

## **Educating Memory vs. Educating Awareness: An investigation into the teaching principles of Dr. Caleb Gattegno (1911~1988)**

Ralph Sumner

### **Abstract**

Dr. Caleb Gattegno was an innovative teacher of mathematics whose fascination with how we learn caused him to challenge the current pedagogical paradigm as a relic of medieval universities. Some of his most important concepts were the “subordination of teaching to learning” and “only awareness is educable.” Dr. Gattegno was often referred to as the “world’s greatest teacher” because of his success in teaching mathematics and foreign languages. In this age of modern technology with computers providing instant memory for all types of information, it becomes less important for humans to remember and more important to know how to use the information. Additionally, memorization is an extremely inefficient type of memory. In an article in the *Journal of Cognitive Neuroscience*, authors Sheth et al state that real-world problems can be broadly categorized as those requiring sequential reasoning and those requiring transformative reasoning. Transformative reasoning is also known as the “Eureka moment” or the “Aha! moment” and indicates a break from past thinking based on a sudden insight that causes restructuring. In this process the problem solver abruptly, through a quantum leap of understanding with no conscious forewarning, moves from a state of not knowing how to solve a problem to a state of knowing how to solve it. Dr. Gattegno’s approach is to set up problems to stimulate this “Eureka moment” type of breakthrough. Then

students are encouraged to verbalize their own awareness in a feedback session to enable restructuring to occur. Finally, students are given further opportunities to utilize their new awareness and integrate it into their useful knowledge.

## Key words

transformative reasoning, Eureka moment, the subordination of teaching to learning, geoboards, the Silent Way, memorization versus retention, energy budget, teacher feedback, student feedback, words in color

## I. A brief introduction of Dr. Gattegno

(ケーレブ・ガテーニョ博士)

Dr. Caleb Gattegno was a mathematician and an educator. He is most famous for his innovative methods for teaching mathematics and foreign languages, as well as reading in one's native language. Dr. Gattegno spoke many languages fluently. His native languages were Spanish and Arabic. (His father was a Spanish businessman working in Cairo, Egypt, where Dr. Gattegno was born.) Dr. Gattegno wrote most of his books in English, although some he wrote in French, the language in which he completed his doctoral thesis in mathematics and later his doctoral thesis in psychology. He spoke and worked in a wide number of languages.

In Egypt, Dr. Gattegno founded Alexandria's first modern university-level mathematics course. While teaching reading, writing and mathematics for UNESCO in Ethiopia, he developed his extraordinary "words in color" method for teaching reading with color-coded charts for use in most major languages. Charts are available in Amharic, Arabic, Mandarin, English, French, Hindi, Portuguese, and Spanish as well as

other languages. In England, Dr. Gattegno lectured in mathematics at Liverpool University and the University of London. Because of his desire to help his students learn, Dr. Gattegno took up the study of psychology, in which he also received his doctorate. Dr. Gattegno was influential in spreading knowledge of developmental psychology and translated several of Piaget's works from French into English. Dr. Gattegno's philosophy of teaching and his teaching methods were based on his life-long love of mathematics and his fascination with how we learn.

Dr. Gattegno founded "Educational Solutions" in New York City and taught seminars there as well as in Europe, India, and Asia. He became especially famous for his teaching methods in mathematics, including the "geoboards" he invented for teaching geometry, and the organizations that he founded still carry on his methods. In foreign languages, he invented the very famous "Silent Way" for teaching language, in which the teacher might remain silent for most of the lesson, sometimes even for all of the lesson. Whether he was teaching languages, algebra, trigonometry, or literacy, Dr. Gattegno's classes were so dramatically successful that he was often called "the world's greatest teacher."

Some organizations founded by Dr. Gattegno include L' Ecole Normale Internationale, CIEAEM (the International Commission for the Study and Improvement of the Teaching of Mathematics), the Belgian Association of Teachers of Mathematics, and in England, the Association of Teachers of Mathematics (originally, the Association for Teaching Aids in Mathematics).

### Some questions for reflection.

1. When teaching, a teacher should

- (a) give students as much information as possible
  - (b) give students as little information as possible
  - (c) give students as much information as they can accept without being overloaded
2. The most important factor in the difficulty and amount of material a student can understand and remember is:
3. Other important factors are:

## II. The theoretical foundation of Dr. Gattegno's pedagogical approach

Dr. Gattegno's teaching methods were based on the following three assumptions.

### Assumption number 1. There is an energy “budget” for learning.

Human beings are very sensitive to the energy cost of their own activities. Therefore, we find methods of learning that gain the most learning with the least effort. In elementary math, Dr. Gattegno proposed the “ogden” which he defined as one unit of effort in learning. The teacher could use this budget in planning lessons. The ogden is similar to the modern idea of computational complexity.

The least effective method of learning, i.e., requiring the most effort for the least results, is **memorization**. In history classes, this could be memorizing names, dates, and events. In math classes, it can involve memorizing theorems. In foreign language classes, it can be the act of memorizing vocabulary lists. Dr. Gattegno proposes that this is the most inefficient method of learning for two reasons: it has a high energy cost for the amount learned, and it deprives us of the *joy of learning*, namely *discovering something for ourselves*. Memorization has a high cost

especially because it does not make use of the student's interest. It is well known that a very important factor in the level of difficulty that students can manage to read in a second language is the level of interest that the students have in the subject matter. Interest is simply an important factor in memory. If we can make use of the students' interest we have a very powerful way of helping them learn. On the other hand memorization is the most difficult type of learning to maintain. We forget very quickly what we have memorized. Often, we have already forgotten the day after final exams.

