

# Writing in the Mathematics Curriculum

Marlow Ediger

Quality written communication is necessary in school and in society. Writing needs to be emphasized across the curriculum. Mathematics can make its many contributions in improving written work. Diagnosis of problems, here, need to be detected with stress being placed upon students achieving desired objectives in writing. Transfer values from one academic area to the next must be in evidence. The mathematics teacher needs to model, provide appropriate student practice in contextual situations, motivate, and encourage good writing habits among pupils. Pupils learn to write as well as write to learn in mathematics.

Students do need to become proficient writers. Writing should be emphasized across the curriculum. Mathematics, as one curriculum area, can and does make a plethora of contributions toward writing proficiency. The teachers need to observe the kinds of errors students make in written work. These may be recorded on a check sheet so that the teacher knows which goals need to be stressed in ongoing mathematics lessons.

Lessons should not stress drill in written work, but rather contextually, as needed, students should be assisted to write well. To start out with suggestions for writing in mathematics, students need to form each numeral legibly. If a numeral is written in reverse form by a young learner, for example, then assistance must be given to write each correctly. Having students write how many are pictured on a series of cards, such as in each set of cats pupils may do this. When diagnosing student daily work, the teacher needs to assist where reversals are made or a lack of clarity is involved. Help given needs to be specific be it in students not knowing the basic facts or not understanding borrowing/carrying in performing a mathematical operation.

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Dr. Marlow Ediger, Professor Emeritus, Truman State University.

Correspondence concerning this article may be addressed to Dr. Marlow Ediger, P.O. Box 417 North Newton, KS 67117.

## *Criteria to Use In Mathematics Writing*

Learning needs to be meaningful. The student then needs to make sense out of what is being learned. He/she needs to think of when they personally, for example, counted something real, such as a set of coins, a place setting for visitors at a dinner table, pet fish in a bowl, and newborn kittens. Journal writing is important here, in that a student may record what was learned and what is left to learn. Needed assistance in writing might be provided by the teacher or peer. Journal writing assists students to reflect upon what was learned. It may provide necessary insight in what was not understood so that the student is increasingly successful in future learnings. Thinking about mathematical experiences helps students to analyze, synthesize, and evaluate what has transpired in order to grow in mathematics achievement.

Interest is a powerful factor in learning. The mathematics teacher needs to provide for the interests of learners. Student choice in activities may well promote interest in learning. An enrichment center in the classroom can provide those choices. Each task at the interest center needs to stimulate students in mathematics achievement. A hands-on approach should also be stressed at the interest center. For example, students may measure, weigh, and find the volume of different containers and record their findings. Thus, students may ascertain how many pints in a quart by actually using these containers to find out. Hands on experiences meet the

personal styles of many students to achieve well in mathematics. Thus, concrete experiences may become a part, as well as within numerous other learning activities for all in the classroom. Concrete activities assist in making [earnings meaningful for students.

Students should perceive purpose in written experiences in mathematics. Writing then should not be done for the sake of doing so, but rather to achieve a definite goal. Thus to increase experiences in doing and understanding word problems, students may be challenged to write these kinds of story problems which might well challenge other learners to complete. Numerical values used and the type of problem written may well relate to what is currently being studied or has been studied recently. The mechanics of writing such as correct spelling of words, proper sentence structure, and meaningful punctuation must prevail as end products. Peers may assist each other in the mechanics of writing. The heart of the story problem should truly stress the solving of a problem. Learners need to think clearly and carefully when pursuing a problem. Dilemma situations take time in coming up with solutions to mathematics problems. Developmentally appropriate problems must be written. Students should feel challenge and yet be able to be successful in achievement. Experiencing failure makes for negative feelings in and toward mathematics. The feeling dimension is salient to stress as objectives in the mathematics curriculum. Positive feelings through successful achievement should assist students in wanting to do more work as well as enjoy mathematics.

Students should work individually as well as collectively in ongoing learning experiences. A preferred learning style for some is to work by the self in assignments to complete as well as in doing voluntary work at an interest center. Others like to work together with others in order to achieve objectives. In society, people work at things individually as well as within a group setting.

Students should have opportunities to follow personal preferences in the style of preferred learning. Maximum learning from a student may accrue from using the style of learning preferred.

The total learning environment should be conducive to maximum student productivity. Thus, the noise level should not be excessive so that students may concentrate on the tasks at hand. A busy classroom environment will produce some noise, but unnecessary noises need to be kept to a minimum. Teacher developed standards of conduct should be printed on a chart for all in the classroom to see clearly. These criteria should be referred to when students violate a standard. Each standard needs to be written as precisely as possible so that agreement exists when a standard has been violated. Rules need to be in the offing what the punishment should be for rule violation. There are teachers who have been successful with rules developed cooperatively with students in the classroom. The feeling is that students then own the standards they have helped to develop and prefer to abide by them. The goal here is to develop a classroom environment that assists optimal achievement in mathematics.

