific data as to retain generalizations.

When considering the ability of less capable students, a distinguishing characteristic was their inability to retain generalizations, patterns of reasoning and abstract mathematical relations. It was also noted that many of these students had little problem of retention in other subject areas. Therefore, the ineptness seemed to be content specific to mathematics.

In assessing mathematical preciciousness, many students are overlooked even though they exhibit several characteristics which Krutetskii (1976) has attributed to very capable students (for a listing of attributes, see Heid, 1983). Because they lack speed in making generalizations, they fail to meet the requirements of quick-wittedness generally associated with gifted students.

In identifying precocity, the final product needs to be considered. Many gifted students suffer from "the elephant syndrome." They need time to sort information and internalize the method of solution. Once they have mastered these tasks, they retain the information and can apply the generalizations in other situations. Unlike many who catch on very quickly but seem to forget pertinent information in short periods of time, these students have a firm grasp of the mental processes of the solution for they have internalized the generalizations.

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