The most efficient method of learning is what Dr. Gattegno called retention. One example of this. I once went to a beautiful town in the mountains of Mexico where I had visited previously. Although I had not been there for a number of years, I was able to say: "The Post Office is just down that street. The cathedral is that way. The central plaza is up here a ways, and the open market is up that street. Oh, there used to be a nice restaurant in that building where I ate some great flautas verdes. Now it is a clothing shop." I had made no effort to memorize the streets or buildings, but I was surprised at how much I could recall. I could have written a travel guide just from my memory.

Assumption number 2. Only awareness is educable. We cannot teach someone to walk, to ride a bicycle, or to speak a language. We can only help them see where to focus their attention. When we help students focus their attention on what is important and it enables them to *discover* something *for themselves*, then we begin to see greater success in teaching. As soon as we become aware of something and integrate it into our lives, we no longer need to pay attention to it. We do it effortlessly, just as we ride a bicycle or speak a language, without thinking about it. Then we have truly learned

it. To teach something, we must first help the student focus awareness, then we must allow the student to discover, and finally, we must provide an opportunity to use this information so that it can be integrated into the student's own life. The role of the teacher is not to *inform* students of some piece of information, it is to help them *discover* it, to provide a conscious act in which they can become aware of the information. When we create an activity for students to learn something, Dr. Gattegno says that the learning takes place in four stages. (1) The student becomes aware that there is something new to be explored. (2) The student must explore the situation to attempt to understand it. The students must be allowed to make their own discoveries. (3) The students are able to use their discoveries while paying attention, and as they use them, their skills become automatic. Paying attention becomes less and less important. Finally, in stage (4) the students can use these skills to acquire new skills. Learning to walk and run allows a person to use those skills to learn to ski or to play soccer. This process is just the same in other areas, including math, languages, reading, and so on. Dr. Gattegno insisted that teachers must *give students as little information as possible* and allow them to learn by discovering for themselves.

Assumption number 3. Teaching must be subordinate to learning.

According to Dr. Gattegno, the role of teachers is not to try to force students to remember information. The job of the teacher is to challenge the students to examine something and make sense of it. Dr. Gattegno urged mathematics teachers to “use the time in class to make students mathematize situations and discover how many chapters of mathematics can be deduced, induced, from a *minimum* of givens.” In a seminar which I attended, I remember Dr. Gattegno saying that if you explain something

to students, they will quickly forget it. If you challenge them to discover the principle governing a language rule, once they have discovered it, it belongs to them, in the same way their native language belongs to them. You never have to teach it to them again. You only need to provide them opportunity to use the rule with awareness until they become so comfortable with the rule that they no longer need to pay attention to it, just as in their native language.

### III. Applying Dr. Gattegno's pedagogical approach: Challenge → Response → Feedback

First, the teacher presents a *challenge*. This causes the students to realize there is something to be explored.

Second, the teacher must then permit the students to *respond* by exploring the challenge and making their own discoveries. During this stage, the teacher is providing **teacher feedback** to the students as to the validity of their assumptions. As some students begin to “get it,” making their discoveries, the teacher can let those students help some of the students while the teacher is helping others. In this stage, it is very important for the teacher to insist that the students who have made the discoveries do not “help” by trying to explain. They must only provide the same type of feedback that the teacher provided for them: letting them know if what they are doing is right or wrong. They *must* allow the students to make their own discoveries.

Third, after most of the students have got it, there is a *feedback session* for **student feedback** which the students discuss what they have learned and try to explain what they have learned and how they know it. This feedback session is a *very powerful* teaching tool! The teacher must be

careful not to interfere. It would be easy for the teacher to explain what they have just done and how their activity illustrates the principles. However, according to Dr. Gattegno, this would be a very lazy action by the teacher. A good teacher would not be so lazy as to explain. A good teacher would challenge the students (without agreeing or disagreeing) during the feedback sessions, and let the students define the rules that they have just learned. Where the learning has not been complete, the teacher then can use that feedback to prepare new exercises to help the students refine their understanding. When I was in seminars with Dr. Gattegno, he never interfered with our discussions of what we were studying. He would often challenge us in the discussions, forcing us to think about what we were saying, but he would never correct us or explain things to us. He neither agreed with us nor disagreed with us. He would also not permit us to quote authorities. We could say anything we wanted from our own experience (awareness), but we were not permitted to rely on what someone else thought.

This cycle of teaching can be applied to many subjects. Dr. Gattegno seemed to believe that it could at least in part be applied to all subjects. I have found that in teaching language, it is an especially excellent means of helping students master grammar. This approach is also useful in teaching new vocabulary and refining the understanding of vocabulary the students already have. It can also be used for story-telling and fluency practice. In his book on using the “Silent Way” to teach languages, Dr. Gattegno says that with this method we are focusing on the functions of language rather than the social uses, which will be put off till later. However, even when we are working on the social uses of language, it is always important for the teacher to keep in mind that the only thing that we can educate is awareness.



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## Web Resources

The Association of Teachers of Mathematics, founded by Dr. Gattegno

<http://www.atm.org.uk/people/caleb-gattegno.html>

The website of John and Susana Pint, "Silent Way" language teaching master teachers

<http://www.saudicaves.com/silentway/>

The Cuisenaire Company, producer of Cuisenaire rods and other study materials

<http://www.cuisenaire.co.uk/>

Web site selling "geoboards," a math teaching tool invented by Dr. Gattegno

<http://www.educationallearninggames.com/geoboard-games.asp>

(サムナーラルフ 本学教授)