The mathematics teacher also needs to use methods of instruction that harmonize with student preferences. The following are some of the preferences that students possess:

1. Direct approaches versus more open-ended procedures of instruction.
2. Student selection of peers to work on a committee versus teacher determination of members.
3. The mathematics textbook being a major source of learning activities as compared to using a variety of sources.
4. Learners seated in rows and columns versus flexible patterns of seating arrangements.
5. A logical versus a psychological sequence in ordering learning opportunities.

### *Organizing the Mathematics Curriculum*

There are selected approaches available in organizing learning opportunities. A separate subjects curriculum may be in the offing whereby arithmetic becomes the heart of the curriculum. The basic operations, for example, of addition, subtraction, multiplication, and division are stressed in ascending order of complexity. Geometry may be added as an integrated component. Here, students perceive relationships between arithmetic and geometry. For increased integration, algebra may be incorporated, as well as tenets of statistics.

When thinking of the integrated mathematics curriculum, one can incorporate history such as historical data pertaining the Roman system of numeration when this system is being studied. All numerals have an attached history such as during the Middle Ages, the concept of one-half could not be visualized by most, since taking a whole and breaking it up into halves, such as a circle, made for two parts. Students with teacher guidance may select a topic to write on dealing with the history of number. When ready, the student should use the word processor. Editing becomes more enjoyable with word processor use. Spell checkers is a good aid to check for spelling errors. Revisions may readily be made with the word processor by using the delete key, cut and paste from the Edit icon, as well as insertions made conveniently as needed.

Programmed mathematics has made for excitement and variety in mathematical learning experiences. Drill and practice programs assist learners to reinforce previous learnings. Simulation programs provide opportunities for students to simulate mathematical activities as they actually occur in the real world. Tutorial programs emphasize new learnings for students in sequence from the easier to those gradually more complex. Games stress individuals or teams challenging each other in a competitive game, involving

mathematics.

A teacher at Boston Academy used a computer program called the Geometer's Sketchboard to stimulate high school students in inquiry procedures (Wiske, 2004):

Her students constructed geometric figures and then analyzed such data as angles, side lengths, and ratios, among other different measures. They developed and tested their own conjectures for measuring, dragging, reshaping, and comparing geometric objects. The software, which records and displays the mathematical relationships of objects, allowed students to examine a similar set of cases, observe patterns, and make generalizations. The accuracy and speed of the computer program freed students from the tedium of construction with traditional tools yet enabled them to experience the process of arranging and analyzing shapes.

New technologies help students understand concepts, methods of reasoning, and effective ways of presenting their ideas in many subject areas. Graphing calculators that instantly relate the graphic and the symbolic representations of mathematical expressions can help students appreciate the nature of variables and functions. Computer based simulations enable students to see and manipulate abstract concepts such as density-- and to model complex ideas such as predator/prey relationships.

Computer programs in mathematics may well provide new experiences for many students. The excitement of challenge and high expectations may indeed stimulate students to achieve at higher levels in mathematics. It might well assist students to perceive the relationship of subject matter. Interest factors are powerful to consider in teaching. The fascination which many students have with computers may encourage increased levels of learning. Quality programs need to be selected which guide the student to

become increasingly independent in learning mathematics.

### *In-service Growth of Teachers*

Teachers need to be open in listening to the methods and ideas on teaching mathematics from peers. Peers need to share means of assisting students to attain more optimally. Thus, mathematics teachers need to meet together periodically to share ideas in developing a quality mathematics curriculum, including the writing component. It is good for mathematics teachers to discuss with peers what is being done on the next as well as the preceding grade levels of teaching. This will assist teachers to improve sequence in learning. New objectives for student attainment should be built upon the previously achieved objective(s).

Workshops may be devoted to helping teachers reach more students such as minority individuals, English Language Learners (ELL), learners with handicaps, as well as those where English is the Second Language (ESL). With heterogeneously grouped students in a classroom, the mathematics teacher has a demanding job in providing for individual differences.

Faculty meetings may involve discussions on such items as guiding students in mathematical writing experiences, scaffolding learnings for students, innovative materials of instruction, new ideas in grouping for instruction, and learning environments conducive for student achievement. There needs to be an assessment of how effective each plan of in-service education is. Have in-service education programs for mathematics teachers helped student achievement? Quality assessment programs should help to answer this vital question.

Research projects conducted by a committee of mathematics teachers may focus on developing the integrated curriculum whereby the language arts areas of writing, reading, listening, and speaking permeate the mathematics curriculum. A variety of

reference sources need to be used such as educational journals, university teacher education textbooks, the Internet, resource personnel, among others. A comprehensive study should provide detailed information pertaining to a good integrated mathematics curriculum.

Observing excellent teachers teach provides models in innovation. A teacher may be able to refine methods of student inquiry learning by observing model situations of instruction. A carefully written observation report may then be shared with other mathematics teachers.

Mathematics teachers need to use the best objectives, methods of instruction, and assessment procedures possible, in teaching and learning situations. Hopefully, students will achieve well under these plans. With state mandated testing, it behooves the teacher, in particular, to aid students to achieve optimally.

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